# Part 6: Wastewater

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## 6.1 INTRODUCTION

This Part of the CoP provides guidelines and standards as a basis for designing wastewater reticulation, treatment and disposal systems that not only function well but are also appropriate and safe environments.

This Part is not intended to be a detailed design guide or to replace the need for wastewater engineering expertise in some areas of the design process. The standards included in this Part are one way of achieving the desired outcomes and performance criteria of the network components described below.

### 6.1.1 Description of the Wastewater System

The Council's wastewater system comprises a number of discrete urban and rural schemes.

At present there are fifteen wastewater schemes in the Waimakariri District, where wastewater disposal is managed by the Council. These range from the small septic tank systems at Ohoka Meadows and Swannanoa to the large urban reticulated schemes of Kaiapoi and Rangiora.

**Table 6.1 List of WDC schemes**

| Scheme | Zone | Type | Treatment & Disposal |
|---|---|---|---|
| Fernside | Rural-residential | STEP system, pumped to WWTP | **Fernside WWTP**<br>Discharge to ground via recirculating sand contactor filter system |
| Kaiapoi | Urban | Gravity reticulation with pumpstations | **Kaiapoi WWTP**<br>Discharge to ocean outfall via oxidation ponds and infiltration wetland |
| Loburn Lea | Rural-residential | Gravity reticulation | **Loburn Lea WWTP**<br>Discharge to ground via recirculating sand contactor filter system |
| Mandeville | Rural-residential | STEP system, pumped to WWTP | **Mandeville WWTP**<br>Discharge to ground via sand filter system |
| Ohoka Meadows | Rural-residential | STEP system, pumped to WWTP | **Ohoka Meadows WWTP**<br>Discharge to ground via recirculating sand contactor filter system |
| Oxford | Urban | Gravity reticulation with pumpstations | **Oxford WWTP**<br>Discharge to ground (centre pivot irrigator) via aerated activated sludge system |
| Pines Kairaki | Urban | Gravity reticulation with pumpstations | **via Kaiapoi WWTP** |
| Rangiora | Urban | Gravity reticulation with pumpstations | **Rangiora WWTP**<br>Discharges to ocean outfall via Rangiora oxidation ponds and Kaiapoi wetland |
| Swannanoa | Rural-residential | STEP system, pumped to WWTP | **Swannanoa WWTP**<br>Discharge to ground via sand filter system |
| Tuahiwi | Rural-residential | STEP system, pumped to WWTP | **via Woodend WWTP** |
| Waikuku Beach | Urban | Gravity reticulation with pumpstations | **via Woodend WWTP** |
| Woodend | Urban | Gravity reticulation with pumpstations | **Woodend WWTP**<br>Discharge to ocean outfall via oxidation ponds and infiltration wetland |
| Woodend Beach | Urban | Gravity reticulation | **via Woodend WWTP** |
| Pegasus | Urban | Gravity reticulation | **via Woodend WWTP** |
| Mapleham | Rural-residential | STEP system, pumped to WWTP | **via Woodend WWTP** |

### 6.1.2 New Developments

Gravity reticulation, with a minimum amount of pumping is the preferred method of wastewater reticulation for new developments.

Standard plans and specifications for submersible pumping stations are available from the Council.

In areas where gravity reticulation systems are not practicable due to flat grades or long distances, alternative systems (such as common pressure main systems, including small privately operated and municipal treatment & disposal systems) may be accepted, subject to the Council's approval. Typically, each lot must have an individual wastewater pump connected to the common pressure main system.

Biofilter design is included in this Part of the CoP. Biofilters are required at the terminal of all pressure mains likely to generate hydrogen sulphide.

## 6.2 CONSENT AND COMPLIANCE ISSUES

The consent and compliance information set out in Part 2: *General Requirements* applies to all works within the Waimakariri District, with the addition of the clauses below.

### 6.2.1 Legislation

The Resource Management Act (RMA) 1991 and amendments is the principal statute that controls land development, including wastewater aspects.

### 6.2.2 Approval Process

Refer to Part 2: *General Requirements*, Section 2.2.6 for information regarding the standard approval process.

### 6.2.3 District Council Requirements

The Council is currently preparing a Wastewater Bylaw. When the Bylaw is adopted it will define the Council's requirements and protection for wastewater drainage work. Requirements in the *Wastewater Bylaw* must be met by any application made after the bylaw is adopted.

Pump stations are defined as structures under the Building Act, and building consents may be required.

### 6.2.4 Consent Application – Information Required

In addition to the information required to support the concept drawings and/or Resource Consent plans in CoP Part 2: *General Requirements*, the following data shall also be provided:

- General layout and alignment of reticulation through to the laterals;
- Connection points to the existing reticulation;
- Pipe diameters of mains;
- Identification of redundancy and networking within the system;
- Confirmation that there is sufficient capacity and that the scheme is cost-neutral.

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## 6.3 QUALITY ASSURANCE REQUIREMENTS AND RECORDS

Provide quality assurance records that comply with the requirements in Part 3: Quality Assurance, during design and throughout construction.

