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6. WASTEWATER RETICULATION

This Part includes:

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

The Wastewater Drainage Bylaw defines the Council's requirements for protecting public health and the environment along with minimum levels of service expected to be provided by new infrastructure.

The Trade Waste Bylaw defines the Trade Waste considerations and requirements for commercial developments connecting to new infrastructure and developers of Commercial/Industrial subdivisions.

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

6.1. REFERENCED DOCUMENTS

Planning and Policy:

- Selwyn District Council Wastewater Drainage Bylaw 2016 (link here)
- Selwyn District Council Trade Waste Bylaw 2016 (link here)
- Selwyn District Council 5Waters – Strategies and Policies 2009 (link here)

Design:

- NZS 4404: 2010 Land development and subdivision infrastructure
- AS/NZS 3500: Part 2 : 2018 Sanitary and plumbing drainage
- AS/NZS 1260 : 2017 :PVCU-Pipes and fittings for drain, waste and vent Pipes
- AS/NZS 2033: 2008 : Installation of polyethylene pipe systems
- As/NZS 2032 : 2006 : Installation of PVC systems
- AS/NZS 2566.1:1998 Buried flexible pipes -Structural design
- AS/NZS 2566.2:2002 Buried flexible pipes -Installation
- AS/NZS 2648.1:1995 Underground Marking tape
- AS/NZS 4130:2018 PE Pipes for pressure application
- AS/NZS 4331:1995 Metallic flanges
- AS/NZS 1546.1: 2008 On-site domestic wastewater treatment units - Septic tanks
- AS/NZS 1547: 2000 On-site domestic wastewater management
- NZS 3104 :2003 –Specification for concrete production
- NZS 3109:1997- Concrete Construction
- NZS 1170: Structural design actions Part 0-5.
- NZS 4219:2009 Seismic performance of engineering systems in buildings
- SNZ HB 44:2001 : Subdivision for people and environment
- New Zealand Building Code Compliance Document G13Foul Water
- Building Code Compliance Documents (link here)
- Transit New Zealand Bridge Manual (2003)
- Christchurch City Council Sewage Pumping Station Design Specification
- Christchurch City Council Private Wastewater Pumping Station Design Specification
- Watercare Waste water network, transmission and treatment Standards
- Water New Zealand Pressure Sewer National Guidelines 2020

- Folder: SDC_Public (selwyn.govt.nz) – Live GIS Asset data for existing services

Construction:

- Christchurch City Council Civil Engineering Construction Standard Specifications Parts 1-7
- NZWWA New Zealand Pipe Inspection Manual

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

6.2. OVERVIEW OF SELWYN DISTRICT'S WASTEWATER SUPPLY

The districts wastewater system has historically been 'Gravity' with grades as flat as possible that would terminate at a pump station and may be pumped into another gravity catchment that would terminate in a further pump station.

The rapid development in various towns has resulted in multiple catchments and multiple pump stations that now get picked up by an arterial system that pumps to the Rolleston treatment plant at the Pines.

Gravity systems are still preferred and during this growth period the design criteria for the pipe networks and pump stations have been refined to suit our needs.

6.2.1. Effects Of New 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.

6.2.2. Wastewater Supply Resource Constraints and Consents

Gravity reticulation networks are Selwyn's preferred reticulation networks. Developments that are located near too, but not within a current Council wastewater reticulation network may be required to install a pumpstation and pressurised rising main to provide wastewater services to the subdivision.

Council will only accept Low Pressure Sewer (LPS) sewer systems under exceptional circumstances. When a proposal to install LPS is accepted by council a consent condition will be applied to the Resource Consent requiring that all lots being serviced by LPS will have consent notices applied to their titles stating that the pump installed on each individually owned private lot is owned and maintained by that lot owner. Evidence showing a development cannot be serviced with gravity reticulation will be required in the Design Report issued to Council for Engineering Approval.

Council will not accept community run supplies or the sharing of Low Pressure Sewer (LPS) pumping units between properties.

Where available, connection to a Council reticulated system is required. Where Council Wastewater reticulation is not available for connection on-site wastewater treatment systems can be installed under a Building Consent if ECan discharge permits are obtained by the applicant, it is the applicant's responsibility to ensure that the on-site wastewater treatment is complaint with their ECan discharge permit requirements.

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.

Privately owned sewer systems servicing industrial lots and/or requirement villages discharging trade waste as defined by Council's Trade Waste Bylaw may require Engineering Approval under an exemption from the Building Consent. Trade Waste is to be kept separate to regular waste on site and be provided with a discharge manhole adjacent to the property boundary.

6.3. WASTEWATER DESIGN CONSIDERATIONS

Council expects designers to develop wastewater reticulation that supports Selwyn District Council's obligations set out in the Wastewater Drainage and Trade Waste bylaw's as well as the 5Waters Strategy.

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

- All options considered and the reason for choosing the submitted design
- The use of alternative technologies (e.g., vacuum wastewater collection systems, fibre glass chambers)
- Demonstration that all lots can be fully serviced for wastewater, and clear indication of which Building Code Acceptable Solution (G13) has been used to calculate this
- Hydraulic adequacy of the system (no surcharging)
- Capacity and ability to service future extensions and development
- Networking, redundancy, and security of supply
- Regular maintenance considerations and "Fit-for-purpose" service life of the system
- Identify the minimum level of service (occupied dwellings) required for all proposed wastewater lines to achieve a self-cleaning velocity and provide Council with a schedule of required flushing times
- Structural strength of the wastewater system components and their ability 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 at all junctions and between rigid structures (manholes) and natural or made ground
- Pipeline's ability to withstand both internal and external forces – including the use of pipe protection (concrete capping) where minimum cover cannot be achieved
- Thrust block/joint restraint design calculations, including soil bearing capacity
- Poisson's effect on flexible pipes 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

Each proposed new pipeline will be assessed for capacity, size, and material on a case-by-case basis.

When proposing the installation of a Low-Pressure Sewer System (LPS) the following points must be addressed in the design report for Engineering Approval:

- The development/property cannot be serviced by technically compliant gravity sewer
- The ground conditions are such that installing gravity is not feasible. Such as:
  - Sites with rocky soil or underlying rock
  - Sites with high water table
  - Areas prone to liquefaction and lateral spread
  - Hilly or difficult terrain (including islands)
- On-site disposal is not feasible or cannot be approved by Environment Canterbury (ECan)
- Densification where existing sewers are close to capacity and flows need to be limited or controlled

Note: all components associated with a LPS wastewater system that are located upstream of the point of supply (on private property) will be the responsibility of the individual property owner and this will be enforced by conditions of the Resource Consent.

Where pumping units are to be used for non-residential purposes, the following information is to be provided to Council in the design report:

- The size and nature of the pumping units to be used and evidence that the units are of sufficient capacity and specification to service the development
- The location of the different pumping units if multiple applications are required
- The intended location to discharge to gravity

When a proposed design requires the installation of a Council vested pump station it must be noted that design factors for pump stations are not currently stipulated Council; however, designs are expected to be in line with industry best practice. Designers will address and explain the performance characteristics of the proposed design in the design report, including:

- Maximum starts/stops
- Inflow/outflow ratio
- Operational control's philosophy of the pump station
- Projected performance of the pump station with reference to sliming conditions of rising main
- Discharge manholes and effects of discharge surcharge on surrounding manholes and properties
- Mitigation measures and control measures arising from the pump station and connected system

6.3.1. Design Life

All wastewater 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.

6.3.2. Material Specifications

The material specification should confirm the requirement of relevant AS/NZS standards and meet manufacturers design, installation and operations requirements.

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 and all concrete structures (manholes and sumps) must not exceed 12 months or the manufacturer's requirement. 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.

6.3.3. 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 – NECS consent requirements
- 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
- How any issues identified in the PSI will be mitigated

6.3.4. Structural Design

All geotechnical ground investigations shall be completed in accordance with New Zealand Ground investigation specification (2017).

Buried pipelines shall be (typically) designed in accordance with AS/NZS 2566.1.1

Design structures to withstand all loads, including hydrostatic and earth pressure and traffic, in accordance with the Bridge Manual. Design structures exposed to traffic to HN-HO-72 loading. All sewer manhole lids in rights of ways and roadways shall be trafficable.

Sewer manhole lids shall be circular ductile cast iron, hinged, with a composite ring and 606 mm diameter opening, be bolted down to the manhole top, and concreted around. No precast lid risers are to be used

Manholes must comply with SDC standard detail drawings that includes the provision of two flexible joints at every pipe connection to a manhole.

A specific design is required for larger pipes, especially where changes of direction are involved. The design must incorporate a standard manhole opening and be able to withstand a heavy traffic loading HN-HO-72.

Buoyancy forces can pass stresses onto connected infrastructure causing premature failure of the service of complete surfacing of a pipeline. The factor of safety against floating should be at least 1.2 excluding skin friction in the completed condition, with an empty manhole and saturated ground. Counter increased forces resulting from greater depths and spans by thicker walls or reinforcing.

Manholes installed below the water table as determined at its highest level shall have a suitable length of riser on base to get above this water level. The Contractor shall make all reasonable attempts to source a riser of suitable height.

6.4. DESIGN PARAMETERS

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

- Point of supply and discharge
- Mains size at the point of supply
- Supply type requirements (e.g., gravity, gravity with pressurised mains connected to a pumpstation, low pressure sewer)
- Additional development to be allowed for in the design
- Existing flow (when known and requested)
- Network requirements
- Other requirements (e.g., minimum mains size)

The use of common drains is prohibited by the Water and Wastewater Bylaw.

Council does hold as-built information of the wastewater network which is available on request; however, Council cannot confirm the accuracy of this information and designers are strongly encouraged to conduct their own survey of the site to confirm measurements.

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

Large diameter pipes (>225mm dia) and trunk mains should not have direct connections.

All pressure sewer systems are to be designed to Pressure Sewerage Code of Australia (WSA07:2007) pressure sewer code principles and Water New Zealand - Pressure Sewer National Guidelines.

All Council vested wastewater mains will terminate into a minimum 1050mm concrete manhole

All discharge manholes require protective coating and odour control measures.

6.4.1. Design Flows

Sanitary sewer flows vary with the time of day, the weather and the extent and type of development within the catchment. Design systems to carry maximum flows without surcharging.

The maximum wastewater flow is given by:

$$MF = \frac{P}{A}\,ratio \;\times\; SPF \;\times\; ASF \times FD$$

Equation 1 - Maximum flow

Where:

- MF = Peak weather wet flow (L/sec)
- Peak Average Ratio = $\frac{P}{A}$ ratio = Dry weather diurnal peaking ratio = 2.5
- SPF = dilution filtration factor
- ASF Average Sewage Flow
- Future Densification (FD) = 1.2
- FD is used to allow for future densification in residential zones by increasing MF by 20%

6.4.2. Dilution from infiltration and inflow

Infiltration is the entry of subsurface water into the pipeline through cracks and leaks in the pipeline. Inflow is the direct entry of surface water to the pipeline from low gully traps, downpipe discharges and illegal stormwater connections.

Table 1 - Storm Peak Factors

Location	Storm Peak Factor (SPF)
Deep Ground Water Table	1.6
Shallow Ground Water Table	2.4

Note: Infiltration from existing reticulation can vary significantly throughout the district.

Deep ground water is defined as ground water that is deeper than 4m based off the highest recorded measurement in the last 5 years.

Please contact SDC to confirm infiltration rates where new reticulation will receive flows from existing reticulated areas. Please contact SDC to confirm infiltration rates where new reticulation will receive flows from existing reticulated areas.

6.4.3. Average Wastewater Flows

The unit average wastewater Flow (Unit ASF) is given by:

$$Unit\ ASF = \frac{persons}{hectare} \times \frac{litres}{person/day}$$

Equation 2 - Average flow

Where:

- Unit ASF is calculated by the net area used (includes roads but excludes reserves)
- $\frac{litres}{person/day}$ = 220 litres per person per day for residential applications

For subdivisions with single household dwellings ASF is calculated using:

$$ASF = Lots_{Total} \times 220 \frac{litres}{person/day} \times 2.7 \frac{people}{Lot}$$

For multiple dwellings ASF is calculated using:

$$ASF = Units_{Total} \times 220 \frac{litres}{person/day} \times 2.7 \frac{people}{Lot}$$

Commercial and industrial zones shall provide capacity for a design flow of 1 $ls^{-1}ha^{-1}$.

For known industries, base design flows on available water supply and known peak flows. When assessing whether a wet industry can be reasonably accommodated in an area that is reticulated but not fully developed, the design should leave sufficient flow capacity in the pipeline to serve remaining developing areas at a unit ASF of 0.25 $ls^{-1}ha^{-1}$ (provided that no other wet industries are being planned).

6.4.4. Total Design Flows for Existing Infrastructure Upgrades

Designs for major wastewater network renewals base all calculations on the actual performance of the catchment being upgraded and not hypothesis. Council does have monitoring systems in place for some (but not all) wastewater catchments. Designers are encouraged to engage with the Development Engineering Team early in the design processes to discuss design options.

6.4.5. Standard Wastewater Supply Pipe

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

- Gravity wastewater mains (vested sewer):
  - Residential – 150mm
  - Commercial – 225mm
- Pressurised (rising) mains – 100mm (designed adequately for capacity requirements of the catchment)
- LPS mains – minimum diameter is governed by design of a self-cleaning system
- Laterals:
  - Gravity – 100mm
  - LPS – 40mm

Council does expect designers to calculate pipe loadings and specify pipe sizes in accordance with good practice.

6.4.6. Minimum Pipe Class and Fitting Class

When designing wastewater reticulation systems, the following minimum pipe classes are acceptable for use in the Selwyn district:

- PVC pipes:
  - Good ground conditions – SN 8
  - Poor ground conditions – SN 16
- All PE pipes – PN 12.5

Note that for Rising Mains the minimum preferred grade is PE 100.

All Council vested PVC infrastructure (including individual laterals to the point of supply) shall be pressure tested to 30 kPa for 2 minutes with an allowable pressure drop of 2 kPa.

All PE infrastructure shall be designed, and pressure tested to the pressure rating of the lowest rated pipework or fitting. See CCC CSS Section 14.3.2, 14.3.3, and 14.3.4 for testing requirements.

6.4.7. Corrosion Prevention and Minimising Wear

Design to minimise corrosion through:

- Selecting materials which will resist corrosion
- Designing in an allowance for corrosion over the 100-year life cycle of the asset
- Providing protective coatings
- Using the measures suggested in clause 6.4.8 - Aggressive Groundwater

Bolts and fittings must be hot dip galvanised and incorporate zinc anodic protection. Protect all metal components with petrolatum impregnated tape (DENSO) applied in accordance with the manufacturer's specification. Do **not** use stainless steel where it may fail because of crevice corrosion caused by cyclic stress in the presence of sulphides and chlorides.

Note: Sewers conveying Trade Waste, as determined by the Trade Waste Bylaw, will have specific material requirements. Refer to the Trade Waste Bylaw for guidance on designing this type of system.

Where a new pressure main will discharge to an existing pipe gravity system, designers must include measures in the proposed design that will reduce the level of dissolved sulphides and remove hydrogen sulphides entering the existing wastewater system. These measures could include any, or a combination, of the following:

- Laying a length of new gravity main to which the pressure main discharges
- Installing a biofilter

Councils' preference is that designers will design out the need for excessively steep gradients where practicable. If a proposed wastewater design results in either of the following:

- Pipe gradients steer that 1:3 over 3m
- Flow velocity > $4ms^{-1}$

The affected pipelines will be subjected to excessive wear. The designer shall include in the design report any lines that will need to have wear-resistant materials, any sacrificial layers that may be necessary to incorporate into the design.

Avoid lateral junctions on these sections of pipeline. Take care to provide adequate anchorage for the pipes.

6.4.8. Aggressive Groundwater

Aggressive Groundwater is generally not encountered in the Selwyn District. Where additional investigations highlight the presence of aggressive groundwater the following requirements apply. **Before** specifying concrete structures within 1km of these known areas, test the groundwater to check whether concrete is appropriate.

Regard groundwater as aggressive to ordinary Portland cement if any of the following criteria are met:

- Over 35ppm calcium carbonate ($CaCO_3$) alkalinity and over 90ppm aggressive carbon dioxide (CO_2)
- Under 35ppm calcium carbonate ($CaCO_3$) alkalinity and over 40ppm aggressive carbon dioxide (CO_2)
- pH less than six
- Sulphate greater than $1{,}000mgl^{-1}$

Measures to counter aggressive groundwater include:

- Providing a sacrificial layer of concrete
- Increasing cover to steel reinforcements in RCC structures
- Using special cements
- Coating concrete structures with coal tar epoxy, or similar, before installation
- Use of alternative materials

6.4.9. Infrastructure Sizing

Size infrastructure considering projected peak demand, associated pipe friction losses, and any future demand requirements. 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)
- Design flow rate
- Wastewater mains gradients
- 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 (where required)
- Positioning of valves, flushing points, flush tanks
- How differences in elevation across the subdivision or development have been considered
- Surge and Fatigue analysis

6.4.10. 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.

6.4.11. Gravity Mains Layout

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

- Lay wastewater mains within the road carriageway as close as practicable to the centreline
- Wastewater mains must be laid straight and at a constant gradient between manholes
- Minimum cover required for wastewater mains located within the carriages is 0.75m
- If minimum cover cannot be achieved specify pipe protection designs in the design report for approval (see CCC CSS SD 342 for guidance)
- Design gradients of gravity mains to achieve a flow velocity of $0.65ms^{-1}$
- The minimum allowable gradients for use on Council vested gravity wastewater reticulation is set out below in Table 2
- If the minimum allowable gradients cannot be achieved, a flush tank may be installed on the affect line with Council approval. Contact the Development Engineer for details.
- Ensure that the bearing capacity of the trench under the wastewater network has a minimum bearing capacity of 50kPa
- In poor ground conditions geotextile wrapping of pipe haunching may be required and will need to be detailed in the design report for approval

- 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
- Design the wastewater system with sufficient ventilation using vented manholes
- Position vented manholes in locations where odour sensitivity isn't a concern and use odour control devices where this requirement cannot be met
- Topographical and environmental considerations
- Manholes must be located within the road reserve where practicable (ideally in the centre of the carriageway) approval must be given when this requirement cannot be met
- Manhole spacing should be as follows:
  - 150mm – 225mm diameter mains maximum spacing of 100m
  - 300mm – 900mm diameter mains maximum spacing of 120m
- Manholes must be located at points of flow direction change; however, the flow deviation angle must not be greater than 90° (see Figure 1 shown below)
- The minimum fall through a manhole from invert to invert shall conform to the values shown below in Table 3
- Ladders are required to be installed in manholes unless the height from the top of the benching to the top of the lid is less than 1.3m
- ROW's which service two or more lots shall have a 150mm wastewater main installed that terminates into a 1050mm manhole. The wastewater main will be vested to Council and require and Easement in Gross to SDC. Individual 100mm laterals shall be provided to the point of supply of each lot serviced by the ROW from the Council vested wastewater main
- 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 – the installation of waterstops will be required in these circumstances. Designs and spacings will need to be provided in the design report for approval
- 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
- The crossing of different asset types (e.g., road, water races, utilities) shall be at 90° where practicable
- Ensure that the wastewater network has appropriate clearances to other services and utilities (refer to Section 11 for more guidance)
- **The Maximum pipe depth of Council vested wastewater mains should be limited so there is less than 3.5m to invert**
- For wastewater mains laid deeper than 2.5m (at invert), Council's preference is that laterals servicing individual lots will discharge directly into the manhole by way of a drop structure (see SD standard drawing SW9.0) where practicable; alternatively, a collector main will be required

Table 2 - Minimum gravity pipeline gradients

	Diameter (mm)	Unflushed Grade	Minimum number of houses above reduced Gradient
Public	150	1:160	≤ 5
Public	150	1:200	> 5

Table 3 - Minimum fall through a manhole

Angle of Deviation	Minimum Fall (mm)
60° – 90°	50
30° – 60°	25
0° – 30°	10

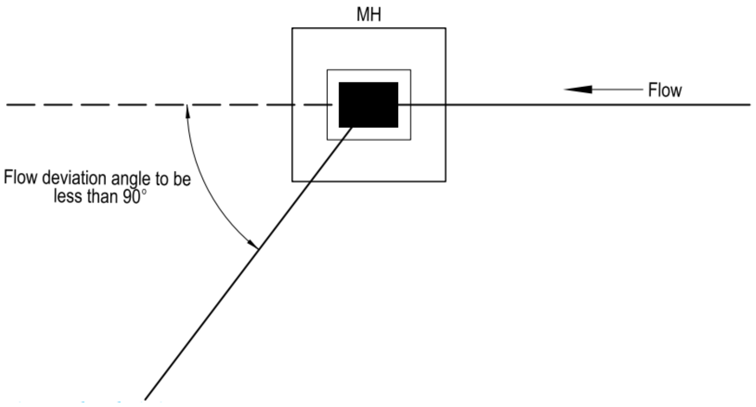

Figure 1 - Flow deviation angle

6.4.12. Gravity Mains Individual Point of Supply

Gravity laterals are privately owned upstream from the point of supply. When designing a subdivision, or servicing an existing lot the design must meet the following requirements:

- Individual laterals shall extend 1m past the road-side boundary to the point of supply for each lot, be end capped, and marked with a red painted marker peg
- Where practicable all laterals shall be laid in a **straight line** to the point of supply 1m into the mid-point of the property boundary but not closer than 1m from any shared boundary
- Laterals laid from the Council vested mains to the point of supply must be laid in a straight line with a constant gradient where practicable
- Laterals shall enter the boundary at a depth that can service the net area of the lot
- Laterals should be laid at a grade of 1:80 unless approval is given by Council
- Laterals off deep gravity mains shall be 'ramp raised' directly off the main to a height where the remainder of the lateral can be laid at a grade of 1:80 to the point of supply

6.4.13. Low Pressure Sewer Reticulation

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

- Lay LPS mains in the berm within the road reserve
- LPS mains must discharge into a 1050mm Council owned manhole
- Sizing of the LPS mains must be dictated by a self-cleaning velocity (include supporting calculations in the design report)
- Flushing points are required at the upstream end of all LPS mains
- Pressure transducers and associated data loggers may be required for any proposed development and will be assessed on a case-by case basis

- Developments proposing to service more than 100 lots with LPS will be required to install 1 pressure transducer and associated data loggers for every 100 serviced
- Boundary Kits must be installed in a black polyethylene box that is located in the road reserve, not in a trafficable location, and within 1m of the shared boundary
- Council is responsible for maintaining the boundary kit
- The boundary kit shall be designed in accordance with SDC standard drawing SW 17.0 and include the following:
    - One way check valve
    - Inspection Point (for flushing and maintenance)
    - Isolation valve
    - A 15 mm tapping point with a ball valve to fit a pressure gauge
- All fittings within the boundary kit shall be stainless steel and approved by Council
- Individual laterals must be laid in a straight line to the point of supply 1m inside the individual lot and be capped
- If required, the developer shall be responsible for the flushing the LPS system as prescribed in the flushing programme for the duration of the defects liability period

The use of tapping saddles on LPS mains is not permitted.

6.4.14. LPS Requirements Upstream of the Residential Individual Point of Supply

Individual lot owners of properties that are serviced by LPS will need to be informed of the following requirements:

- Individual lot owners will be required to install a storage tank and a Council approved pumping unit at their cost
- The on-site pumping unit and all associated systems and components shall be owned by the individual lot owner and located within the privately owned lot (not within the road reserve)
- The ongoing operation and maintenance costs of the on-site pumping unit and all associated systems and components shall be met by the individual lot owner
- The pumping unit shall be fitted with an alarm that is sufficient to signal to the lot owner the system has failed
- Pumps shall be of the progressive cavity type and must have a grinder/macerator impeller mechanism
- Council prefers E1 grinder pumps to be installed and installation of a different grinder pump **must be approved by Council Engineers**
- The storage tank shall have an emergency storage volume of 594 litres above the pump on level and a minimum total storage capacity of 700 litres

6.4.15. LPS Requirements Upstream of the Non-Residential Individual Point of Supply

As well as what has been stated in Section 6.4.14 the individual pumping units installed for this type of application must meet the following specification requirements and be approved by Council Engineers prior to installation:

- Semi-positive displacement
- Pumps must be certified to the Grinder Pump Standard NSF/NZS 1546.1 2008

- Flow rate must be a minimum of 0.4 l/s at 55m head
- Pump control panel must include overpressure, run dry, low voltage, low pressure, and thermal overload protection
- All electrical components must be compliant with AS/NZS 60335.2.41
- The discharge pipe must be rated to PN16
- Pumps and motors shall be rated to IP68
- Tank fittings and materials must be fit for purpose
- The pump shall be fitted with pipe couplings to allow the removal and replacement of the pump without the need for confined space entry

6.4.16. Pressure Pipelines – Rising Mains

Design the components of a pressure pipeline to withstand a maximum operating pressure that is no less than any of the following:

- 400 kPa
- $1.5(H_s + H_f)$
- Pump shutoff head
- Positive surge pressure

Where:

- H_s is the static head
- H_f is the friction head

When designing a pressure pipeline adhere to the following:

- Lay pressure pipelines in the berm where practicable
- Pressure pipelines must terminate into a Council owned 1050mm manhole
- Surcharge all lengths to ensure the pipeline has full flow to prevent sudden discharges of foul air at the pump
- Install air valves at high-points along the pipeline to removed trapped air
- Install scour valves at low-point along the pipeline for maintenance
- Locate all valves in concrete chambers large enough to provide easy access for maintenance
- Consider soft closing, non-return valves for installations in high head situations.
- Lateral connections to provide individual points of supply are not permitted
- Provide a factor of safety of 2 for buckling as a result of negative or external pressure
- Ensure the flow velocity is sufficient to transport solids through the line to minimise the time fluid spends in a pressure main
- The minimum pipe velocity must be $0.9ms^{-1}$ for pipe diameters less than 300mm
- Council approval must be given for all situations where the minimum pipe velocity cannot be achieved, and a daily scouring cycle must be incorporated in the design and detailed in the design report for review
- For pipe diameters larger than 300mm, the designers are required to work with Council's Development Engineer to confirm the acceptable hydraulic parameters in the rising main design
- Allow for issues such as operation and maintenance and consider failure of any mechanical surge protection measures and protection from damage during these situations.
- Design and detail thrust blocks individually.

6.4.17. Pump Stations Design Guidance

The following list details some minimum requirements for pump station design that need to be addressed in the design report submitted for Engineering Approval:

- Pump station and equipment individually designed for adequate storage and flow for future proofing (performance-based design)
- Council requires Flygt pumps to be installed and selected appropriately
- In principle the proposed design shall be in accordance with the standard design supplied by SDC (the standard design is under constant review ensure you are using the latest version)
- Pump stations **must** be located within a utility reserve that has legal road frontage for all-weather access (not located within the road reserve)
- Adequate parking space is required for a sucker truck and Hiab to be safely parked and used on site
- Have the Hiab parking next to the wet well to remove pumps for servicing
- Separation from rest of the area with fence and lockable gates
- Protect all permanent surfaces from corrosion – seal all wash-down area
- Concrete wet wells must be protected from corrosion by an approved lining system
- Valve chamber is required to be separate from the wet well
- An inlet valve is required on the gravity main upstream of the wet well
- Purpose built electric kiosk with lockable door, with standard SDC lock (if not providing a building) & Generator plug
- SDC may require the developer to provide a genset adequately designed to provide electrical backup for pump stations deemed critical to the wastewater network. This will be agreed at Resource Consent or Engineering Approval stage.
- Telemetry, SCADA, and flow meter shall be installed with the pump station. Contact Council for minimum requirements.
- Outside security light for working at night position over the wet well
- Reticulated water supply with RPZ backflow prevention and 32mm ID pipe for wash down pumps and wet well
- Minimum of 8 hours storage of the design ASF (average sewer flow) – note that this can be provided within the reticulation.
- Rising main sized to meet the hydraulic requirements of the proposed system (minimum 100mm ID)
- Odour control must be installed with an Armatec system
- Stainless steel must be used for all pipework and fittings located in the wet well
- Install a stainless-steel ladder in the wet well for maintenance
- Council requires McBerns LFVP airtight cover & lockable lids with safety grates for both the wet well and valve chamber
- The whole pump station and facilities should be designed for easy maintenance and servicing of equipment

As part of the Council's review, Council may provide designers with specific requirements that need to be addressed in the final design.

Standard designs do not negate the requirement of the designer to take into account site specific details of proposed pump stations.

6.4.18. Biofilters

Designers should prevent odours by:

- Avoiding the use of pressure mains
- Reducing turbulence generally
- Minimising retention times

A biofilter is a device used to treat odours arising from the wastewater system. Where Council deems there is a risk of nuisance from foul air discharge to the surrounding community, Council may require developers to construct biofilters.

The principal odour component of wastewater is H_2S (hydrogen sulphide) and the biofilter operation makes use of the ability of naturally occurring bacteria to convert the H_2S to acid and elemental sulphur.

Typically, the situations where odours cause nuisance are where the wastewater is more than eight hours old, held in anaerobic conditions in pressure mains and where there is high turbulence that encourages H_2S to come out of solution. Council expects good design to avoid causing these conditions.

Council shall approve the design and installation of all biofilter and odour control devices. Standard details of acceptable devices are available upon request from Council's Water Services Team.

6.4.19. Wastewater Mains in Easements

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

The preferred solution for wastewater reticulation is to avoid easements over private property; however, where it is not possible to put Council wastewater mains within the Road Reserve an easement in gross favour of Council is required.

The easement width is the greater of:

2.0 m x (depth to invert) + OD

3.0 m

Where OD is the outside diameter of pipe laid.

Where easements are agreed with Council the easement registration must provide the Council with rights of occupation and access and ensure suitable conditions for operation and maintenance.

Building over Council vested wastewater pipelines, connections, junctions, or manholes **is not permitted**.

6.4.20. 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. See Appendix II for more information about Trenchless Technology.

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.

6.4.21. Connection Design Requirements

When specifying the connection details, consider the following:

- Pipe materials
- Relative depth of mains
- Standard fittings
- Pipe and fitting restraint and anchorage
- Existing flow levels within the wastewater pipeline and constructability
- Limitations on shutting down major mains to enable connections
- Existing cathodic protection systems

SDC requires all wastewater connections (new mains and individual laterals) to manholes meet the following standards:

- Drop structures for PVC connections and collector mains shall be designed in accordance with SDC standard drawing SW9.0
- All PE pressure main connections to manholes shall be designed in accordance with CCC CSS SD341 – alternative designs shall be submitted for approval and assessed on a case-by-case basis
- All PVC pipeline connections to manholes shall be by way of starters & shorts or shorts and finishers
- All LPS pipeline drop structure connections to manholes shall be designed in accordance with SDC standard drawing SW9.0A
- Corbel specifications are to meet CSS SD341 Sheet 4
- Corbels located in area's affected by high ground water will require the implementation of scabbling
- All steel works in corbels shall be fixed in place with Chemset or equivalent product

SDC requires all individual lateral connections to existing wastewater pipelines meet the following standards:

- Use Y-junctions that **do not** have an inspection point when connecting to the wastewater mains
- When connecting to existing PVC pipes use slip collar connections only

- When connecting to existing AC pipes use Gibault fittings wrapped in Denso as per the manufacture specification
- When connecting to existing LPS mains use welded fittings (such as EF couplers)

Tapping bands/saddles are not permitted to be used for any wastewater connection. Any connection to the existing wastewater network that will require the installation of a manhole will need to be designed by the developer's engineer and detailed in the design report for Council approval.

6.5. System review

When the pipe selection and layout have been completed, perform a system review, to ensure that the design complies with both the parameters specified by the Council and detailed in the ECOP. The documentation of this review must include a full hydraulic system analysis. Compliance records must cover at least the following requirements:

- Pipe and fittings materials are suitable for the application and environment
- Pipe and fittings materials are approved materials
- Pipe class is suitable for the pipeline application (including operating temperature, surge, and fatigue where applicable)
- Seismic design – all infrastructure is designed with adequate flexibility and special provisions to minimise the risk of damage during an earthquake, and with consideration for the cost and time to repair any potential damage. Provide specially designed flexible joints at all junctions between rigid structures (e.g. pump stations, bridges, buildings, manholes) and natural or made ground
- Layout and alignment meet the Council's requirements
- Demonstration of low points
- Maximum operating pressure will not be exceeded anywhere in the pressure pipe system
- Capacity is provided for future adjacent development

6.5.1. Demonstration of Low Points

A critical component to include in the system review is the assessment of the low point in the overall network. The Design Report submitted for Engineering Approval shall include a demonstration of system analysis specifically to demonstrate the overflows will not occur at gully traps. Note that this may require analysis of the existing network outside of the proposed works boundary. Where insufficient network analysis has been done to satisfy Council, the Asset Manager may commission a review of the network design by Council's network consultants. This may involve modelling for complex proposals.

Low points in the network must be clearly identified, and mitigation and management of overflows must be addressed. It is not acceptable for low points to occur at domestic dwelling gully traps, or in areas where overflows could present health risk to individuals, the public, or the environment. Designers shall ensure the risk of overflow is minimised through appropriate emergency storage, and that consideration is given to safe location and disposal of overflows in the case of system failure.

6.6. CONSTRUCTION

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

Construction shall comply with CCC CSS unless otherwise stated.

6.6.1. Installing New Infrastructure

All connections to new and existing wastewater mains must be witnessed by a Council representative and comply with the proposed designs or Council requirements set out in Section 6.4.21.

Y-junctions installed on new wastewater mains to vest to Council are required to be socket/spigot Y-junctions.

6.6.2. PE Pipeline Construction

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

- 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 thereafter

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, equipment, and materials 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.

6.6.3. CCTV Inspection

All new PVC wastewater reticulation that is vested to Council shall be inspected with CCTV in accordance with the NZ Pipe Inspection Manual (link here) to confirm construction has been completed in accordance with the approved engineering drawings.

Pipes shall be jetted **immediately** prior to CCTV inspections. Council has zero tolerance for debris in wastewater lines.

The CCTV footage and operator analysis (CCTV logs) shall be collated on an indexed USB Drive or sharepoint link supplied to Selwyn District Council with the completion document package for review and acceptance. The CCTV inspection is to be carried out once construction is completed. If requested, a second inspection shall be done at the end of the defect liability period.

6.7. 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)
- Warranty Information and manuals
- Pressure test results and witnessed dated certificate (and .csv raw data for LPS and Pressurised mains)
- Extent and locations of each test performed
- Pre-construction and construction weld test results
- Commissioning documentation
- Material specification compliance test results (e.g., Material test certificates and weld tests)
- Bedding and Backfill Compaction test results and location plan
- Confirmation of thrust block ground conditions
- Operations and maintenance manuals – pump station
- 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 surfaces 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 4 - 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 5 - 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 6 - 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.

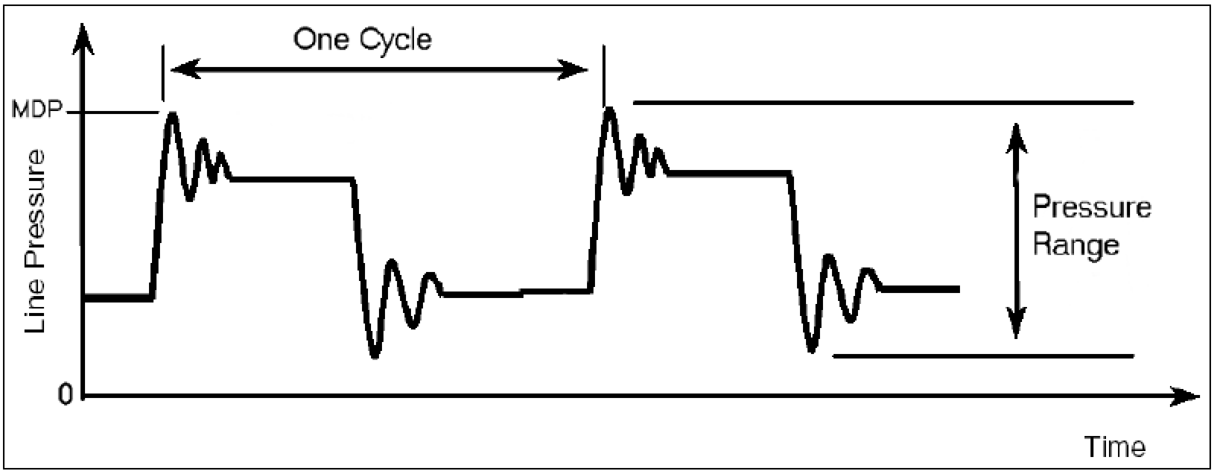

Figure 2 - Pressure cycle And pressure range

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.

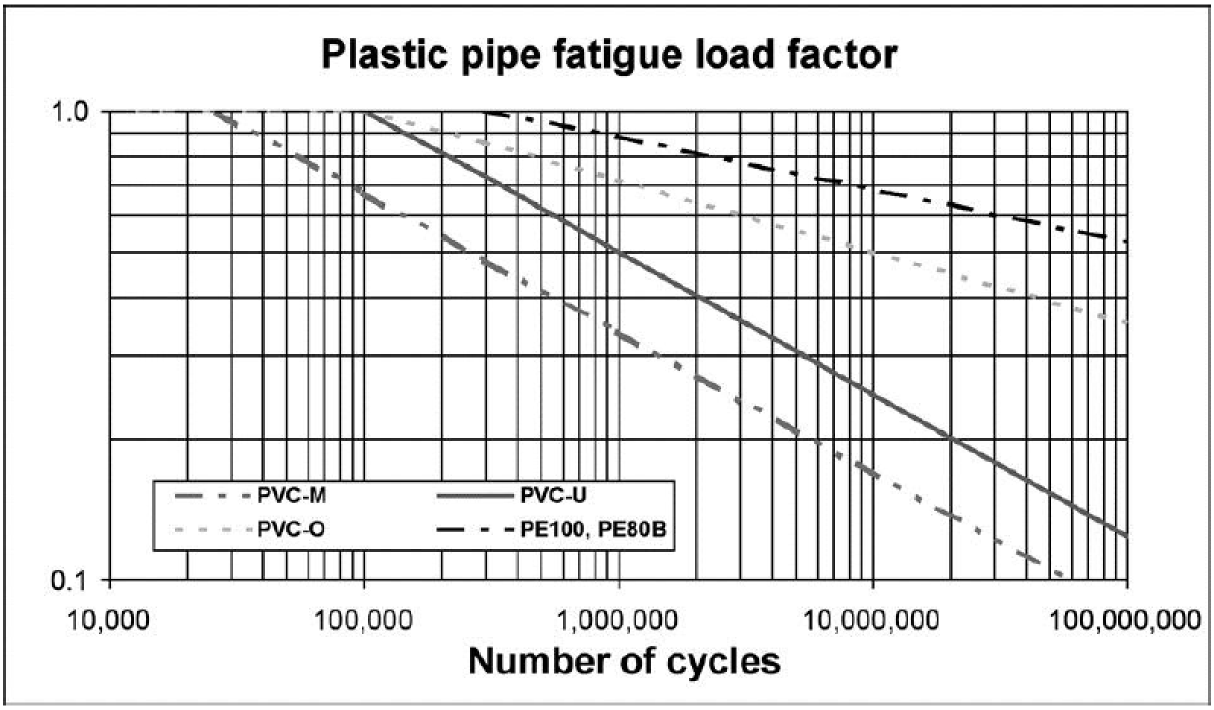

Figure 3 - Determining fatigue load factor

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 7 - 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 8 - 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: TRENCHLESS TECHNOLOGY

When working in high volume roads, public areas, adjacent to trees or through private property, consider using trenchless technologies. Factors that need to be considered when making this decision include minimising disruption and environmental damage, social costs, design life of the proposed method, and the economic impact of the work.

Thorough surveys and site investigations, which minimise the risk of encountering unforeseen problems during the work, are essential for the success of trenchless construction. Ensure that the method used complies with the pipe manufacturer's specifications.

Options available include the following:

- Pipe bursting
- Cured in Place Pipe Lining (CIPP)
- Directional drilling and Guided boring
- Slip lining.

The Council may approve other technologies on a case-by-case basis as they are considered or developed. When proposing a new trenchless technology, submit a full specification to the Council that covers the design and installation process.

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 effects of any possible ground heave
- Invert levels and grade and the construction tolerances on them
- How pipe support and reinstatement of pits will be addressed
- Details of pipe materials and jointing

Pipe bursting

Pipe bursting is suitable only for replacing sewers that are constructed of brittle pipe material, such as unreinforced concrete and vitrified clay. Generally, this method is not suitable for replacing reinforced concrete pipes.

Obtain accurate information about the original construction material and the condition of the existing pipeline, including whether there have been any localised repairs, and whether sections of the pipeline have been surrounded or haunched in concrete. Take special care when the existing pipe has been concrete haunched, as this will tend to raise the invert level of the new pipeline and cause operational problems. Shallow pipes or firm foundations can also disturb the ground above the burst pipe.

Replace the entire pipe from manhole to manhole. The number and frequency of lateral connections may influence the economic viability of this technique.

Grouting of the annulus, especially on the hills, is an essential part of this technique. Where special techniques are required, ensure these are approved **before** the work commences.

Cured in Place Pipe Lining (CIPP)

Cured in place pipe (CIPP) lining systems are preferable for renovating gravity sewers. Before undertaking CIPP, check the structural integrity of the host pipe and ensure that the hydraulic capacity is sufficient for projected future peak flows.

The CIPP liner must produce a durable, close fit with a smooth internal surface. The liners must be resistant to all chemicals normally found in sewers in the catchment area. The manufacturer must submit guarantees to this effect to the Council.

The design of the CIPP liner, including the required wall thickness under different loading conditions, must comply with the manufacturer's recommendations and specifications. Submit a liner specification to the Council that addresses the design procedure and installation methodology. Follow the layout of the *Specification for renovation of gravity sewers by lining with cured-in-place pipe*.

As the host pipe is blocked during the insertion and curing operations, adequate flow diversion is essential for this method. Repair any structural problems at the junctions by open dig prior to CIPP installation.

The opening of connections must be carried out remotely from within the lined sewer. For this purpose, prepare accurate location records by detailed surveys prior to CIPP installation. Additional grouting of junctions may be required after opening.

Directional drilling and guided boring

Restrict sewer installation using guided boring or directional drilling to instances where their construction tolerances are acceptable. Consider possible ground heave over shallow pipes.

Consider the space requirements for the following:

- Drill pits, including working space
- Drill rigs, including access paths for drill rigs
- Drill angle (the drill rig may need to be placed some distance away from the sewer starting point, depending on the angle)
- Placement of an appropriate length of the joined sewer on the ground for pulling through the preformed hole
- Erosion and sediment control

Surface-launched drilling machines require larger construction and manoeuvring spaces compared to pit-launched drilling machines. Consult specialist contractors before selecting this technique.

Slip lining

It is essential to carefully consider the effect that the work will have on the system operation **before** using a slip-lining technique, especially in relation to finished invert levels and capacity.

Carefully inspect and prepare the host pipe prior to the installation of the new pipe. Use a sizing pig at the investigation stage, to confirm clearances.

Replace the entire pipe from manhole to manhole. Reconnect lateral connections to the new sewer as set out in *CSS: Part 3*, clause 7. 3 – Thermoplastic Jointing of Polyethylene Pipe by Electrofusion Welding. The number and frequency of lateral connections may influence the economic viability of this technique.

Carry out grouting of any annulus after installing the new pipeline and gain approval for the technique to be used **before** the pipe is installed. Ensure that grouting doesn't cause buckling or flotation of the internal pipe.

Slip lining of 150mm diameter sewers is not permitted.

Appendix 2: Standard Drawings

Drawing Name		Drawing Description
SW	1.0A	Sewer connection policy (front lot, 2 & e connection on ROWs)
SW	1.0B	Sewer connection policy (sewer private and public land)
SW	1.0C	Sewer connection policy (sewer public for multi users)
SW	2.0A	Lateral connections (PVC & AC)
SW	2.0B	Lateral connections (PVC)
SW	3.0	Lateral connections (concrete)
SW	4.0	Private pumping station connection to public main
SW	5.0	Connection to sewer pressure mains with Acuflo Jumbo
SW	6.0	Lifting socket
SW	7.0A	Sump filter basket design for vented manholes
SW	7.0B	Sump filter basket design for vented manholes (large manholes)
SW	8.0	Precast manhole
SW	9.0	Drop structure in manhole
SW	10.0	Pipelaying at manholes for PVC-U
SW	11.0	Pipelaying haunching details for PVC-U
SW	12.0	Standard circular inspection chamber
SW	14.0	Standard pump station 3 sheets
SW	15.0	Hoist arm and mount assembly for sewer pump station
SW	16.0	Corbel construction for a manhole
SW	17.0	Lower pressure boundary kit