PINE RIVERS SHIRE COUNCIL

DESIGN MANUAL

CIVIL INFRASTRUCTURE DESIGN

DESIGN STANDARDS

Part 1 Design Standards for Roadworks

Part 2 Design Standards for Stormwater Drainage Works

Part 3 Design Standards for Water Supply Works

Part 4 Design Standards for Sewerage Works

PINE RIVERS SHIRE COUNCIL

DESIGN STANDARDS

PART 3
DESIGN STANDARDS FOR WATER SUPPLY WORKS

Section 1 Introduction

Section 2 Design Procedure

PINE RIVERS SHIRE COUNCIL

PART 3 - DESIGN STANDARDS FOR WATER SUPPLY WORKS

SECTION 2
DESIGN PROCEDURE

2.1.0 PREAMBLE

Water mains represent a significant investment in community infrastructure with an expected long-term service life. Where a reticulated water supply is available, and required, the community expects and demands access to this resource with a minimum of disruption and inconvenience. Similarly, the consumer expects the water delivered to meet a consistent and high quality in areas of colour and clarity, odour, taste and suitability for use.

In all elements associated with design and construction for a water supply network, regard for these core expectations must be held uppermost.

Water is recognised as a valued commodity by the Pine Rivers Shire Council and the community. The principles of water conservation must be considered and integrated into the design and construction of the water reticulation system.

2.2.0 HEADWORKS OR PRIORITY INFRASTRUCTURE PLANS

The headworks or works toward priority infrastructure for which the Pine Rivers Shire Council will require a contribution, are those identified as such in the headworks report or Priority Infrastructure Plan (PIP). Works internal can be identified as those works generally within the area of land which is the subject of the development application. Works external will be the balance of works necessary in order that the sewerage service can be provided.

Matters relating to water supply headworks or priority infrastructure charges should be raised by the developer at the time of lodging the development application with the Pine Rivers Shire Council.

Charges will be levied in accordance with the relevant Headworks or Priority Infrastructure Plan on all properties where the property or new allotments are required to be connected to the reticulated water supply network, or where the developer has requested connection to the reticulated water supply network. Also refer section 2.3.0 of the Design Standards for Water Supply.

2.3.0 CONNECTION TO WATER

2.3.1 MANDATORY CONNECTION TO THE WATER SUPPLY NETWORK

All properties under development and new allotments in the following land use categories shall to be connected to a reticulated water supply, with suitable flow and pressure to be made available to the whole of the allotment area: -

- Residential 'A'
- Residential 'B'
- Local Business
- Central Business
- Commercial
- Neighbourhood Facilities
- Home Industry
- Service Industry
- Future Urban
- Special Residential
- Park Residential
- Future Rural Living

2.3.2 SPECIAL EXEMPTION FROM CONNECTION TO WATER SUPPLY

The creation of new allotments in the in the land use categories of: -

- Special Residential
- Park Residential
- Future Rural Living

that do not meet the minimum requirements for water supply to permit direct connection to a reticulated water supply network may be permitted, subject to consideration and approval by the Pine Rivers Shire Council.

Properties of this nature are would be localised examples; and are the exception to the normal requirements for connection to the reticulated supply network. Allotments are likely to be an isolated few in a larger development.

Allotments in these land use areas may be connected to the reticulation network in accordance with the requirements of section 2.5.7 of the Design Standards for Water Supply Works.

2.3.3 CONNECTION TO WATER SUPPLY NOT REQUIRED

Allotments in the land use areas of: -

- Rural Residential
- Rural

are not required to be connected to the reticulated water supply network. A developer or property owner may request approval from Pine Rivers Shire Council for the connection of allotments in these areas to the reticulated network. Permission, if granted will be subject to conditions similar to those applied for other land use areas.

2.4.0 WATER

2.4.1 FUTURE DEMAND FOR WATER

The expanding community will lead to an increased demand for potable water. However, sources for and availability of raw water suitable for consumption are not likely to follow pace with development.

This will lead to developers having to consider the demand their development will have for water and implement innovative solutions to reduce the demand on the reticulated supply.

2.4.2 GENERAL

All designs shall comply with the requirements of these design standards, the requirements of the Pine Rivers Shire Council Priority Infrastructure Plan (PIP) for Water Supply, the relevant specifications and standard drawings herein, and relevant legislation.

The Pine Rivers Shire Council encourages the consulting engineer to incorporate such specifications and drawings, as they may deem appropriate, into the project documentation. By so doing, the consulting engineer accepts responsibility for their use as if they are the authors of the specifications and drawings.

In designing water mains, the consulting engineer shall make allowance for any land, external to the subject land, which ultimately will be serviced via the proposed works. The consulting engineer shall obtain from the Pine Rivers Shire Council the details of all existing water supply infrastructure into which the proposed works will connect.

All water supply works whether internal or external to the site, or both as the case may be, relevant or reasonably required in respect of the proposed development, shall be provided at the developer's cost, unless the works are part of the Headworks or Priority Infrastructure Plan (PIP) network.

In particular, the developer is required to meet the full cost of providing an appropriate reticulated water supply system with capacity sufficient to pass through his or her land the design flows and pressures required by all upstream properties, as determined by a Pine Rivers Shire Council engineer, when such upstream properties are fully developed in accordance with the Pine Rivers Shire Council Planning Scheme.

The water supply works shall be extended from an approved take-off point to the upstream boundary of the development site unless otherwise approved by a Pine Rivers Shire Council engineer.

The consultant shall verify that the existing downstream water supply system has sufficient capacity to cater for the proposed development.

Any works necessary to upgrade the water supply network to cater for a particular development shall be provided at the developer's cost unless the upgrade works are part of the Headworks or Priority Infrastructure Plan (PIP) network.

The costs, payments, contributions and credits associated construction of Headworks or PIP items by a developer as part of any development works is covered by the relevant Pine Rivers Shire Council policies.

2.4.3 QUANTITY OF WATER

Based on review of the State Government's guidelines and Local Government practice in South-east Queensland, the following parameters shall be used for design and assessment of water supply systems. These factors are to be applied in accordance with procedures detailed in the Queensland Department of Natural Resources and Mines Guidelines for Planning and Design of Urban Water Supply, and the Pine Rivers Shire Council's requirements.

Table 2.4.0

CALCULATION OF WATER DEMAND

Item	Description	Adopted Design Parameter
Water Demand		
1	Average Day demand (AD)	360 l/EP/d
Occupancy Ratio		
2	Equivalent Person/ Equivalent Tenement EP / ET	2.8 - for areas within the existing headworks boundary 2.6 - for areas outside the existing headworks boundary
Density of Development		
3	Demand generated by existing and future development	Refer to Item 4
Demand Factors		
4	Mean Day Maximum Month (MDMM)	1.5 x AD
5	Maximum Day (MD)	2.25 x MDMM
6	Maximum Hour (MH)	Residential Demand (l/Hr) = (4.5 24) x AD Non-Residential Demand (l/Hr) = 3.4 24) x AD
Peak Demand Modeling Periods		
7	Bulk Distribution	Both the following Scenarios must be modeled; - Scenario 1 - Reservoirs cannot empty under 3 consecutive maximum day demands Scenario 2 - During MDMM demand, reservoir shall have net positive inflow and shall be capable of continuous operation under this demand
8	Zonal Reticulation	Flow and pressure levels of service must be satisfied under 3 consecutive days of maximum day demand

The occupancy rates of Equivalent Tenements for various land uses shall be calculated in accordance with Table 2.4.1

Table 2.4.1

OCCUPANCY RATIO

Proposed Land Use	Allotment Size			Future Demand Applied to Existing Land Use
	0 - 574m^2	575 - 1199m^2	> 1199m^2	
RESIDENTIAL Residential A Future Urban Special Residential Special Development Home Industry	0.80 ET / Lot	1.00 ET / Lot	1.56 ET / Lot	10 ET / Hectare
LOW DENSITY RESIDENTIAL Park Residential Rural Residential Future Rural Living Special Development	1.25 ET / Lot	1.56 ET / Lot	3.12 ET / Lot	2.5 ET / Hectare
RESIDENTIAL B				
Dwelling Home	0.80 ET / Lot	1.00 ET / Lot	1.56 ET / Lot	
Community Title	0.55 ET / Lot	0.55 ET / Lot	0.55 ET / Lot	
Multi Unit Dwelling	0.45 ET / Unit	0.45 ET / Unit	0.45 ET / Unit	22 ET / Hectare
Institutional (non Medical)	0.45 ET / Unit	0.45 ET / Unit	0.45 ET / Unit	
Other	0.80 ET / Lot	0.80 ET / Lot	0.80 ET / Lot	
NON RESIDENTIAL Central Business Commercial Local Business Neighbourhood Facilities General Industry Extractive Industry Service Industry Special Facility Special Purpose Sport and Recreation Park and Open Space	Dependent on Land Use	Dependent on Land Use	Dependent on Land Use	Dependent on Land Use

2.4.4 QUALITY OF WATER

The quality of water delivered to the consumer must be in accordance with the Australian Drinking Water Guidelines 1996.

Whilst the quality of reticulated water is initially determined by the quality of raw water, and the filtration and treatment control processes, the distribution system also shares a role in maintaining the quality of supply.

The layout of the distribution network, design of major and minor individual mains and other elements within the network, selection of materials and construction standards each have a contribution to make in maintaining reticulated water quality within the established standards.

Circumstances may arise where a diminished quality of water below the required standards could occur due to localised circumstances. Designers must be sensitive to maintaining water quality standards by considering low-flow or low demand characteristics in major mains and installations. With the reticulation network, configuring the layout to reduce dead-end mains, locating property service connections well before the end of mains and including loop mains will all assist in maintaining water quality for the end customer.

Many of these can be minimised by including the criteria established in these standards into design of the main. The following cases should be avoided:-

- consider decay of disinfecting agent by long sections of dead-end mains without constant and reliable demand
- detention times in large concrete-lined mains where the pH may be effected
- sections of low velocities in mains – segments of varying diameter may be required

Recognition of these circumstances, the inclusion of safeguards and often innovative solutions from the project designer are necessary.

2.5.0 WATER SUPPLY NETWORK

2.5.1 DISTRIBUTION SYSTEMS

The distribution system includes all water supply infrastructure from the source to individual property service connections for the total area serviced by a reticulated water supply. The distribution system includes pumping stations, reservoirs, trunk mains and reticulation mains. These components of the distribution system are discussed further below.

- **Pumping Stations** are located within the water supply system to transport and lift water to the required levels within service reservoirs to ensure supply to consumers over the distribution area. They may also be used to boost flows or pressures within pipelines to satisfy the system demand.

- **Service Reservoirs** are water storage facilities located strategically throughout the serviced area. They provide storage capacity to balance out fluctuations in demand and operating pressures for a serviced area and reserve storage for emergencies.

- **Trunk Mains** are larger diameter pipelines supplying water from one major component in the network to another e.g. service reservoirs. Trunk mains may also be a system of larger pipelines supplying water from a major component to or about an area of smaller pipelines within the reticulation system.

  Trunk mains are considered to be pipelines of 300 mm diameter or greater, except in Dayboro and Samford areas where trunk mains are considered to be 225 mm diameter or greater.

  The primary purpose of trunk mains is for transport of water and thus, they are generally not used for direct connection of property services. Property service connections may be made under special circumstances.

- **Reticulation Mains** are relatively small diameter water mains that distribute flows from trunk mains or service reservoirs to the consumer. Reticulation mains are generally up to 200 mm diameter in areas except for Samford and Dayboro where reticulation mains are generally limited to less than 200 mm diameter.

  Property service connections are usually made with reticulation mains for supply to individual consumers.

  Where water mains of trunk mains size have property service connections supplying each property within an urban or park residential areas, then these mains are considered as reticulation mains as they serve a dual function.

- **Property Service Connection** is the section of pipework and fittings (including water meter) maintained by the Pine Rivers Shire Council that connects individual properties to the water main and provides the point to which the land owner will connect their property service.

- **Property Service** is the private supply system from the connection point off the reticulation (or trunk) main to private property, dwelling etc. The property service may supply a single allotment or building, or multiple allotments or buildings etc. in the case of a community title development.

  Property service connections shall only be made to trunk mains where special circumstances exist and with written approval from the General Manager, Pine Water.

2.5.2 WORK THROUGH PRIVATE PROPERTY

In the event that works are to be constructed through property not under the control of the developer, arrangements shall be made with the Pine Rivers Shire Council to obtain the names of affected property owners. Works shall not be undertaken in property not under control of the developer without prior written consent of the registered property owner. A copy of the owner's written consent shall be provided to a Pine Rivers Shire Council engineer.

Water mains constructed on private property are to be avoided wherever possible. Water mains on private property require approval from the General Manager, Pine Water. Where water mains are constructed on private property, easements are to be taken over the subject land along the route of the water main, including all associated works and thrust blocks. The minimum width is to be 4.0 m. Easements shall be registered in the name of the owner or party responsible for the future condition and maintenance of the water main.

A Pine Rivers Shire Council engineer shall be provided with a letter signed from the registered owner stating that all reinstatement work has been satisfactorily carried out prior to the Pine Rivers Shire Council accepting work constructed in private property "on maintenance".

2.5.3 TRUNK MAINS NETWORK

The network of trunk mains represents the major arteries transporting water around the Pine Rivers Shire.

They will connect a water treatment plant with storage reservoirs, and storage reservoirs with the reticulation network, for distribution of water to the consumer.

Trunk mains are an interconnected network of pipelines that are strategically sized and located to link between key nodes in the water supply network. The network represents a series of loops that ensures a supply of water is available to all areas within the water supply area at all times.

In some circumstances, due to the order of development or in outlying areas, a trunk main may be installed that represents the sole means of supply into a consumer area. In these circumstances, the Pine Rivers Shire Council will require that the area be connected to the major network to develop a looped supply as soon as practicable to ensure continuity of supply to consumers and a satisfactory standard of water is delivered.

The construction of an interconnection main may be required by a Pine Rivers Shire Council engineer where it is deemed necessary to ensure a desirable level of service is available to the consumer.

In these circumstances, a smaller diameter pipeline than would be normally required may be approved by a Pine Rivers Shire Council engineer.

2.5.4 SIZING OF TRUNK MAINS

Trunk main sizes will be determined by a dynamic network analysis.

The results of the network analysis are detailed in a Network Master Plan. Trunk main sizes shall be determined by referring to the most recent copies of this master plan.

2.5.5 RETICULATION MAINS NETWORK

The reticulation mains distribute water from trunk mains to the consumers.

The network of reticulation mains must be laid out as a ring-feed or looped system. A “tree” configuration of branch mains that do not interconnect will not be accepted.

The reticulation network must provide for the delivery of water to consumers from a variety of directions to ensure supply is maintained to the maximum number of consumers during downtime of any section of main for repair or maintenance.

The layout and configuration of the reticulation network must ensure that not more than 40 properties will be without water at any time because of downtime on a section of reticulation main.

It is acknowledged that the order of some developments may require a long length of reticulation main to be constructed to service an area, and that downtime on such a main may result in a significant number of properties experiencing loss of water supply.

Layouts promoting numerous branch mains that result in “ends” that do provide a ring feed interconnection to another main will not be accepted. Wherever opportunities exist, reticulation mains are to be interconnected with mains in adjacent streets to create a loop configuration.

Looped interconnection may be omitted on ends of streets where future extensions of the street are proposed.

Where cul-de-sac streets have a pathway link through to another street, the reticulation main shall be connected to the main in the adjacent street through the pathway link via a loop main. Parks and pathway links between streets can also be used to provide a looped configuration of mains.

2.5.6 SIZING OF RETICULATION MAINS

Reticulation or distribution mains shall be designed to carry the flows required to comply with Table 2.4.0 (refer to Section 2.4.3 of the Design Standards for Water Supply Works). Reticulation mains are to be sized and interconnected to provide sufficient redundant capacity to allow for interruption of flow from one direction. In general, the minimum acceptable diameter of pipes serving more than 24 residential properties shall be 150mm.

For Commercial / Industrial areas, the minimum water main diameter is 150mm.

The absolute minimum pressure will only be permitted in isolated, small, highly elevated areas.

Reference should also be made to the Network Master Plan for any special requirements within the proposed development.

Developments less than 2.0 hectares
- Residential A and Park Residential Cul-de-Sacs

The following information can be used for determining the number of allotments that can be serviced from a 100 and 150 mm diameter water main in a small Residential 'A' or Park Residential developments of a single cul-de-sac. Figure 2.5.0 shows the configuration of cul-de-sacs this design criterion may be used for.

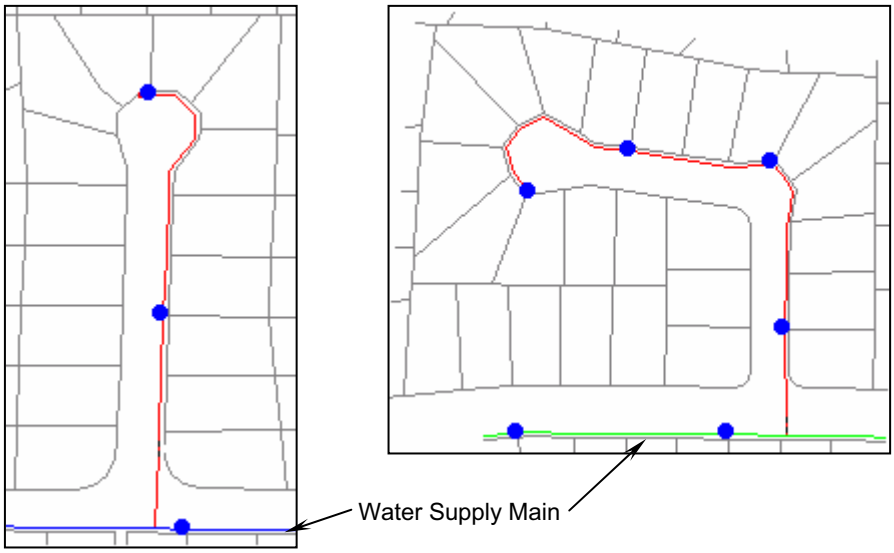

Figure 2.5.0

The values shaded green (light coloured) in the Tables 2.5.1 and 2.5.2 below can be serviced, whilst those shaded red (dark coloured) cannot be provided for, due to less than permissible pressure or flow. Not more than 20 allotments are permitted in any cul-de-sac.