### 6.3.1 The Designer

The designer of all wastewater systems that are to be taken over by Waimakariri District Council must be suitably experienced in the design of wastewater systems. The qualifications and experience of the designer may be requested by the Council for approval prior to commencement of the design. The design reviewer must have at least equivalent experience to the designer.

### 6.3.2 System Review

When the pipe selection and layout have been completed, perform a system review to ensure that the design complies with the parameters specified by the Council and detailed in the CoP. 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 particular application and environment;
- Pipe and fittings materials are approved by the Council;
- Pipe class is suitable for the pipeline application (including structural strength, operating temperature, surge and fatigue where applicable);
- Layout and alignment meets the Council's requirements;
- Maximum operating pressure will not be exceeded anywhere in pressurised systems;
- Capacity is provided for future adjacent development;
- Self-flushing volumes are achieved at least once per day to all sewers and rising mains.

### 6.3.3 Engineering Design Approval

Provide the following information to support the engineering drawings and Design Report, as a minimum:

- Proposed status of mains (public or private);
- Detailed offsets, alignments and grades of designed pipelines;
- Detailed plans of the proposed wet well, pumping and treatment systems, storage and reticulation layout, if applicable.
- All assumptions used as a basis for calculations, including pipe friction factors;
- Design checklists or process records;
- Design flow rates;
- System review documentation as detailed in 6.3.2;
- Trenchless technology details, where appropriate;
- Calculations carried out for the surge analysis of pressure pipes where appropriate;
- Summaries of hydraulic modelling, including design parameters and assumptions;
- All options considered and the reason for choosing the submitted design.

### 6.3.4 Construction Records

Provide the information detailed in CoP Part 3: *Quality Assurance* and the CCC *Construction Standard Specifications* (CSS), including where applicable:

- All performance test results;
- Material specification compliance test results;
- Site photographs;
- Pressure test results;
- Commissioning results.

The developer must provide the Council with a certificate for each pipeline tested including the date, time and pressure of the test. The details of the pipes, including manufacturer, diameter, type, class, date of manufacture, serial numbers, jointing and contractor who laid the pipe, must be included on the certificate, where applicable.

### 6.3.5 Post-Construction Records

Provide the information detailed in CoP Part 3: *Quality Assurance*, Part 12: *As-Builts*, and the CCC *CSS*, including where applicable:

- Design report;
- Completion certificates;
- Producer statement – design review;
- Producer statements – construction, construction review;
- Commissioning report, including all test results;
- Operations & maintenance manuals, where applicable;
- As-built plans and records;
- Guarantees and warranties.

### 6.3.6 Code of Compliance

Where a building consent is required for a structure or structures, the developer shall apply for and obtain a Code of Compliance Certificate for that structure prior to the issue of the 224 certificate by the Council.

### 6.3.7 Operations and Maintenance Manual

Provide an Operations and Maintenance Manual for any wastewater quantity and/or quality control facilities such as pump stations, treatment facilities and odour control units. The manual must include:

- A description of the facility and its purpose;
- Design criteria;
- A description of major features;
- Normal operational procedures and constraints (e.g. resource consent conditions);
- Emergency operational procedures (where relevant);
- A copy of any resource consents relating to the facility;
- A maintenance schedule for all items requiring periodic maintenance including landscaping;
- A schedule of suppliers and contact details for key components;
- A copy of manufacturers' operating & maintenance instructions for key items;
- A copy of the as-built drawings and commissioning report for the facility.

The manual shall be contained in clearly marked A4 ring binders, divided into sections with clearly marked dividers. Drawings and other bulky information may be appended in separate folders. One copy shall be provided to the Council for review. Once the manual has been approved by Council, a final copy shall be provided to site and two printed and bound copies, plus electronic copies in Word (*.doc) and PDF (*.pdf) format, shall be provided to Council. CoP Part 10 clause 10.6 – *Establishment & Maintenance* expands on these requirements.

### 6.3.8 Acceptance Criteria

All pipelines, pump stations, and other integral components must be tested, certified and inspected as appropriate before acceptance by the Council. Perform testing in accordance with CoP Part 3: *Quality Assurance*.

## 6.4 GENERAL DESIGN PRINCIPLES

### 6.4.1 Design Considerations

Consider the:

- Options to minimise pumping and maximise gravity conveyance of wastewater;
- Hydraulic adequacy of the system;
- Ability of the network to minimise and control odours;
- Structural strength of components to resist applied loads;
- Health & Safety requirements, particularly for access to confined spaces;
- Environmental requirements;
- Impact of the works on the environment and community;
- “Fit-for-purpose” service life of the system;
- Best way to minimise the “whole-of-life” cost;
- Resistance of each component to internal and external corrosion or degradation;
- Installation requirements expressed in CCC CSS: Part 4;
- Potential to use trenchless installation methods in sensitive areas (refer Section 6.14)
- Capacity and ability to service future extensions and development;
- Risks of overflows and their likely locations during extreme events;
- