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7. WATER RETICULATION

This Part includes:

- The assessment of required infrastructure
- Technical design requirements
- Material requirements
- Completion Documentation requirements for vested asset acceptance

The Water Supply Bylaw defines the Council's requirements for protecting the water supply along with minimum levels of service expected to be provided.

Unless stated below Sewlyn District Council defers to the construction standards set out in CCC CSS.

7.1 REFERENCED DOCUMENTS

Planning and Policy:

- Selwyn District Council Water Supply Bylaw 2008 (Document Link
- Selwyn District Council 5Waters – Strategies and Policies (2009) (Document Link)
- Ministry of Health Drinking Water Standards for New Zealand 2005 (amended 2018) and any subsequent amendments Guidance and Resources | Taumata Arowai
- Selwyn District Council - Disinfection and Hygiene for Water Reticulation (WSP 005)

Design:

- Christchurch City Council Water Supply Wells, Pumping Station and Reservoir Design Specification
- SNZ/PAS 4509:2008 New Zealand Fire Service Fire Fighting Water Supplies Code of Practice (Fire Service Code of Practice)
- AS/NZS ISO 9001:2015 Quality Management Systems – Requirements
- AS/NZS 4020:2010 Testing of products for use in contact with drinking water
- AS/NZS 2566.1:1998 Buried flexible pipelines structural design
- AS/NZS 2566.1:1998 Buried flexible pipelines structural design, supplement 1
- AS/NZS 2845.1:2018 Water supply – Backflow prevention devices
- AS/NZS 4130:2018 Polyethylene (PE) pipes for pressure applications

Construction:

- Christchurch City Council Civil Engineering Construction Standard Specifications Parts 1-7 (CSS) (Document here)

Where a conflict exists between any Standard and the specific requirements outlined in the Engineering Code of Practice (ECOP), the ECOP takes preference (at the discretion of the Council).

7.2 OVERVIEW OF SELWYN DISTRICT'S WATER SUPPLY

Selwyn District Council's water supply is essentially a number of separate schemes that sources high quality groundwater from confined aquifers, with a number of surface water takes.

Monitoring and control of pumps and pressures are undertaken from the Selwyn District Council's main offices in Rolleston, via telemetry, using a Supervisory, Control and Data Acquisition (SCADA) system.

SDC's networks include the following supplies:

Restricted Supplies:

- Acheron
- Dalethorpe
- Hartleys
- Hororata

On Demand Supplies:

- Arthurs Pass
- Castle Hill
- Claremont
- Dolyleston
- Dunsandel
- Jowers Road
- Lake Coleridge
- Leeston
- Raven Drive
- Rakaia Hutts
- Springston
- Te Pririta
- Upper Selwyn Huts

Combination of On Demand and Restricted

- Darfield
- Greater West Melton
- Kirwee
- Lincoln
- Prebbleton
- Rolleston
- Sheffield
- Southbridge
- Springfield
- Tai Tapu
- Taumutu

Please contact SDC Water Services to confirm current status of scheme specific treatment processes (such as residual disinfection) and availability of connections (including type of connections).

7.2.1 Effects of Development on the Water Supply Network

System extensions, upgrading headworks and any other specific works required to provide water for a new development will be funded in accordance with the Council's Development Contributions Policy .

Any development reliant on the municipal supply will be required to contribute to the infrastructure necessary to connect. The developer is responsible for the cost (or part cost) of any system extension.

7.2.2 Water Supply Resource Constraints and Consents

Generally, Council will not accept community run supplies. Where available, connection to a Council reticulated system is strongly preferred.

Consents to take surface or ground water in the Selwyn area are required for both public supply and private purposes from the Canterbury Regional Council (Environment Canterbury). Canterbury Regional Council must be consulted for information on likely consent conditions.

Upon consent application, developments with infrastructure that will be vested in the Council will be issued with design parameters.

Design infrastructure with sufficient capacity to cater for all existing and predicted development within the area to be served. Make allowance for areas of subdivided or un-subdivided land capable of future development, as specified by the Council in the design parameters.

On-demand water supply systems, without fire-fighting capacity to Fire Service requirements, will not be approved.

If, for any reason, the Council approves a development without public supply to the Council's level of service, in an area where such a supply could reasonably be expected, the Council reserves the right to add a note to the property file advising of the situation.

7.3 WATER SUPPLY DESIGN CONSIDERATIONS

Council expects designers to develop water supplies that support Selwyn District Council's obligations to provide safe and reliable potable water. Any proposed design is expected to be in line with current best professional practice. For projects of moderate to large scale and/or complexity, or within sites of network significance, Council may require its network modeller to confirm the proposed design's impact on Council's network. The cost of this modelling will be met by the Developer/applicant.

When designing a proposed water supply for Council to review please consider the following and provide supporting evidence in the Design Report:

- Hydraulic adequacy of the system
- Requirements of the Fire Service Code of Practice
- Capacity and ability to service future extensions and development
- Networking, redundancy and security of supply
- Maintenance considerations and "Fit-for-purpose" service life of the system
- Best way to minimise the whole-of-life cost
- Ability of the water system to maintain acceptable water quality, including consideration of materials and their disinfection demand, and prevention of back siphonage and stagnation
- Structural strength of water system components to resist applied loads, including ground bearing capacity
- Seismic design - all infrastructure must be designed with adequate flexibility and special provisions to minimise risk of damage during earthquake. Provide flexible joints and isolation

valves at all junctions between rigid structures (e.g. reservoirs, pump stations, bridges, buildings, manholes) and natural or made ground
- Pipeline's ability to withstand both internal and external forces, taking into account any transient temperature changes
- Poisson's effect and end restraint designs to compensate where necessary
- Resistance of each component to internal and external corrosion, degradation and ground contamination.
- Location of major reticulation and its potential for significant traffic disruption. Discuss at an early stage with Council
- Impact of the works on the environment and community

In general a minimum of 300kPa is supplied at the point of supply.

Design all parts of the water supply system that are in contact with drinking water using components and materials that comply with AS/NZS 4020. Select the pipe material to ensure a minimal impact on water quality within the system. Council reserves the right to request quality assurance documentation and relevant experience and track record of supplliers prior construction.

7.3.1 Design life

All water supply distribution systems are expected to last for an asset life of between 50 and 100 years (depending upon asset type) with appropriate maintenance and must be designed accordingly to minimise life cycle costs for the whole period.

All products must be fit for their respective purpose and comply in all respects with the Council's current specification for the supply of that material and the standards referenced.

7.3.2 Material specifications

Manufacturers of any pipes and fittings intended for use in the Selwyn district distribution system must have a certified quality management system in place that complies with AS/NZS ISO 9001. This system must apply to all aspects of the manufacturing processes, including product handling, administration and stock control.

The Council requires the right to verify that any and all contracted and subcontracted products conform to the specified requirements (clause 7.5.2 of AS/NZS ISO 9001). Full product identification and traceability is required (clause 7.5.3 of AS/NZS ISO 9001). Protection of the quality of the pipe and fittings includes transportation and off-loading at the delivery point (clause 7.5.5 of AS/NZS ISO 9001). Full quality records (as per the manufacturer's Quality Assurance manual) must be available on request for evaluation by the Council and be kept for a minimum period of 10 years.

Both the developer and the contractor are responsible for ensuring the appropriate handling, storage, transportation and installation of pipes and fittings to avoid damage and to preserve their dimensions and physical properties. The total exposed storage period from the date of manufacture to the date of installation for all PVC and PE pipe must not exceed 12 months. Store fittings under cover at all times.

The Council reserves the right to require full details of the manufacturer's means for demonstrating compliance. Irrespective of the means of demonstrating compliance and the supplier's and manufacturer's quality assurance systems, responsibility remains with the developer to ensure the installation of products that conform with the requirements of the ECOP and the appropriate standards. The Council may arrange for independent testing to be carried out on randomly selected samples or assembled joints.

Positive verification inspections or testing results obtained by the Council shall not limit the supplier's responsibility to provide an acceptable product, nor shall it preclude subsequent claims made under warranty due to manufacturing defects, faulty design, formulation or processing.

7.3.3 Contaminated sites

Avoid contaminated sites wherever possible. If a contaminated site cannot be avoided, provide details about the following issues with the Design Report:

- Compliance with statutory requirements – NCES consent
- Options for decontaminating the area
- Selection of materials and jointing techniques to maintain the water quality
- Safety of construction and maintenance personnel
- Any special pipeline maintenance considerations

7.3.4 Specific structural design

Design pipelines being installed at depths greater than detailed in *CSS: Part 4* to resist structural failure. The design must comply with AS/NZS 2566.1 including Supplement 1. Provide details of the final design requirements in the Design Report.

Any ground that has an ultimate bearing capacity less than 150 kPa is unsatisfactory for watermain construction. In such environments, engage a geotechnical specialist to investigate the site and to design and supervise the construction of an appropriate support or foundation remediation system for the watermain. Refer to clause 3.6.4 – Peat (Geotechnical Requirements) for further information.

7.4 DESIGN PARAMETERS

When the developer is providing water reticulation for vesting in the Council, the Council will provide the following parameters, after receipt of the application plan:

- Point of supply
- Mains size at the point of supply
- Supply type (e.g. on-demand or restricted)
- Design number of connections, as provided by the developer
- Additional development to be allowed for in the design
- Static pressure
- Residual pressure at peak system demand in the network
- Residual network pressures during fire demand at critical point of supply
- Fire water classification at point of supply
- The minimum residual pressure at house site at peak system demand
- Networking requirements
- Other requirements (e.g. minimum mains size)

In areas identified for future growth Selwyn District Council may require the proposed development infrastructure to be oversized. Where this occurs Council would consider a developers agreement to cover the extra over costs associated with the oversizing.

Large diameter pipes (>200mm dia) and trunk mains should not have direct connections.

7.4.1 Living zones in on-demand water supply areas

The design average flow rates for the Selwyn District are based on Figure 1.

Provide the design flow rates, for developments other than standard living zones (e.g. multi-unit developments or older persons" housing), with the Design Report.

The minimum residual pressure at all points of supply must be no less than 300 kPa (and no more than 600kPa unless otherwise agreed with the SDC Development Engineering Manager) and applies to ground level at the highest likely building site on each allotment.

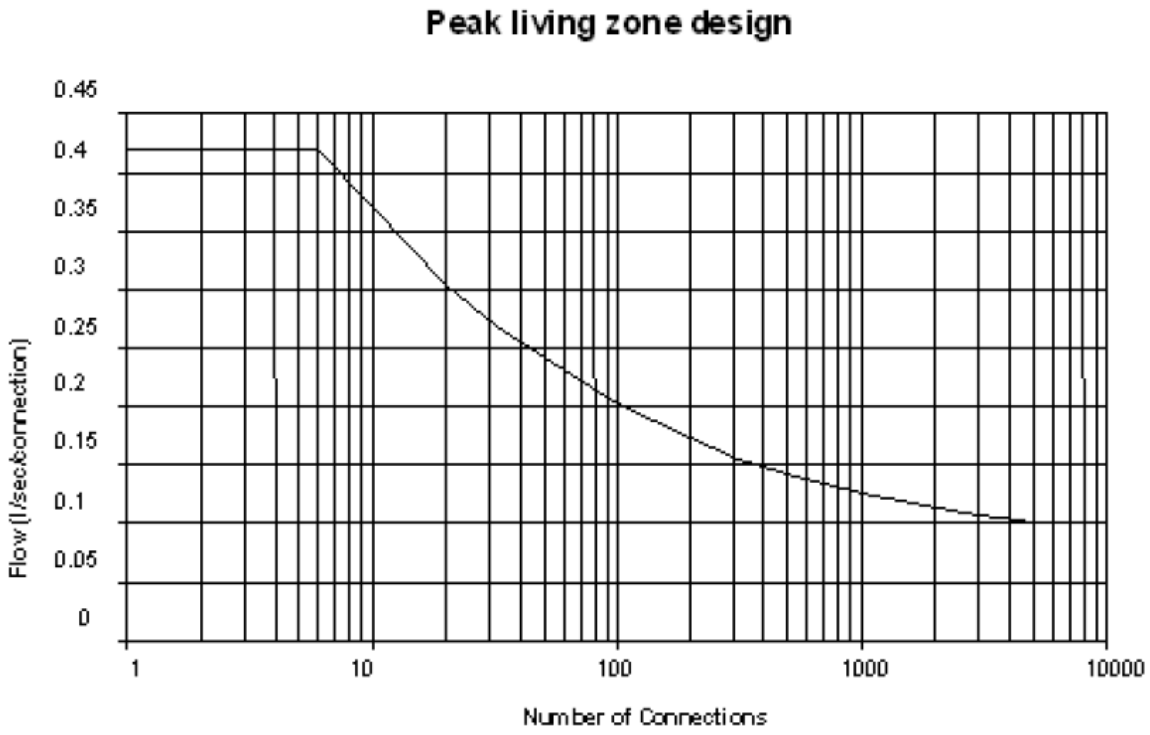

Figure 1 - peak living zone design flow rates

7.4.2 Business zones in on-demand water supply areas

Industrial and commercial zones shall be developed with a minimum flow rate of 1.0 l/s/Ha unless it can reasonably be shown that consumption will be higher, in this case use the higher consumption figure determined.

The minimum residual pressure at all points of supply must be no less than 300 kPa (and no more than 600 kPa unless otherwise agreed with the SDC Development Engineering Manager) and applies to ground level at the highest likely building site on each allotment.

7.4.3 Design for restricted water supply areas

Design any rural restricted supply to provide three days storage at the design flow for each property. Provide each property with a restrictor at the time of connection that will pass the allocated number of units over a 24-hour period, depending on the volume set down under the resource consent. Rural

restricted supply connections shall include dual check valve manifold with restrictor and tanks shall have a ball cock to provideair gap separation.

Any other sources of water on any property must not be connected to the reticulation upstream of the air gap separation. Design rural restricted supplies for domestic purposes, rather than for stock water or irrigation purposes.

Individual sites may provide their own water bores for domestic purposes. These bores must be established in accordance with the consent requirements of Canterbury Regional Council. The water must be tested to show that the water quality is potable in accordance with the *Drinking Water Standards*.

7.4.4 Fire Supply Design

The water supply reticulation must comply with SNZ PAS 4509:2008 Fire Service *Code of Practice*. In particular, the reticulation must meet the requirements for firefighting flows, residual fire pressure and the spacing of hydrants.

Designers must consider fire supply and demonstrate how the fire requirements will be met.

When considering the effect on the reticulation network of the firefighting hydraulics (flow, headloss and pressure) scenario, as determined by SNZ PAS 4509:2008, the minimum pressure at all points of supply in the network shall not be less than 200 kPa.

Blue RRPMs ("cat eyes") shall be installed at or near the road centreline with a yellow triangle next to it on the hydrant side, for all hydrants installed in the Selwyn district.

Hydrant Marker posts are to be installed to comply with Section G3.4 of the NZ Fire Service *Code of Practice*. Hydrant posts are not required in urban areas. The type of hydrant marker required is shown on drawing WS10.0

Many industrial and commercial sites require the installation of fire services. The site owner is responsible for providing these fire services, which must be designed to meet the requirements of the New Zealand *Building Code*.

All firemain connections to the Council reticulation must have a flow meter and testable backflow prevention fitted.

7.4.5 Standard Water Supply Pipe Sizes

When designing water reticulation systems the following pipe sizes are acceptable for use in the Selwyn district: (Pipe sizes are Nonimal diameter unless otherwise stated):

- Watermains – 100, 150, 200, 300, 375, 450, and 600mm
- Submains – 63mm Outside Diameter (OD) PE
- Laterals:
    - Front Lots – 25mm OD PE
    - Rear Lots – 32mm OD PE
    - Commercial developments – approved on a case-by-case basis

7.4.6 Minimum Pipe Class And Fitting Class

The minimum pipe class for watermains is PN12 unless a higher pressure rating is required as identified in the design report (including an allowance for surge and fatigue). The minimum class for fittings is PN16 unless PE fittings are being used in which case they shall be the same pressure rating as the pipe.

The infrastructure shall be designed and pressure tested to the pressure rating of the lowest rated pipework or fitting (PN12). Refer to SDC policy WSP 005 regarding hygiene, infrastructure sterilisation and minimum qualifications for pipe installers and CCC CSS Section 14.3.2. 14.3.3. and 14.3.4 for testing requirements.

7.4.7 Infrastructure Sizing

Size infrastructure considering projected peak demand, fire flows and associated pipe friction losses. The design report shall include but not be limited to:

- The method used for sizing (including hydraulic model, calculations, and friction factors as per NZS 4404)
- How degradation of material has been included within the design
- Selecting pipework and fittings materials and classes
- Designing and position of thrust and anchor blocks
- Positioning of valves and hydrants.
- Submain connectivity and number of points of supply served
- How differences in elevation across the subdivision or development have been taken into account
- How supply point pressures will be managed as part of the design to comply with design parameters
- Surge and Fatigue

Some of Selwyn District Councils water supplies are pumped, so keep hydraulic gradients (other than for firefighting purposes) below 0.01m/m. The Council may approve exceptions to this rule in isolated cases where the pressure is independent of pumping rates.

7.4.8 Surge and fatigue

Plastic pipes are susceptible to damage from cyclic loads, above ground installation and changes in temperature. The design report shall include an assessment of both surge and fatigue in accordance with the criteria set out in Appendix I - Design for Surge and Fatigue.

7.4.9 Pumping Stations & Reservoirs

Any requirement for a secondary pumping station will become apparent during the preliminary reticulation design. The Council will take into account the long-term cost-effectiveness (i.e. total life-cycle costs) of the structure before accepting any infrastructure to be vested in the Council.

Obtain requirements for pumping stations from the Council prior to design. On hills, all pumping stations must pump to a reservoir to even out any fluctuations in demand, unless the Council states otherwise in the design parameters.

Unless otherwise identified by SDC, when designing and sizing reservoirs, refer to the CCC Water Supply Wells, Pumping Station and Reservoir Design Specification.

7.4.10 Mains Layout

Adhere to the following factors when deciding on the general layout of the mains:

- Lay water mains in the berm area of public road reserves.
- When undertaking watermain renewals and the berms are full, lay mains within the road carriageway 1m offset from the kerb.
- Consider the need for existing mains to be replaced due to their physical condition and/or inadequate capacity or whether new mains are required to provide additional capacity
- Provide easy access to the main for repairs and maintenance
- The location of valves for shut off areas and zone boundaries. Note the “40 property” constraint in the Sluice valves section, for shutting off sections of the network
- Provision for hydrants, scour and air valves
- Required clearances to other utilities and structures (see Section 12)
- Topographical and environmental considerations
- Avoidance of dead ends
- A hydrant must be placed at the end of all permanent and temporary sections of dead end mains greater than or equal to 100mm diameter
- Providing dual or alternate feeds to minimise customer disruptions
- Large diameter pipes (>200mm dia) and trunk mains should not have direct connections.
- Reticulation shall be installed to Fire Code of Practice specifications (SNZ PAS 4509 and subsequent amendments).
- Toby boxes are required in accordance with standard drawing WS3.0A and WS3.0B within 1m of each lot boundary. Laterals shall be extended from the toby to 1m inside each section being serviced. The lateral will be capped with a mechanical fitting and its position marked on site.
- Allow for known future utility services, road realignment, road reinstatement, crown lowering and road widening.
- The preferred position of surface boxes, e.g. sluice valves and fire hydrants, is in line with either side of property entranceways, to avoid interference with parked vehicles. Locate surface boxes clear of road carriageways, feature paving such as cobblestones, and within roundabout islands where possible.
- In cul-desacs lay principal mains to within 20m of the end of the cul-de-sac with a fire hydrant at the end. Measure the distance to the terminal hydrant from the road boundary at the end of the cul-de-sac
- Give special consideration to the design and installation of pipelines in any land prone to slips or instability or with a gradient steeper than 1:10
- Cross existing utilities and services at 90 degrees where practicable and no less than 45 degrees
- Where crossing stormwater drains, water races or streams the details of the crossing and approvals from affected parties shall be provided in the design report
- Include the design of pipeline supports and loading protection with the design of above-ground watermains and document in the design report. Address any exposure conditions such as corrosion protection, UV protection and temperature re-rating. Provide details of mechanical protection to prevent vandalism and rockfall.

7.4.11 Reticulation location and depth in legal road

Generally water services shall be located as set out as shown below in Table 5.

Water service	Location within road corridor
Mains	On the outside of the service trench but not under the Kerb and Channel. Minimum pipe cover 0.6m, maximum cover 1.2m unless otherwise agreed in writing with the Development Engineer.
Submains	0.5m off the boundary Pipe Cover: 0.6m in the berm and 0.75m in the road.

Table 1 - Location of water services in the road corridor

All pipiework must comply with minimum cover requirements. In exceptional circumstances where minimum cover can not be achieved, Council may approve the use of concrete capping (in accordance with CCC CSS). Council must be made aware of these instances at the Engineering Approval stage.

7.4.12 Watermains in easements

Avoid installing infrastructure within land which will require easements over private property.

Typical situations where the Council may approve mains in easements include those where there is the need for a link main to provide continuity of supply or to maximise water quality, or where fire protection is required. Easements may be located over private property, public reserves, crown reserves, other government-owned land, private roads or accessways in both conventional and community title subdivisions.

Easement width is the greater of:

2 x (depth to invert) + OD

3.0 m

The easement registration must provide the Council with rights of occupation and access and ensure suitable conditions for watermain operation and maintenance.

7.4.13 Reticulation On Private Property

Water supply laterals downstream of the point of supply toby box and in mutually owned right-of-ways are considered to be privately owned and must be protected by easements in favour of the dominant tenants.

Unless otherwise agreed in writing with Council, a single point of supply is provided to each individual section valuation number.

7.4.14 Working near structures

Watermains that are located close to structures, such as foundations for walls and buildings, must be clear of the “zone of influence or toe” of the structure’s foundations, to ensure that the stability of the structure is maintained and that excessive loads are not imposed on the watermain.

7.4.15 Submains

Typically submains are circuits with crossovers and connections to the main at each end. These can be to hydrant risers or taping bands. Valves are to be installed at each end. Table 2 (shown below) identifies the maximum number of lateral connections that may be serviced by a single circuit submain.

Table 2 - number of allowing connections to a submain

Number of Connections	Length (m)									
	50	100	150	200	300	400	500	600	700	800
2	63	63	63	63	63	63	63	63	63	63
4	63	63	63	63	63	63	63	63	63	63
6	63	63	63	63	63	63	63	63	63	63
8		63	63	63	63	63	63	63	63	
11			63	63	63	63	63			
14			63	63	63					
25			63	63						
27			63							

7.4.16 Temporary ends of water mains

Lay watermains to within 1.0m of a subdivision boundary, where it is intended that the road will extend into other land at some future time.

In new development areas, construct mains to terminate approximately 2.0m beyond finished road works, with a hydrant. The hydrant must be suitably anchored, to ensure that future works do not cause disruption to finished installations.

7.4.17 Trenchless technology

Trenchless technology can be used subject to the confirmation of suitability of ground conditions by the engineer and as detailed in the design report.

Submit the following, with the Design Report:

- How the required clearances from other services and obstructions will be achieved
- The location of access pits and exit points
- The depth at which the pipeline is to be laid and the tolerance on this, to ensure minimum cover is maintained
- How pipe support and ground compaction will be addressed

- Details of pipe materials and jointing
- Identify risks associated with conducting works in the existing ground conditions

The Council may also request process details.

7.4.18 Connection Design Requirements

When specifying the connection details, consider the following:

- Pipe materials, especially capacity for galvanic and other corrosion
- Relative depth of mains
- Standard fittings
- Pipe and fitting restraint and anchorage
- Limitations on shutting down major mains to enable connections
- Existing cathodic protection systems

Design connections from the end of an existing main to address any differing requirements for the pipes being connected, particularly restraint, spigot/socket joint limitations and corrosion protection. Use standard fittings and pipework to connect mains. Confirm all sluice valves near the connection are restrained.

Any alterations or connections to the existing reticulation system must be done at the developer's expense. Timing for connections must be agreed in advance.

The design of new connections shall take into account constructability and minimising the duration and extent of water supply shut down.

All connections to existing mains must be approved prior to construction, with proof of successful pressure test, chlorination and E.coli test provided to relevant Council Engineer (Water Services or Development Engineer). Application for connections are available via the SDC website. All connections to existing mains must be witnessed by the Councils approved Network Management Contractor.

7.4.19 Provision for pressure testing and sterilisation

Sterilisation (via chlorination) and pressure testing of water infrastructure must be undertaken prior to connection to the public system. **Pressure testing and sterilisation of new mains against an existing live reticulation valve is not permitted.** Pressure testing and chlorination shall include all pipework, fittings, submains and laterals to the point of supply of all individual lot.

The designer shall allow for chlorination and pressure testing as part of their design and include the testing philosophy within the design report.

Disinfection and hygiene of all new water reticulation is regulated by the SDC Standard Operating Procedure WSP005. Pressure testing and chlorination must be completed and approved before any connection to SDC's water network. Reports must be produced for both pressure tests and chlorination. Corde will follow the shutdown procedures and connection to the existing network must be done either by Corde or under the direct supervision of Corde staff. All contractors must work as instructed by SDC or Corde.

7.5 SYSTEM REVIEW

When the pipe selection and layout have been completed, perform a system review, to ensure that the design complies with parameters specified by the Council. The documentation of this review must include a full hydraulic system analysis.

Compliance records must cover at least the following requirements:

- Minimum residual pressure can be maintained at all property connections
- Maximum operating pressure will not be exceeded anywhere in the system
- Pipe class is suitable for the pipeline application (including operating temperature, surge and fatigue)
- Pipe and fittings materials are suitable for the particular application and environment
- Pipe and fittings materials are approved materials
- Minimal likelihood of water quality problems or water stagnation
- Valve spacing and positioning allows isolation of required areas
- Mains layout and alignment meets the Council's requirements
- Meets minimum firefighting demands
- Control valves, where required, are positioned to provide the required control of system
- Watermains are extended to boundaries (to allow servicing of future developments)
- Connections (to existing or future subdivisions) form a cohesive network and provide security of supply
- Capacity provided for future adjacent development

7.6 RETICULATION FITTINGS

7.6.1 **Valves**

Sluice valves are required on mains next to the branch of any tee. Other valves must also be provided to ensure that turning off a maximum of **five** valves can isolate the network in any area. The maximum five-valve shut off must **not** isolate more than 40 properties.

Sluice valves are also required at each end of submains. Submain sluice valves are to be 50mm Hawle or AVK or similar.

All valves need to be installed in a CI box and lid sitting on at least 2 interlocking concrete frames as per *CCC CSS SD412*

New subdivisions shall locate all valves in the berm. Where renewals and connections to existing mains are approved in the road these shall include valves located away from intersections and live traffic lanes.

Attach sluice valves on mains to flanged fittings at junctions rather than plain-ended fittings. All galvanised bolts bolting flanges together are required to be Denso wrapped and taped over.

Sluice valves shall be anticlockwise closing resilient seated.

7.6.2 Backflow

Design and equip drinking water supply systems to prevent back siphonage. Backflow prevention devices must meet the requirements of AS/NZS 2845.1.

All non-residential properties shall have testable Reduced Pressure Zone (RPZ) type backflow prevention devices installed at the point of supply. These RPZs are owned and maintained by private property owners since they are to be installed immediately downstream of the point of supply (at the boundary). These devices to be installed with frost proof protection in compliance with AS/NZS 3500.1 at the point of supply, likely to be the property boundary.

The property owner must undertake annual backflow testing on point of supply RPZ. The owner of the property to which the RPZ is installed shall keep appropriate records.

7.6.3 Air valves

Investigate and document in the design report the need for air valves at all high points. The number and location of air valves required is governed by the configuration of the network, in terms of both the change in elevation and the slope of the watermains.

Install air valves in a secure enclosure above the ground (and with air valve above the 100 year flood level), with an isolating valve at the main and immediately upstream of the air valve to permit servicing or replacement without needing to shut down the main.

Air valves are not normally required on reticulation mains in residential areas, as the service connections usually eliminate air during operation. Where the need is primarily for admission and exhaust of air during filling and emptying operations, a hydrant located at the high point is usually adequate.

Dual-acting air valves, incorporating an air valve (large orifice) and an air release valve (small orifice) in a single unit, are generally preferred for distribution and trunk mains, and where required on reticulation mains. The sizing of air release valves shall be documented in the design report.

7.6.4 Hydrants, additional hydrants and scour valves for maintenance activities

Hydrants, additional to those required by the *Fire Service Code of Practice*, may be needed to facilitate maintenance activities, such as flushing the watermains. Ensure that there are approved and adequate drainage facilities to cope with the contents of the watermain from maintenance operations.

Where automatic dual-acting air valves are not installed at high points on the watermains, install a hydrant to release air during charging, to allow air to enter the main when emptying and for manual release of any build up of air as required.

Provide hydrants at low points on watermains, to drain the pipeline when scours are not installed. As a general rule, place a hydrant or scour at the lowest point of elevation where the volume of water unable to be drained exceeds 15m^3. This normally applies to mains greater than or equal to 200mm diameter.

7.6.5 Pressure reducing valves and check valves

Pressure reducing valves are preferred over break pressure tanks, and must be sized for minimum and maximum demand. The pressure reducing valves must have V-porting and relief valves, capable of taking full flow to an approved outfall, which is visible to the public.

Consider and allow for increased pressures as a result of pressure reducing valve failure.

All pressure reducing valves must have bypass pipe work and shutoff valve arrangements. This allows the valve to be isolated for maintenance or to reverse the flow if necessary.

7.6.6 Thrust blocks on mains

Thrust blocks should be considered for all fittings and valves, to withstand the greater of:

- Maximum operating pressure and test pressure, including transient and pump shut off head
- Adjacent pipeline class rating
- The minimum pressure of the lowest rated pipework or fitting
- The precast thrust block detailed in CCC CSS: Part 4, SD 406 may be used if all of the following criteria are met:
  - The fitting or valve is up to and including 150mm diameter
  - The maximum operating pressure is up to and including 700 kPa
  - The trench ground conditions can sustain an ultimate bearing capacity greater than 450 kPa, as established by testing
  - The thrust block will not experience up-thrust
  - The thrust block must have a minimum surface area of 0.18m^2 in contact with an undisturbed trench wall. Precast thrust blocks should not be used in loose gravelly ground.

If the above criteria are not all complied with, design and detail thrust blocks individually for the site bearing capacity as per *NZS 4404:2010 WS 004*. Consider the buoyancy effect of any alteration in the watertable.

Confirm the bearing capacity of the in-situ soil and the installed thrust block design and record in the Contract Quality Plan prior to installation.

Also detail anchorage for in-line valves on pipelines that are not capable of resisting end bearing loads.

In-line anchor blocks should be installed where it is deemed that longitudinal movement could occur as with the end of a PE pipeline connected to a PVC pipeline (as per *CCC CSS SD411*)

7.6.7 Restrained joint watermains

Restrained joint watermain systems (such as fully welded PE) can be used in place of thrust blocks to prevent the separation of unrestrained pipework and fittings.

Specify details of joint systems in the Design Report, including the:

- Length of restrained pipeline and adjacent fittings required to ensure the transfer of thrust forces to the ground strata
- Requirement for details of the jointing systems to be shown on the as-built records, including the location of restrained portions of pipelines

7.6.8 Detector tape

An approved 'detectable' warning tape shall be installed 200mm above all water main pipe, whether installed by open cut or trenchless technology. The tape shall include a stainless steel wire for use with a metal detector.

7.6.9 Point of Supply Connections and property meters

Refer to SDC website for more information regarding individual private water connections.

Any connections (including meters) will become the property of, and be maintained by the Council.

All water boxes shall be installed within 1m of the legal road boundary in the public road reserve. Water meter boxes shall be installed outside of trafficable areas, however if unavoidable use trafficable covers and frames.

As required under Council Policy W208, water meters shall be installed to Council specifications. Meters shall be Kent MS-M meters on a Accuflo metal manifold which includes a non-return valve all installed within an Accuflo meter box (SDC WS3.0B).

As-builts and watermeter serial numbers must be provided to council within 7 working days of completing connection.

7.6.10 Reticulation Network Flowmeters

Reticulation network flowmeters are to be supplied and installed when requested for the recording of water velocity and flow at suitable locations in the water network. The flowmeter requirements shall be specified by SDC at the time of development.

7.7 CONSTRUCTION

Construction of the water supply system must not start until approval in writing has been given by the Council.

Construction shall comply with CCC CSS unless otherwise stated.

7.7.1 Authorised Installers

All work on water reticulation systems shall be undertaken by a Water Supply Installer who is dedicated to the job on site overseeing the work who meets one of the requirements below:

- Is certified as a Christchurch City Council (CCC) Authorised Water Supply Installer, OR;
- Holds one of the following qualifications, as a minimum:
  - National Certificate in Water Reticulation (Planned and Reactive Maintenance Technician) (Level 3), OR;
  - New Zealand Certificate in Utilities Maintenance (Strand Water) (Level 4), OR;
  - Have committed to ongoing training towards the New Zealand Certificate in Utilities Maintenance (Strand Water) (Level 4), OR;
  - New Zealand Certificate in Infrastructure Works (Pipeline Construction and Maintenance) (Level 4) (strand Drinking-Water), OR;
  - New Zealand Certificate in Pipe Installations (Level 4) (trenched).

The qualified Water Supply Installer shall be present on site to oversee the pipe installations, connections and sterilisation process. This requirement shall apply to:

- Tendered capital works on the reticulation system;
- Subdivision works;
- Reticulation maintenance works.

It is also noted that the above outlines generic minimum requirements. The Selwyn District Council may impose any other requirements over and above these minimum requirements for individual construction contracts or subdivision consents, if deemed necessary.

7.7.2 PE Pipeline Construction

All PE pipe joins are to be Butt Welds and Electrofusion couplers. The following weld test requirements must be met during construction:

- One pre-construction test for each weld
- One construction test weld for any number of welds up to 20 and then 1 test weld for every 20 welds completed

Note: the pre-construction and construction weld test results are required to be submitted with the completion documents supply to Council for review and acceptance.

Pre-construction welds must be done on site and with the same personnel and equipment that will be used to complete the whole job. If at any time throughout the course of construction either of the following changes:

- The personnel
- The welding equipment
- The welded material changes

Pre-construction weld tests will need to be redone.

7.7.3 Connecting New Mains to Existing Mains

All connections to existing mains must be approved prior to construction, with proof of successful pressure test, chlorination and E.coli test provided to relevant Council Engineer (Water Services or Development Engineer). Application for connections are available via the SDC website. All connections to existing mains must be witnessed by the Councils approved Network Management Contractor.

Where water is needed to be temporarily shut off to enable connection to the Council reticulation, an application must be submitted on the SDC website at least 10 working days prior to connection. Once approval is given, the Council's Network Management Contractor must be contacted to arrange a shut-down including all public notifications. Council's Network Management Contractor must be in attendance for every water outage with their costs to be covered by the developer or project. Attendance both at the start of the outage and also for the reconnection of the Council supply is to be covered. Council reserves the right to recover 100% of costs related to Council's nominated contractor supervision. For developers this will be charged to the consent holder.

As identified by WSP 005, if the newly chlorinated main has not been connected to the existing reticulation within 15 working days of chlorination, the main shall be retested for E. coli as per the initial testing. If any of the new samples fail the E. coli test the disinfection procedure must be repeated.

7.8 COMPLETION DOCUMENTATION

Provide the information detailed in Section 2 of the Selwyn District Council Engineering Code of Practice, including:

- Producer Statements
- As built information (see Section 4)
- Schedule of Materials (AMIS Spreadsheet)
- Watermeters and their serial numbers
- Warranty Information and manuals
- Pressure test results and dated certificate (and .csv raw data)
- Chlorination test results and dated certificate
- Bacteriological test results
- Extent and locations of each test performed
- Material specification compliance test results (eg Material test certificates and weld tests)
- Bedding and Backfill Compaction test results
- Confirmation of thrust block ground conditions
- Operations and maintenance manuals.
- Site photographs as requested
- Final inspection approvals

It is councils intent that at the time of practical completion or S224 that there are no outstanding works or defects with all serfaces reinstated and established.

APPENDIX I. DESIGN FOR SURGE AND FATIGUE

Introduction

All pipelines are subjected to pressure surges during their lifetimes. Some of these pipelines, e.g. rising mains, will experience significant and regular pressure surges, while others may be subjected only to minor diurnal pressure variations.

Rapid pressure fluctuations and surges generally result from events such as pump start-up and shutdown, or rapid closing or opening of valves, including “slamming” of air valves as can happen during venting of bulk air from pipelines.