The change in elevation referred to in the tables indicates the difference in elevation between the supply main serving the cul-de-sac branch and the highest point along the cul-de-sac. This high point can be located at any point - as a hump - along the cul-de-sac and is not necessarily at the end of the street.

The water supply main servicing the cul-de-sac must have two connections to the network in its ultimate state of development. The cul-de-sac may be serviced from a section of dead end main, provided the network analysis proves that sufficient pressure and flow is available at the critical supply node feeding the end of main and cul-de-sac.

In some instances of development layout and sequencing where the second interconnection of a water supply main to the network has not been completed, it may be appropriate to question the validity of the following tables. In these circumstances, a network analysis that includes the water supply main and cul-de-sac may be required.

Table 2.5.1.A

RESIDENTIAL 'A' CUL-DE-SAC - 100 MM DIAMETER WATER MAIN

Change in Elevation (m)	Number of Allotments			
	5	10	15	20
0				
2.5				
5				
7.5				
10				
12.5				
15				

Table 2.5.1.B

RESIDENTIAL 'A' CUL-DE-SAC - 150 MM DIAMETER WATER MAIN

Change in Elevation (m)	Number of Allotments			
	5	10	15	20
0				
2.5				
5				
7.5				
10				
12.5				
15				

Table 2.5.2.A

SPECIAL AND PARK RESIDENTIAL CUL-DE-SAC
100 MM DIAMETER WATER MAIN

Change in Elevation (m)	Number of Allotments			
	5	10	15	20
-15				
-12.5				
-10				
-7.5				
-5				
-2.5				
0				
2.5				
5				
7.5				
10				
12.5				

Table 2.5.2.B

SPECIAL AND PARK RESIDENTIAL CUL-DE-SAC
150 MM DIAMETER WATER MAIN

Change in Elevation (m)	Number of Allotments			
	5	10	15	20
0				
2.5				
5				
7.5				
10				
12.5				
15				

A network analysis will be required where a localised boosted supply is to be provided to allotments as part of the development.

Where the development layout requires a reticulation main to continue past a loop main connection to service properties, the reticulation main diameter beyond this point may be reduced to assist in maintaining water quality provided all flow and pressure requirements are able to be met. Mains providing service connections to properties shall not be less than 100 mm diameter.

Developments Over 2 Hectares, and Other Zones

A reticulation network analysis will be required for all developments over 2 ha in area, and for developments with uses other than those provided in the above tables.

2.5.7 ALLOTMENTS WITH RESTRICTED ACCESS TO ADEQUATE WATER SUPPLY

In some localised areas of the Pine Rivers Shire, house sites may be found which are unable to be supplied with reticulated water due to their elevation and inability to comply with the absolute minimum design criteria. Typically, these locations should only be expected in land use areas designated as Special Residential, Park Residential and Future Rural Living.

In the land use areas mentioned above allotments may be permitted which do not meet the minimum criteria in the Design Standards for Water Supply for connection to the reticulated water network.

Allotments in these land use areas may fall into the criteria listed in Table 2.5.3, with the corresponding options for connection to the reticulated water supply network.

Table 2.5.3

Case	Availability of Adequate Water Supply	Connection Options
1	Allotments able to be serviced by the reticulated water network	a) Construction of water mains to provide for connection of allotments to the water supply network is mandatory
2	Allotments where adequate supply of reticulated water is only available to a maximum specific level (RL) across an allotment	b) The developer may elect not to construct a water main specifically for these allotments. c) The Developer may elect to provide for connection of the allotment to the water supply network by constructing a water main past the allotment frontage d) Water is available due to service the need to service other allotments in accordance with Case 1
3	Allotments where adequate supply is only available to the frontage of an allotment	b) The developer may elect not to construct a water main specifically for these allotments. c) The Developer may elect to provide for connection of the allotment to the water supply network by constructing a water main past the allotment frontage d) Water is available due to service the need to service other allotments in accordance with Case 1
4	Allotments where adequate supply is not available to the frontage of an allotment	e) The option for provision of a reticulated water supply to these properties is not available to the developer

Adequate water supply is defined as "Provision of water to the whole of an allotment in accordance with the minimum criteria for the Design Standards for Water Supply".

Where the ability to connect an allotment to the reticulated water supply is provided in accordance with Case 2(c and d) and 3(c and d) of Table 2.5.3, the developer will accept Council placing a note on the property detailing conditions under which a reticulated water supply is provided to the allotment. This note will be made available to prospective purchasers of the allotment.

The provision of the water connection remains the responsibility of the property owner. The connection of allotments meeting Case 2 (c and d) and 3 (c and d) of Table 2.5.3 shall be connected to the network in accordance with the relevant Council Policy.

2.5.8 NETWORK ANALYSIS REQUIRED

A developer will be required to conduct a network analysis where the proposed development is out of sequence with the priority infrastructure plan or where interim or unexpected staging of mains is proposed. An analysis for sizing of reticulation mains will be required as addressed in Section 2.5.6 of the Design Standards for Water Supply Works.

A network analysis will also be required if the development area is the subject of a major development that is of a higher density of use than has been considered in formulating the Pine Rivers Shire Council reports. Smaller developments that are of higher density than

envisaged by the Pine Rivers Shire Council in its planning scheme may be required to undertake analysis to determine the adequacy of the water supply network on a surrounding local area scale.

Where a network analysis is required, the analysis is to give consideration to and is to include details of: -

- how the proposed development will influence the current augmentation plan
- the effect on the existing water supply network (trunk and reticulation)
- changes required to the existing water supply network should the development proceed, including timing of works
- changes required to the proposed network augmentation in the priority infrastructure plan should the development proceed, including timing of works
- where a localised boosted supply is involved, shall ensure the design and installation of boosted supply does not unduly affect the remainder of the water supply network

2.5.9 LOOP MAINS

Loop mains consist of a pipeline constructed between one reticulation main and another to create a looped system for improved service and flow in the network. It is desirable that the subdivision road layout is designed to create looped roads to assist in satisfying this criterion. However, loop mains may use pathway connections, parkland and areas of crown land to connect between mains.

As a loop mains purpose is to supplement the “major” reticulation mains to a street or area, they may be of a reduced diameter than would ordinarily be required to service an area.

By nature, loop mains serve as a reticulation main. However, property service connections are not permitted from the loop main.

Construction standards and all other requirements for reticulation mains remain applicable to loop mains. An isolation valve is required near each end of the loop main. Hydrants would not necessarily be required on a loop main for fire fighting purposes as the major reticulation system provides this function. Hydrants will be required in low points or high points for air entry/release and scour purposes.

Where loop mains are constructed through parks and reserves, loop mains may be used to supply water to the park. Loop mains may also be used to supply community buildings in parks if the level of supply is adequate. If a community building is some distance from the regular reticulation main, a hydrant may be fitted to the loop main near to the building.

Table 2.5.4
SIZING OF LOOP MAINS

Reticulation Main Diameter	Minimum Diameter for Loop Main
100 mm	63 mm PN8 PE80B (MDPE)
150 mm	63 mm PN8 PE80B (MDPE)
200 mm	100 mm (PVC)
225 mm	100 mm (PVC)
250 mm	100 mm (PVC)

2.5.10 PROPERTY SERVICE CONNECTIONS

The property service connection describes the length of pipework and fittings between the reticulation main and the point at which the property owner connects their private plumbing system to the water supply network. The property service connection is owned and maintained by the Pine Rivers Shire Council and includes the stopcock and water meter.

The private plumbing system is connected to the property service connection by the private land owner.

The Pine Rivers Shire Council has produced a number of standard drawings showing the configuration of property service connections.

2.5.11 WATER PRESSURE

All mains shall be designed to carry the demand covered in Section 2.4.3 of the Design Standards for Water Supply Works, whilst maintaining a minimum allowable pressure.

Table 2.5.5

REQUIREMENTS FOR WATER PRESSURE

Item	Description	Adopted Design Parameter
System Pressure		
1	Minimum Operating Pressure	22 m above the highest elevation on any allotment in the pressure zone with the water level in the reservoir not less than 1.5 m below top water level
2	Absolute Minimum Operating Pressure	In isolated high level areas the minimum operating pressure may be reduced to 16 m above the highest elevation on any allotment with the water level in the reservoir not more than 1.0 m above reservoir floor level
3	Maximum Operating Pressure	80 m above the lowest elevation of any allotment in the pressure zone
Fire Fighting Requirements		
4	System Pressure	12 m minimum at any location in the reticulation mains with model conditions as detailed in this table below.
5	Fire Flow	Residential - 15 l/sec (simultaneous with background demand) Commercial/Industrial - 30 l/sec (simultaneous with background demand) Special Risk/Hazardous Land Use - To be assessed
6	Background Demand	MH demand - Refer to Table 2.4.0, Section 2.4.3 of these Design Standards
7	Reservoir Level (AHD)	Set at Reservoir Mid-Water Level (MWL) where:- MWL = (Top Water Level – Floor Level) 2

The absolute minimum pressure will only be permitted in special circumstances.

Reticulation Mains Network

The maximum allowable working pressure in the reticulation network providing direct supply to consumers is 80 m static head or 800 kPa at the property frontage to prevent damage to private plumbing, fixtures and fittings.

Where consumers are to be serviced from a main exceeding the permitted reticulation pressure, a pressure reducing valve (PRV) is to be installed to ensure pressures downstream of the PRV are maintained at a suitable maximum and minimum pressure range. Care must be taken to ensure pressures are controlled in the reticulation loop and that trunk main pressure is maintained at the higher range where necessary. This may require PRVs at various locations where interconnection with a higher pressure trunk main occurs.

Details for pressure reducing valve installations can be found in the Pine Rivers Shire Council standard drawings.

Trunk Mains Network

The maximum operating pressure in the trunk mains network is controlled only by the availability of pipes, fittings and components of a suitable pressure rating to withstand operating pressures, including those associated with water hammer and pumping surges within these mains for the design life of the water main.

Pressure Zones

To provide an adequate standard of service across varying elevations in the Pine Rivers Shire, the water supply network has been “sectioned” into pressure zones that have different operating ranges for the hydraulic grade line of the network.

The pressure zones are detailed in the Water Supply Network Master Plan.

Care shall be taken by the designer to ensure they have a satisfactory understanding of the water supply networks in the area they will be working to ensure cross connection between these separate systems does not occur.

2.6.0 LOCATION OF WATER MAINS

2.6.1 LOCATIONS FOR MAINS

Water mains shall generally be located along road reserves or across areas of public space.

Water mains will only be permitted across private land under exceptional circumstances, and only with written authority from the General Manager Pine Water, and the owner of the property across which the water main is to be located.

Where a water main has, or is required to be constructed in or over private property, the Pine Rivers Shire Council requires an easement to be provided over the subject land. The easement shall cover the entire route of the main, encompass all associated fittings, pits or chambers and thrust blocks etc. The width of the easement shall be suitable for access by vehicles and plant as may be considered appropriate for maintenance and works on the water main.

A 4.0 m wide easement is considered the minimum desirable width for an easement over water supply pipelines. The width of easements is a function of the diameter of the water main and shall be selected in accordance with Table 2.6.0.

Table 2.6.0

MINIMUM WIDTHS FOR EASEMENTS OVER WATER MAINS

Water Main Diameter	Width of Easement
Up to 450 mm	4.0 m
525 mm	4.5 m
600 mm	4.5 m
900 mm	4.5 m
1050 mm	5.0 m

An absolute minimum easement width of 3.0 m may be accepted in restricted areas.

The selection and approval of easement widths shall be at the sole discretion of a Pine Rivers Shire Council engineer, having due consideration for pipeline diameter, installed features, safe access, maintenance requirements and site criteria etc.

2.6.2 ALIGNMENT

The alignments for water mains in road reserves for the various classifications of roads are shown on the Pine Rivers Shire Council standard drawings for service allocations.

In circumstances where the standard water main alignment is occupied by an existing water main or other infrastructure, an alternate alignment may be selected.

When investigating an alternate water main alignment, the designer shall consider all future design criteria for the roadway and undertake a thorough investigation of the future use of the proposed route. These shall include, among other things:-

- road classification and future construction standard
- future land use
- horizontal alignment and road widening
- alignment and allocations for other services infrastructure
- future service infrastructure allocations and requirements
- environmental values

Details of the alternate alignment chosen, together with supporting information shall be provided to a Pine Rivers Shire Council engineer for approval.

2.6.3 COVER OVER WATER MAINS

The minimum cover over water mains in various locations is shown on the Pine Rivers Shire Council standard drawings and this cover shall be adhered to over the full length of the main.

Where water mains are to be constructed along or across routes controlled by other authorities, these authorities may have specifications requiring more cover than those required by the Pine Rivers Shire Council.

In any case, the Pine Rivers Shire Council cover requirements remain the minimum. The minimum cover values are based on various criteria including:-

- maintaining a satisfactory cover to reticulation mains whilst permitting minor earthworks on the verge for driveways etc
- sufficient cover to maintain the structural integrity of the water main using economical pipeline materials
- component sizes of various fittings including valves and hydrants etc. that must be accessible from the surface
- for reticulation mains, a reasonable depth permitting access to the main for the connection of property services

The minimum cover requirements also apply to trunk water mains. However, trunk mains may require cover greater than the minimum to suit various route design criteria.

Water mains are not to be laid at excessive depths unless the design criteria for the water main route require this.

In selecting a suitable cover or depth, for both reticulation and trunk mains, the following shall be considered among other things:-

- road classification and future construction standard
- future land use
- vertical alignment, road regrading and widening
- depths of future service infrastructure including longitudinal and cross-road stormwater drainage
- environmental values
- aesthetic values if proposed works are to be visible above ground

All water mains shall be laid underground unless local circumstances favour their above-ground construction. Circumstances where water mains may be constructed above ground include:-

- crossings of creeks or gullies etc
- connections into pits, chambers or buildings
- low flat areas where a high water table or potential acid sulphate soils may be found
- where installations are best suited above ground due to regular access and/or maintenance requirements

Where segments of water main of any substantial length or diameter are proposed to be constructed above ground, special approval will be required by the Pine Rivers Shire Council. It is recommended that approval–in–principal be sought from the Pine Rivers Shire Council before commencing detailed design.

2.6.4 CLEARANCE TO OTHER SERVICES

Where water mains cross other services, the minimum vertical clearance between the water main and all other services shall be 300 mm. The space between pipes shall be backfilled with graded bedding sand.

Where a water main must cross a sewer, it is desirable that the water main cross above the sewer to assist in the prevention of cross contamination should a failure occur in either pipeline.

Where 100 and 150mm diameter water mains cross over drainage culverts and there is insufficient cover to provide both clearance and cover, then a 75mm separation between the water main and the culvert may be accepted as an absolute minimum, provided that the water main with reduced cover and clearance is constructed of ductile Iron, and the separation is filled with an inert compressible filler.

2.7.0 DESIGN PRINCIPLES

2.7.1 GENERAL

All materials and components to be installed in the water supply network are to be selected and specified in accordance with the relevant Pine Rivers Shire Council Specification and relevant Australian standards. Reference should also be made to the Pine Rivers Shire Council standard drawings for construction details that must be considered during detailed design of water mains.

The Pine Rivers Shire Council expresses its authority to issue approvals for use of certain materials, fittings etc., and to reject the use of other materials, fittings or components it believes unsuitable or undesirable to include in the water supply network. In general, product approvals/rejections pertain to more regularly used and available products. Product approvals are considered, following a request from a supplier or manufacturer.

Only those products approved by the Pine Rivers Shire Council are to be considered during the design and included in the construction of water mains. It is acknowledged that circumstances will occur where special or non-standard installations will be required using alternate and specialised products or fittings. Where these are proposed for use, details of the circumstances shall be discussed with Pine Rivers Shire Council engineers at the earliest possible time to obtain the Pine Rivers Shire Council opinion on their acceptability for inclusion in the water supply network.

Approval for use of alternate products will not be considered at the time of installation of products where the Pine Rivers Shire Council has an approved product suitable for use.

2.7.2 MATERIAL SELECTION

The following types of pipe are approved for use for water mains:-

Flexible Pipes

- Unplasticised Polyvinyl Chloride (uPVC) PN 16 minimum – approved products only.
- Optimised Polyvinyl Chloride (OPVC) PN 16 minimum – approved products only.
- Modified Polyvinyl Chloride (PVC-M) PN 16 minimum – approved products only.
- Glass Filament Reinforced Thermosetting Plastics (GRP) – special approval required.
- Medium Density Polyethylene (MDPE) – as permitted for loop mains. Special approval required in other installations.
- Acrylonitrile Butadiene Styrene (ABS) – special approval required.

Rigid Pipes

- Ductile Iron Cement Lined – Class K9 minimum, or PN20 minimum pressure rated pipe. A tar epoxy coating with the pipe laid in a polyethylene sleeve is the minimum requirement for external protection.

- Mild Steel – Class or wall thickness selected as required for the purpose. An internal coating of cement mortar or a medium density polyethylene coating (MDPE) in conjunction with an external MDPE coating is a minimum requirement.

Selection of Materials for Valves, Fittings and Miscellaneous Objects

Selection of components shall be in accordance with the Pine Rivers Shire Council specifications.

Materials used for the various fittings and items required to be installed in conjunction with water main pipelines are many and varied. An experienced engineering knowledge and judgement shall be applied to the selection of appropriate materials to be used in the pipeline from the range of approved products.

Property Service Connections

The following types of pipe and fittings are approved for use for property services and minor pipework associated water installations:-

- Type B De-Zincification Resistant Copper
- Brass Fittings
- Medium Density Polyethylene (MDPE) and Acrylonitrile Butadiene Styrene (ABS) – special approval required

2.7.3 MATERIALS' LIMITATIONS

Materials shall be selected for their suitability of use in the particular area and ground conditions. Geotechnical investigations shall be performed where necessary or where the Pine Rivers Shire Council requires them, to ensure the most appropriate specification and selection of materials.

The family of PVC pipes shall not be used near potential sources of organic solvents such as oil/fuel depots. Lead stabilised uPVC is not accepted as a pipeline or fitting material.

Ductile iron pipes may be used where the normally required cover over the water main is not available. Ductile iron or mild steel pipes shall be used at creek crossings or other locations where the water main is required to be above ground.

Changes in pipe material may be made at any given point along the pipeline as necessary to suit construction requirements. Isolated lengths of different or differing materials shall not be permitted unless required by design criteria. Change of materials shall not be permitted for the sake of using small quantities of surplus material.

Ductile iron and cast iron fittings and pipes shall be internally cement lined and externally coated with a tar epoxy external coating as a minimum. In particularly aggressive ground conditions, fittings may need to be externally coated with a fusion bonded polymeric coating in accordance with AS/NZS 4158.

All ductile iron or cast iron fittings shall be installed in a polyethylene sleeve, including fittings with fusion bonded coatings.

Particular fittings such as sluice valves, hydrants and pre-tapped property service fittings shall be supplied with an internal and external fusion bonded polymeric coating in accordance with AS/NZS 4158. Other fittings may also be supplied with this coating and protection method where available.

Fittings selected shall be suitable for use with the particular pipeline material and other fittings. For example, UPVC socket fittings shall not be used with ductile iron pipelines.

Particular attention shall be paid to ensure dissimilar or incompatible metal parts do not come into contact with one another.

2.7.4 TRENCHES

Various trench configurations and bedding and backfill practices are shown in the Pine Rivers Shire Council standard drawings and described in the Pine Rivers Shire Council specifications.

The selection of a trench configuration is dependent on the nature and grade of the ground, bearing capacity of the soil and location of the pipeline.

Compaction of bedding and backfill shall be in accordance with the Pine Rivers Shire Council standards and specifications.

Warning tapes incorporating a metallic trace wire are to be included in all water main trenches.

Reticulation Mains

Trench widths are to be selected to provide suitable work space for construction and compaction of bedding and backfill, whilst limiting the excavated area. Trench widths shall generally be in accordance with the Pine Rivers Shire Council standards.

Trunk Mains

The location and width of trenches and construction benching shall be taken into account during design of mains. The total width of excavation shall be kept to a minimum, and shall avoid intruding into zones required for the long term sustainability of existing vegetation, or stability of existing and future structures.

Shored trenches are to be used where other construction means are not viable.

2.7.5 ABOVE GROUND PIPELINES

Where aboveground pipelines are required, the selection of pipeline material and installation solutions are to be designed in accordance with manufacturers specifications, taking into account all current and potential (including reasonable accidental) loads.

Flexible pipes will not be permitted above ground.

2.7.6 PROTECTION OF WATER MAIN PIPES AND FITTINGS

All metallic pipes and water main fittings buried in the ground are to be protected internally and externally to prevent corrosion.

Table 2.7.0

PROTECTION SYSTEMS

Pipeline Component	External Protection	Internal Protection
Ductile Iron (DI) pipes (buried)	Bitumen painted + Polyethylene sleeve/wrap	Chloride resistant cement mortar
Ductile Iron (DI) pipes (installed above ground)	Bitumen painted	Chloride resistant cement mortar
Steel (MS) pipes	Fusion bonded medium density polyethylene	Fusion bonded medium density polyethylene
		Chloride resistant cement mortar
Valve bodies and complex shaped fittings	Thermally bonded polymeric coating + Polyethylene sleeve/wrap	Thermally bonded polymeric coating
Regular simple shaped pipeline fittings	Thermally bonded polymeric coating + Polyethylene sleeve/wrap	Thermally bonded polymeric coating or Chloride resistant cement mortar
	Bitumen coating + Polyethylene sleeve/wrap	

All metallic fittings included on non-metallic pipelines are to be seal-wrapped with a polyethylene sleeve irrespective of their external protective coating.

2.7.7 MINIMUM VERTICAL GRADES FOR WATER MAINS

As water mains are a pressure system, grades of mains are not critical. However, for efficient operation, minimum and constant grades are preferred and required in larger mains to manage entrapment of air in the pipeline and facilitate emptying of a pipeline.

The minimum grade for laying a water main is to be 1 m in 250 m.

Reticulation Mains

Reticulation mains are not subject to minimum grades. However, they should be laid on continuous rising or falling grades without localised high points.

Trunk Mains

Trunk mains are subject to minimum vertical grades and consistent grades. Designs should be modified to exclude localised high or low points wherever possible.

Mains laid in flat terrain shall be designed to the minimum grades to introduce air release and scour points along the main.

2.7.8 STEEP PIPELINES

Water mains with flexible joints laid on steep grades are to be anchored at specific intervals to prevent movement of the pipeline down the trench.

Anchor blocks are to be mass concrete and designed to distribute loads equivalent to a 900 bend of the pipeline diameter. Stops are to be placed at the following intervals:-

Table 2.7.1

SPACING OF ANCHOR BLOCKS

Pipeline Gradient	Anchor Block Spacing
Greater than 1 in 3	Every pipe
1 in 3 to 1 in 4	Every 2nd pipe
1 in 4 to 1 in 5	Every 3rd pipe
1 in 5 to 1 in 6	Every 4th pipe

2.7.9 ANCHOR BLOCKS

Anchor blocks are to be placed to resist thrust forces created by the dynamic movement of water through the pipeline to distribute these forces to the natural soil taking into account the maximum bearing capacity of the soil.

Anchor blocks are to be placed to counteract all unrestrained bends and fittings where unequal resultant forces can be found. Thus, anchor blocks will usually be required at each of the following:-

- bend - vertical or horizontal
- tee fitting - vertical, or horizontal
- end of pipeline
- pipeline reducer
- pipeline - where flanged fittings as above are attached
- valves

Also refer to the design principles for steep pipelines

Anchorage requirements for valves will be dependent on size and soil type. Typically, forces associated with sluice valves of 100, 150 and 200 mm diameter can be successfully countered by the surface area of the valve and soil backfill in the trench when in service, and the length of attached pipeline. Valves of these sizes installed in soft clay shall have thrust blocks attached in accordance with the relevant Pine Rivers Shire Council standard drawing. Valves larger than this size will need to have thrust blocks included as part of design.

Anchor blocks are not to encapsulate any joints unless no alternative exists.

Fittings installed above ground, and vertical bends with resultant forces in an upward direction, are to have anchor blocks specifically designed so as the mass of the anchor block and restraining straps are able to counter the forces involved. Restraining straps are to be

suitable for long term burial in all ground conditions and capable of retaining their required restraining capacity over the life of the pipeline.

Downward and horizontal forces are to be transferred into the undisturbed natural soil by providing an end surface area of the anchor block that distributes the forces at the not more than the bearing capacity of the soil.

Care is to be taken that thrust forces are not transferred to undisturbed soil of insufficient depth (width) to carry the applied load. An example of this may be where a thin undisturbed wall exists between the designed water main trench and a recent adjacent parallel trench. In such cases, the pipeline is to be laid at a greater depth to provide bearing capacity against undisturbed soil.

The designer is also required to consider the possibility of future construction of infrastructure in the area behind thrust areas along the pipeline and, where likely, design the water main to be installed at a greater depth to ensure bearing capacity is maintained against undisturbed soil.

Thrust forces associated with pipework and fittings installed inside or through pits and chambers may be transferred into the walls of the pit or chamber and distributed to the surrounding ground. To ensure this, flanges shall be installed on all pipework carrying thrust which penetrates the walls of pits. Pit walls carrying thrust forces are to be designed to cope with these forces.

2.7.10 JOINTS

Joints in pipes may be designed as flexible joints or rigid joints.

Specialised joint systems may be required for interconnection of pipelines to some existing infrastructure, or during maintenance or repair of the pipeline.

Loose flange couplings which rely on set–screws for retention on pipe barrels with will not be permitted.

Table 2.7.2

JOINTS

Pipeline Material or Component	Joint	Joint Type
PVC pipelines	Push-in spigot and socket Rubber O-ring seal	Flexible
	Flanged joints Rubber gasket	Rigid
Ductile iron pipes and Fittings	Push-in spigot and socket Rubber O-ring seal	Flexible
	Flanged joints Rubber gasket	Rigid
GRP (Hobas) pipes	Slip collar butt joint Rubber O-ring seal	Flexible
Mild steel pipes and Fittings	Split collar butt joint (welded)	Rigid
	Welded butt joints	Rigid
	Ball and Socket Rubber O-ring seal	Flexible
	Spherical slip-in Rubber O-ring seal	Flexible
Gibaults	Rubber O-ring seal	Flexible
Loose-flange Couplings	Flanged joint Rubber gasket	Rigid
Pipe repair clamp, or Tapping saddle *	Long, rubber lined (coated) stainless steel sleeve (often multi-segment)	Flexible
Minor components fitted to pipeline components	BSP thread	Rigid

* selected product and installation requires special approval from the Pine Rivers Shire Council

Rubber joint rings are to be are to be compatible for jointing all materials of compatible pipe systems. Specially sized rings or gaskets are not permitted.

Flanged joints are to conform to:-

Table 2.7.3

FLANGED JOINT REQUIREMENTS

Pipeline Material	Flange Type	Applicable Standard
Ductile Iron	Integrally cast	AS 4087 - Figure B5 - Class 16
	Screw on	
Grey Cast Iron	Integrally cast	AS 4087 - Figure B2 - Class 14
Mild Steel	Welded	AS 4087 - Figure B7 - Class 14

2.7.11 ISOLATING VALVES

Isolating valves are used to isolate segments of water mains from the network.

The location and frequency of isolation valves along each branch of the pipeline shall be selected to ensure that not more than 40 consumers are affected by any shut down of a segment of water main at any one time.

Isolating valves are to be located in the verge or other places clear of the road carriageway wherever possible, having regard for any future road widening or alterations, and safety of personnel required to operate valves. Valves shall be located as close to the junction of mains as practical. Where this is not possible, they shall be located opposite common allotment side boundaries projected perpendicular to the kerb or road edge, or a property truncation. Valves are to be positioned so as to avoid being located in conflict with likely future driveway locations.

Isolating valves may be either resilient seat sluice valves or butterfly valves. The selection of type shall be dependent on the diameter of valve required, and circumstances available for installation.

Isolating valves over 300 mm diameter are preferred as butterfly valves, due to the difficulties associated with the size (height), cost, weight, difficulty of actuation and thrust anchorage on a sluice valve of this size and over this size. Butterfly valves are to be located in pits or chambers.

Isolating valves of 300 mm diameter and greater are to be restrained to control thrust on the valve when closed. Isolating valves of diameters less than 300 mm may also need to be restrained depending on the bearing capacity of the surrounding soil and backfill material used. Use of the buried pipeline to carry thrust forces is not accepted in these circumstances.

All valves of 375mm diameter and greater shall be installed in a valve pit.

Valve spindles are to be reachable from ground level in accordance with the Pine Rivers Shire Council standard drawings.

Reticulation Mains

Isolation valves are to be installed on all branches of any pipeline junction (tee, cross or wye etc.) in the reticulation network.

Valves are to be positioned along each branch before any property service connections are likely to be made on the branch main.

Valves are to be positioned opposite the projection line of the property boundaries of the “tee road” at intersections and near to the pipeline junction on the “through road” as indicated in

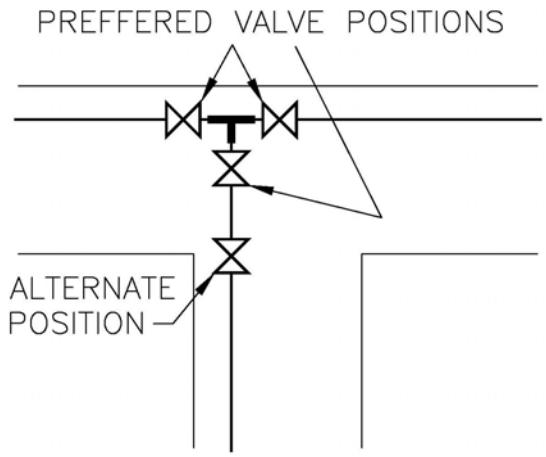

Figure 2.7.4

Trunk Mains

Isolation valves are to be installed on all branches of any pipeline junction (tee, cross or wye etc.).

Valves on branch mains are to be positioned as close to the major pipeline as possible or opposite the projection line of the property boundaries of a “tee road” at intersections.

Isolating valves are to be installed at intervals of not less than 500 m or more than 750 m along a trunk main.

Butterfly valves on trunk mains of 450 mm diameter and greater may be installed one standard size less than the water main pipe diameter by using reducers fitted each side of the valve.

Valves in Pits and Chambers

All valves installed in pits or chambers shall be capable of being retained by one flange alone.

Valves shall be capable of retaining the full working pressure of the valve with no pipework fitted against the un-retained flange of the valve.

The valve spindle is to be accessible through the covers or roof of the pit without the need to enter the chamber wherever possible. When butterfly valves are used and the actuator spindle is not accessible from outside the pit, a handwheel shall be provided on the valve.

2.7.12 HYDRANTS AND HYDRANT POINTS

Hydrants are positioned along water mains for the primary purpose of drawing water for fire fighting. Hydrants also serve other functions such as:-

- air entry and exit points by opening the hydrant during emptying and filling of mains
- scouring or emptying of mains by opening the hydrant
- pressure testing of mains (with the hydrant removed)
- injection point for sterilisation of mains (with the hydrant removed)
- insertion and removal point for swabs to clean pipelines
- taking water by licensed persons

As hydrants serve these other purposes, the hydrant tee shall branch off from the obvert of the main. In any case, the tee shall always be fitted such that a rising grade is maintained from the obvert of the main to the hydrant. Hydrants are to be positioned in the verge or other places clear of the road carriageway wherever possible, having regard for any future road widening or alterations.

Hydrants are to be installed in an approved hydrant box and cover and their positions marked in accordance with the Pine Rivers Shire Council requirements.

Hydrants are to be positioned opposite common allotment side boundaries projected perpendicular to the kerb or road edge, or a property truncation. Hydrants are not to be positioned on deflections in property frontages. Hydrants are to be positioned so as to avoid being located in conflict with likely future driveway locations.

Reticulation Mains

Hydrants are to be installed along all mains at a spacing of not more than 80 m.

A hydrant shall be installed at the “end” of each main, a minimum distance of 6 m beyond the last property service connection point. Hydrants on the ends of reticulation are to be fitted on to a ducks-foot or hydrant bend.

Where a loop main is provided, the hydrant will be installed as follows. The actual position will depend on the location available for connection of the loop main and the location of the last property service connection.

- Loop Mains less than 100 mm diameter - on the reticulation main end 6 m minimum after the last property connection point, or immediately after the connection point for the loop main.

- Loop Mains 100 mm diameter – on the reticulation main end 6 m minimum after the last property connection point, or immediately before interconnection of the loop main.

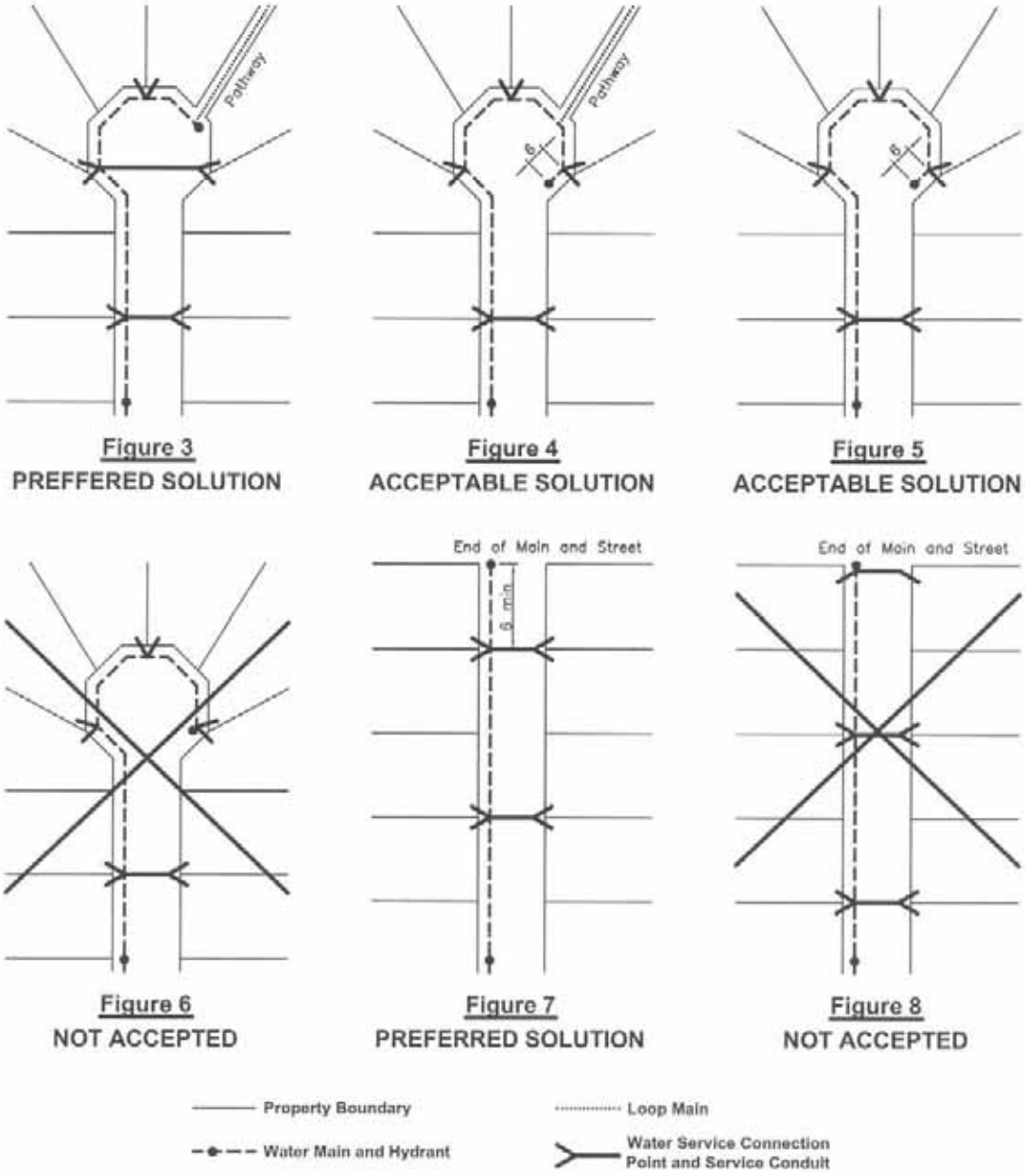
Pathway
Figure 3
PREFFERED SOLUTION
Pathway
6
Figure 4
ACCEPTABLE SOLUTION
6
Figure 5
ACCEPTABLE SOLUTION
Figure 6
NOT ACCEPTED
End of Main and Street
6 min
Figure 7
PREFERRED SOLUTION
End of Main and Street
Figure 8
NOT ACCEPTED
Property Boundary
Loop Main
Water Main and Hydrant
Water Service Connection
Point and Service Conduit