For the purposes of the ECOP, a pressure surge is defined as a rapid, short-term pressure variation. Surges are characterised by high-pressure rise rates, with minimal time at the peak pressure. Surge events usually consist of a number of diminishing pressure waves that cease within a few minutes.

The frequency and magnitude of the pressure transients affects the choice of pipe pressure class. Ensure that the following aspects are considered when designing for surges and fatigue:

- That the maximum and minimum pressures are within acceptable limits for the pipe and fittings for all surge events (including infrequent events such as power failure, emergency shut-down, rapid closure of fire hydrants)
- Consider the potential for fatigue and select the pipe pressure class accordingly, to allow for frequent repetitive pressure variations
- The pipe and the quality of installation and their influence on the fatigue resistance of the pipe

The following sections provide a methodology for dealing with surge and fatigue, so that pipe lifetimes are maximised.

Pressure surge events

A surge analysis is required to check whether damaging pressure surges (or surges that could cause customer complaint) could occur in a system. The level of detail of the surge analysis should be appropriate to the pipeline, e.g. a reticulation pipeline may require only consideration of rapid closure of fire hydrants and conservative selection of pipe pressure rating.

Pipelines that may be subjected to more severe surge effects e.g. rising mains, areas close to control valves (reservoir inlet valves and pressure reducing valves) and where specified by the Council, require a more detailed level of analysis, or the selection of pipe materials that may not be subject to surge and fatigue problems.

The source(s) of significant pressure surges in a water system should be identified and included in any surge analysis. Mitigating measures may be needed to minimise any surges generated, and any surge control devices must be designed accordingly. As a minimum, such a surge analysis should consider:

- Identified causative scenarios (e.g. power failure, pump trip, component failure, air valve operation)
- The highest pressure along the pipeline
- The lowest pressure along the pipeline
- Rapid closure of valves
- Vacuum and air relief requirements along the pipeline under all conditions

Note that non-slam air valves may be required on plastic pipelines, to minimise the risk of severe surges being generated by the movement of trapped air, and to minimise the potential for instantaneous “slamming” shut of a conventional air valve.

If, during the design phase, it is found that the minimum pressure in the mains could fall below atmospheric pressure during pressure surge events or drain down, mitigating measures must be designed to eliminate or minimise these effects. If negative pressures are a possibility, buckling of the pipe must be considered and a safety factor of at least 2.0 applied.

The maximum operating pressure for a pressure pipe network must include an allowance for pressure surge (see Figure 4). The allowance for surge to be included must be the higher of the calculated surge value or 200 kPa.

Plastic pipes are able to accommodate occasional short-term surge pressures well in excess of their nominal design pressure (PN) rating, e.g. as caused by power failure or accidental events. In such cases, the material PN may be multiplied by the surge factors given below (Table 3).

Table 3 - Surge factors for various pipe materials

Pipe Material	Surge Factor	Material Capacity (kPa)
PVC-U, PVC-O	1.5	1.5 x pipe PN
PE 80B, PE 100	1.25	1.25 x pipe PN

Fatigue

Consideration of the effect of fatigue is particularly relevant to plastic pipes that are subjected to a large number of stress cycles. Fatigue considerations can generally be ignored for ferrous pipe materials, e.g. ductile iron and concrete-lined steel. The important factors are the magnitude of the stress fluctuations and the frequency of these loads.

For fatigue loading situations, the maximum pressure reached in the pressure cycle must not exceed the capacity of the pipe, as defined above.

Fatigue does not need to be considered if the number of pressure cycles during the pipe"s designed lifetime does not exceed the values below (Table 4)

Table 4 - Critical number of surges in a pipe lifetime

Pipe Material	Critical Number of Cycles in Lifetime
PVC-U, PVC-O	100,000
PE80B, PE 100	300,000

The procedure for fatigue design is:

- Confirm the design lifetime of pipeline (The pipeline design life must be taken as 100 years unless specified otherwise by the Council)
- Estimate the likely number of pressure cycles during design life
- Calculate the range of pressure surges
- Calculate the fatigue load factor
- Determine the equivalent operating pressure
- Select the pipe PN rating

Number of pressure cycles

Calculate the expected number of cycles during the pipe"s lifetime, based on realistic estimates of the number of pressure cycles per day or per hour. If the primary pressure variation is followed by a smaller number of pressure fluctuations on each cycle, as shown in Figure 4, the calculated number of cycles should be doubled.

Table 5 (shown below) shows the number of pressure cycles over 100 years for various numbers of cycles per day and hour.

Table 5 - Pressure cycles in 100 years for various numbers per hour per day

Cycles Per Hour	Cycles Per Day	Total Number of Cycles in 100 Years
0.04	1	36,000
0.5	12	440,000
1	24	880,000
10	240	8,800,000
60	1440	52,500,000
120	2880	105,000,000

Range of pressure surges

Calculate the pressure range of the regular pressure surges by surge analysis. Figure 2 shows a typical cyclic pressure pattern. Where pumps are controlled by variable frequency drives, select a pressure cycle that is representative of the anticipated worst case operating cycle, unless sound judgement indicates that a lesser pressure cycle will be representative of the pipeline operation over 100 years.

The effects of infrequent or accidental conditions, e.g. power or surge protection device failures, may be ignored provided the peak surge pressure does not exceed the values derived from Table 4.

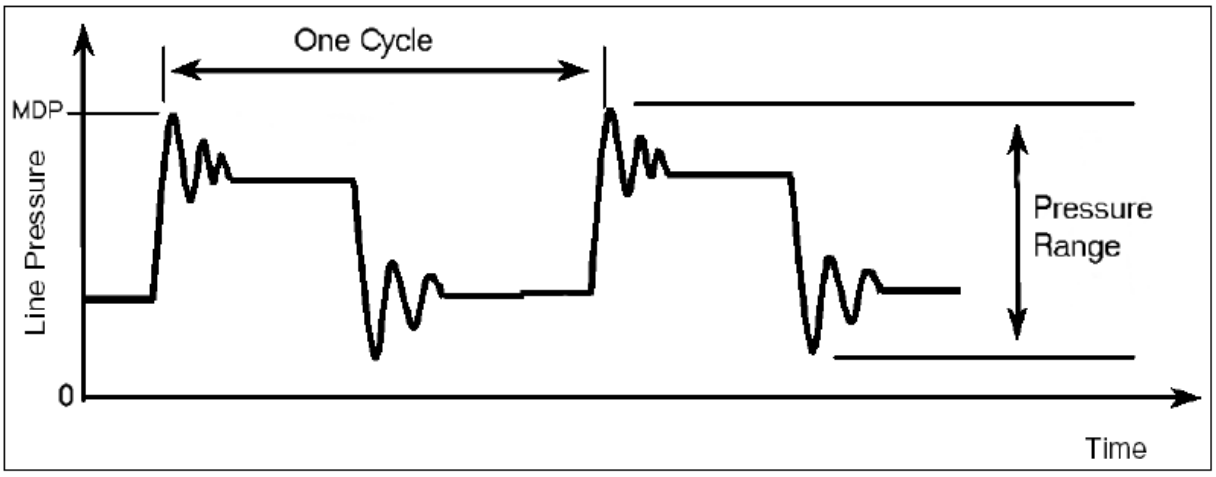

Figure 2 - Pressure cycle And pressure range

Note that the pressure range will vary along the pipeline. Economies may be possible on some pipelines by dividing the pipeline into sections and evaluating the fatigue design for each, subject to the approval of the Council.

Fatigue load factor

The fatigue load factor for the relevant plastic pipe material(s) must be determined from Figure 3. PE 80C (HDPE) is not approved for pressure pipelines in the Selwyn District.

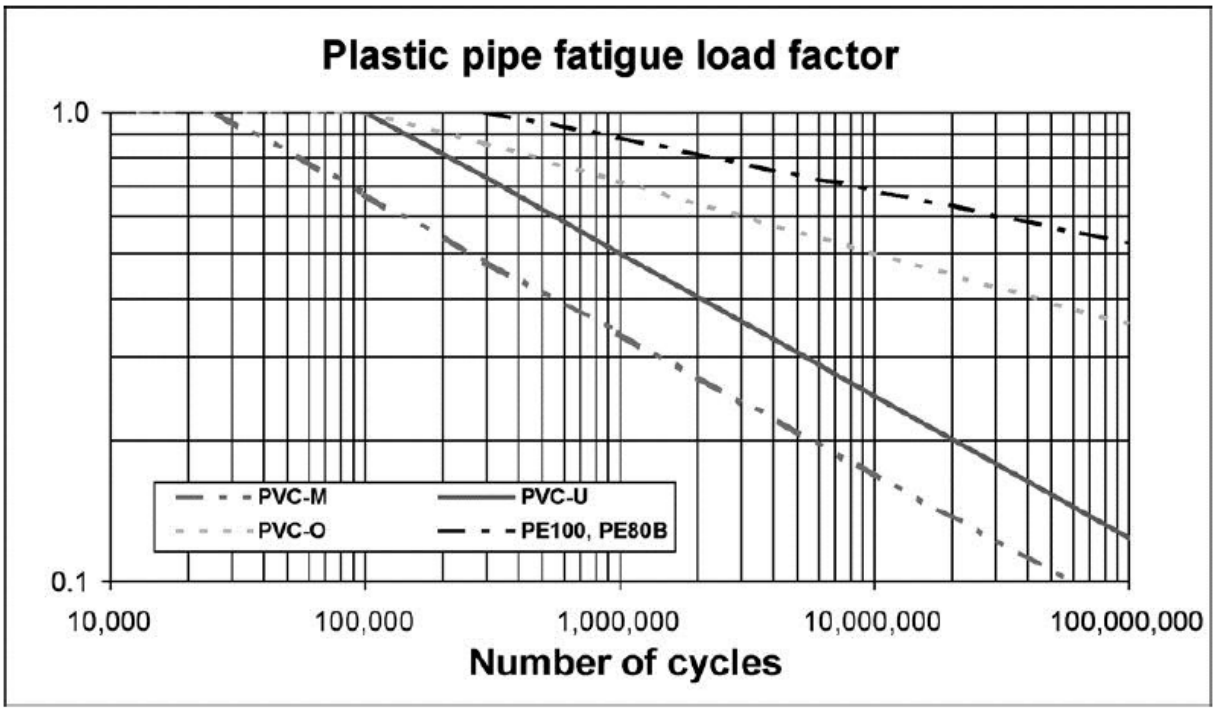

Figure 3 - Determining fatigue load factor

EQUIVALENT OPERATING PRESSURE

Calculate this using the following equation:

$$P_{eo} = \frac{\Delta P}{FLF}$$

Where:

P_{eo} =	Equivalent operating pressure (bar)
ΔP =	Cyclic pressure range (bar) (refer Figure 4)
FLF =	Fatigue Load Factor (refer Figure 5)

Pipe PN rating

The specified pipe pressure rating must exceed both the equivalent operating pressure, Peo and the maximum operating pressure for the system.

De-rating factors for PE fittings

It is necessary to de-rate fabricated or moulded PE sweep bends and tees that are used with PE pipes conforming to AS/NZS 4130. See CSS: Part 4 for requirements for forming and welding. The use of de-rated fabricated fittings is only allowed in special circumstances and requires Council approval.

Table 6 and below show the geometry and manufacturing factors to be applied for various fitting geometries and fabrication techniques.

Table 6 - geometry factors

Fitting Description	Geometry Factor
Equal Tee	0.6
Reducing Tee (Branch dia < 0.33 x dia of main)	0.6
Reducing Tee (Branch dia > 0.33 x dia of main)	0.8
Formed sweep bends (no reduction in wall)	0.9
Segmented bends (butt welded)	0.7

Table 7 - Manfucaturing Factor

Welding Technique	Manufacturing Factor
Moulding	1.0
Butt welding	0.9
Socket fusion	0.8
Extrusion welding	0.6
Saddle fusion	1.0

No other welding method is acceptable.

De-rate the nominal pressure rating of the fitting by multiplying its rating by the product of the geometry and manufacturing factors.

APPENDIX II. STANDARDS DRAWINGS.

Water standard drawings			**Refer to CCC CSS unless otherwise stated below**
Asset code	Drawing No		Name
WS	3.0A		GM-900 Manifold Unit Jumbo Box
WS	3.0B		GM-900 Manifold unit - standard water meter & restricted connections
WS	10.0		Standard Fire Hydranmt Marker Post