Figure 2.7.5

Trunk Mains

Where trunk mains are located in areas where existing reticulation mains are in place, hydrants are not required on the trunk main for fire fighting purposes.

Thus, the location and spacing of hydrants can be selected to suit their other functions such as air entry, testing and sterilisation points.

Where there are no reticulation mains in place, hydrants shall be installed on the trunk main at a spacing of:-

- not more than 200 m where the Pine Rivers Shire Council water reticulation and planning documents indicate future reticulation mains in the area; or

- not more than 80 m where the Pine Rivers Shire Council water reticulation and planning documents indicate there to be no future reticulation mains in the area.

Trunk mains are divided into segments by the installation of section valves. Air entry and release points and scour outlets may be provided by hydrants, as discussed in other sections of this document.

Hydrants can be positioned on a branch offset from the through main to position the hydrant in the verge or other location clear of road carriageway.

2.7.13 LINE ENDS

Pipelines are to end with either an:-

- end cap - fitted to a pipe spigot
- end plug - fitted to a pipe socket
- blank flange - fitted to a flanged fitting or pipe special
- hydrant tee - and associated fittings

Ends are to have an accompanying thrust block or be retained on a flanged pipe or special fitting as described below.

Reticulation Mains

Wherever possible, reticulation mains are to be designed as a loop service connecting with another main.

Permanent ends of mains are to end with a hydrant bend, hydrant (and associated fittings) and thrust block,

Temporary ends to water mains which are intended to be extended as a future stage of development are to end with a hydrant tee, hydrant (and associated fittings) and thrust block,

Refer to Figure 2.7.5, Figures 3 to 8 for details of solutions.

Trunk Mains

Trunk mains may be reduced in diameter to transition to reticulation mains or terminate at another trunk main.

Trunk mains terminating in an end usually represent staged construction requiring future extension. In these circumstances, a section valve is to be installed near to the end of the line. This valve can be manipulated closed to permit connection of the future extension without having to close down operation of the whole of the existing main.

All temporary ends on trunk mains (mains that are to extend in the future) shall end with a flanged end cap fitted to a pipe special with a thrust flange. The thrust flange is to be captured in a suitably designed thrust block constructed across the trench.

This system allows the future extension to be joined to the existing main without the need to remove a large thrust block at an end cap. The new main can be joined to the existing main with a minimum length of untested and unsterilised pipeline.

2.7.14 AIR RELEASE AND AIR ENTRY

For pressure mains to function effectively, all air must be evacuated from the main following initial post construction fill and any maintenance on the main. Under some conditions, air can build up in mains from the release air dissolved in water. Entrapped air can inhibit efficient pumping and create water hammer in mains. Similarly, when mains are being emptied, unless air can be admitted into the pipeline, vacuum pressures can build up to the extent that pipes may collapse.

Air release points are installed at the high points along water mains to permit the venting of built-up air in the mains. These points are also used to permit the entry of air.

To address these issues, air release and entry points shall be fitted with a combination of air valves allowing air entry and exhaust or a single double-acting air valve that provides both capabilities.

Air valves shall be sized according to the Pine Rivers Shire Council standards, the specific characteristics of to particular pipeline and in accordance with manufacturer's specifications.

Air valves are to be fitted on to an off-take tee, usually rising vertically from the obvert of the main. In constrained and special circumstances a scour tee may be fitted with the branch positioned off the obvert of the main. Branch pipework shall be installed to ensure that a rising grade is maintained to the air release valve.

A service valve (section valve) in the form of a butterfly valve or gate valve shall be positioned immediately below every air valve (or on the branch pipework) to permit servicing of the air valve. The service valve shall be fitted in a readily accessible position to workers at ground level without need for excavation. The valve is to be fitted in a manner that retains the valve permanently in place and the main operational with the air valve removed.

Air from the air valve shall be released to the atmosphere through suitable pipework. Exhausted air shall not be permitted to build up in a sealed pit.

Reticulation Mains

Air valves are to be positioned on every high point along all reticulation mains of 250 mm diameter and greater. An air valve shall also be installed on the end of any reticulation main in this size range where the end of the main is the highest point on the main.

Air valves are not considered necessary on reticulation mains less than 250 mm diameter.

Trunk Mains

Air valves are to be positioned on every high point along all trunk mains.

Trunk mains are divided into segments by the installation of section valves. Air entry and release points must be provided at suitable locations on each segment of the main for effective emptying and filling.

Where air valves are not necessary along sections of main for optimum in-service performance of the main, hydrant points may be used to allow air release or entry when filling or emptying of the main or section of main.

2.7.15 SCOUR POINTS

Scour points are required on water mains to permit controlled emptying of a main for maintenance works and for flushing and cleaning of a main.

Scour points are to be located at the lowest points along a pipeline.

Reticulation Mains

Scour points are required on all reticulation mains of 250 mm diameter and greater, as described below for trunk mains.

Scour points are not required on reticulation mains less than 250 mm diameter. Hydrants are commonly used and are permitted for scouring purposes on reticulation mains below this size. Hydrants shall be positioned at the lowest point of a reticulation main.

Trunk Mains

Scour points shall be incorporated into the design of all trunk water mains. Scours shall consist of a tee branch aligned to the invert of the water main.

A valve is to be located on the tee, or along the outlet pipework close to the tee, but preferably out of a road carriageway. Valves controlling scours are to be treated the same as isolating valves.

The outlet pipework shall be extended from the branch to a suitable outlet point. Suitable outlets for scour pipework are:-

- stormwater catchpit
- stormwater manhole
- culvert wall or endwall – not discharging directly into a creek or stream
- a manhole or chamber constructed for the purpose of pumping from

Outlets, especially those not discharging into a chamber, are to be carefully designed to control the projection, disbursement and erosion effects caused by released water.

Trunk mains are divided into segments by the installation of section valves. Scouring points are to be installed at the lowest point on each section of a main to permit emptying of the main.

On occasions where a scour point may not be effective due to an outlet point of a suitable level not being available, emptying of the main may be effected using a hydrant point, where the contents can be pumped out.

2.7.16 CONNECTIONS TO EXISTING MAINS

The designer shall consider the requirements of connecting new work into the existing water supply network. The underlying principles to be considered when designing connection works shall include:-

- minimisation of effects on major supply systems (reservoirs may need to be full if working on major trunk mains)
- minimisation of down-time of any segment of the existing water supply system
- minimisation of disruption to consumers
- ease of installation and/or pre-assembly of components (constructability)
- minimisation of untested pipework
- minimisation of wastage of water and materials (at the time and in the future)
- dosing and removal of testing, flushing and superchlorinated disinfecting waters

Where a project is known to require future extension, or includes planned connection of future mains at pre-determined locations, the designer shall include all components into the project necessary to permit these future works to be carried out under the principles described above.

The planned and designed-in allowance for future interconnection or extension of mains is especially critical for works associated with the trunk main system. Disruption to this system must be kept to an absolute minimum of time and number of occurrences due to effects on potentially critical segments of the supply network.

This may require the designer to include:-

- additional branch tees and associated valves and fittings etc. at key locations
- pipeline ends restrained, in place of thrust blocks on end caps
- continue pipework through walls of pits and chambers

2.7.17 MISCELLANEOUS FITTINGS

Bends

Socket – Socket and Spigot – Socket flexible joint bends and other fittings which generate a resultant thrust are not to be installed less than 10 times the pipeline diameter apart. .

Flanged bends and fittings may be installed coupled together.

Couplings

Gibault couplings will be required to enable installation of fittings etc. in to existing pipelines. They will also be used to permit the dismantling and removal of components from pits, chambers and pipelines etc.

Loose-flange couplings may be used for similar purposes as gibaults, however are used where there is limited space available for dismantling joints, and dismantling of flanged components is required.

Neither gibaults nor loose flange couplings are considered capable of accommodating or transferring thrust forces.

Thrust Flanges and Weep Flanges

Flanges are commonly used to transfer unresolved forces from the pipeline in to an anchor block or chamber wall. The following types of flanges may be used for this purpose:-

- special cast fitting integrally cast thrust flange
- pipe special with welded thrust flange
- pipe special with mechanically fastened thrust (weep, or puddle) flange

It is preferred that all cases be manufactured under controlled conditions by pipe of component suppliers. In all cases, the thrust flange shall have dimensions and configurations not less than their respective pipe or fitting standards required for ordinary flanges.

Weep flange configurations are the same as for thrust flanges, however are fitted to assist with inhibiting the influx of groundwater in to below-ground chambers and do not need to transfer thrust forces.

2.7.18 PROPERTY SERVICE CONNECTIONS

Property service connections are the length of pipework, including the fittings, stopcock and meter, between the water main and the property boundary, which are maintained by the Pine Rivers Shire Council. The property owner will connect their private water supply plumbing to this pipework.

The configuration of property service connection pipework may take many forms depending on the use of the land and quantity of water required. Details and diagrams for property service connections are detailed in the Pine Rivers Shire Council standard drawings. Where a hydrant and pretapped property service fitting are required at the same common property boundary, the hydrant shall take priority. The pretapped fitting may be placed as close as practicable to the hydrant in a position clear of potential future driveway locations, or on the next common property boundary.

Pretapped property service fittings are to be installed for commercial and industrial properties where they are serviced by mains of a diameter compatible with these fittings. The requirement for a larger diameter property service connection will be considered as part of the allotment owners' assessment of their use of the site.

Hydraulic consultants sizing and designing property service connections shall consider aspects of backflow prevention in their design.

Community Title Developments

The provision of water to community title developments will be made from one point on the water supply network and supply metered at this point.

In larger community title developments managed by a single administrative body, a second metered connection to the Pine Rivers Shire Council water supply network may be permitted in the interests of providing a looped internal network and backup point of supply. Requests for approval of this configuration are to be directed to the General Manager, Pine Water.

The metering arrangements for community title developments will be in accordance with the relevant Pine Rivers Shire Council policy.

Connections to Reticulation Mains

On reticulation mains, pre-tapped property service fittings are to be installed into mains at the time of construction of the water main (where these fittings are available to suit the pipe diameters). Pre-tapped property service fittings are to be the same diameter as the water main. Where pre-tapped fittings are not available to suit the pipe diameters, alternate fittings are not required.

Where pre-tapped property service fittings are to be installed along the water main, the fittings are to be positioned opposite property side boundaries and preferably on the opposite side boundary to electrical and communication connections.

Property service connections may only be made to reticulation mains.

Connections to Trunk Mains

Connections to trunk mains may only be considered where special circumstances exist, can be demonstrated and with approval from the General Manager, Pine Water.

Under these circumstances, the Pine Rivers Shire Council may require the developer to supply fittings for the tapping of the water main.

2.7.19 SERVICE CONDUITS

Conduits are to be provided under roadways and hard surfaced areas to facilitate the installation of property service connections without excavation. Conduits are to extend behind the kerb and channel and continue, without a break, under concrete pathways where these are constructed on the verge adjacent to kerb and channel.

Service conduits are to be positioned and installed in accordance with the Pine Rivers Shire Council standard drawings.

2.7.20 PIPEWORK IN PITS AND CHAMBERS

Pits or chambers are usually required for the installation of pressure reducing valves, and larger section valves where butterfly valves are employed, or for other special installations.

Location

It is preferable for pits and chambers to be located clear of the existing and future road carriageway wherever possible. However it is acknowledged this may not be possible in many circumstances.

Where a pit must be positioned within a road carriageway, preference should be given to locating it: -

- clear of an intersection or the turning path of large/heavy vehicles through an intersection
- in the shoulder clear of any driven lane
- in, or across, one driving lane only

A pit shall not be installed across the line of kerb and channel between the road carriageway and verge.

Pits are to finish level with their surrounding surface, or design future surface levels, unless their design configuration requires otherwise.

Pits are to include a sump and, wherever possible, this shall connect to a free-draining outlet.

Flotation

In areas where there is a high water table, all pits are to be checked and designed to ensure flotation of the pit will not occur.

In determining flotation characteristics, the designer may include the pit and all pipework permanently cast into the pit i.e. pipework penetrating the walls.

Pipework and fittings which may be removed from the pit and pipework in trenches leading to and from a pit may not be included in any calculations to assist in the prevention of flotation.

Ends

Where a branch line terminates at a pit, and this line is to be extended in the future, a valve is to be installed on the branch line allowing the future extension to be joined to the existing line without interruption to supply.

The end branch is to be brought through the pit wall and terminated outside the pit with a suitable end cap, plug, or blank flange (see, also, “line ends”).

Valves

Where the pit is for installation of an on-line section valve, the layout must accommodate thrust and dismantling for removal of the valve and/or other pipeline fittings. The valve shall be retained on the pipework from the direction of flow.

Where the pit accommodates a tee or cross branch, valves are to be positioned on each branch line. A valve cannot be installed on each pipeline leg within one pit as thrust forces cannot be addressed whilst maintaining the ability to dismantle and remove components. A minimum of two branch valves shall be included in the pit. Section valves, if in close proximity (less than 100 m away) can serve as branch valves. In other circumstances, another pit to

accommodate a branch valve must be located within this distance.

Thrust

Refer to the section dealing with anchor blocks.

Jointing

Pipework located inside pits shall be designed to permit dismantling for maintenance and servicing of valves and for future modification to pipework.

Fittings such as gibault joints, which permit movement of fittings for the separation of flanges, shall be strategically incorporated into the pipework layout.

Pipework, or pipe specials over which gibaults joints are to be installed shall be designed so that the complete length of the gibault barrel and one ring (collar) is able to be accommodated fully on one of the components being joined.

Access

Access into pits and chambers is to be designed to suit:-

- manipulation (operation) of valves without the need for personnel to enter the pit
- placement of a portable de-watering pump within a sump in the pit from the ground level or pit surface level
- personnel access
- access which permits maintenance of and removal of serviceable components from the pit e.g. valves, pressure reducing valves, fittings etc.

Provisions for personnel access must be in accordance with Occupational Health and Safety requirements for access space and include a ladder or step irons permanently installed in the pit.

Pits may have a cast concrete top incorporating suitably sized access openings strategically located to suit the above criteria or a top cover that is fully removable. Access covers located in a traffic area (not only roads) are to be Class D to AS 3996.

2.7.21 WATER DRAW-OFF POINTS

In areas where new park residential, special residential and future rural living areas are developed on the fringe of the water supply network, the Pine Rivers Shire Council may require the installation of a designated point to permit the drawing-off of water from the main. Selection of the site for the draw-off point should consider the following criteria:-

- be along a road of highest order classification possible (Refer Design Standards for Roadworks)
- be easily accessible and safe for use by water tanker trucks
- be relatively remote from residences and commercial properties
- preferably be on, or near to an end of a reticulation pipeline
- be within 500 metres of a suitable safe truck turning or manoeuvring area
- preferably be on a main of 200mm diameter

The facilities to be provided as part of the draw-off facility include:-

- a paved and sealed pull-off facility clear of the through road driving lanes, suitable for a heavy rigid vehicle, constructed similar to a bus bay, or
- a paved and sealed pull-off facility within a parking area of a sealed road carriageway clear of through traffic, or
- a safe truck turning or manoeuvring area is to be provided where this is not available within 500, and
- a hydrant is available or installed within 5m reach of the pull-off area
- attention is to be paid to ensure safe operation of the through road, and safe turning to and from the through road, including road geometry, sight distance, passing lanes etc.
- branch water mains installed solely for the purpose of supply to the filling point may be 100mm diameter

2.7.22 TELEMETRY

The Pine Rivers Shire Council may require telemetry control to be installed on some water supply installations, for example pressure reducing valve installations, pumping facilities and reservoirs.

Advice is to be sought from the Pine Water Section of Pine Rivers Shire Council on the standard installation arrangements required.

2.7.23 TESTING

Water mains shall be tested in accordance with the requirements and procedure described in the Pine Rivers Shire Council specifications for water supply works.

The designer shall consider the specific requirements associated with testing of the water mains and include these features in the pipeline design. This will include installation of places to fill and drain the main and for the connection of testing equipment.

2.7.24 FLUSHING AND STERILISATION

Water mains shall be flushed and sterilised in accordance with the requirements and procedure described in the Pine Rivers Shire Council specifications for water supply works.

Super-chlorinated water shall be disposed of in a way that will not cause any harmful effects to, or degradation of, the flora or fauna and streams or waterways, including erosion. Disposal will require dilution or neutralisation of the super-chlorinated water.

The designer shall consider the specific requirements associated with this work and include these features in the pipeline design. This will include installation of places to fill and drain the main and for the dosing of the disinfecting agents.

Any cross connection, temporary or otherwise, to the live system while sterilising is to be fitted with backflow prevention in accordance with AS 3500.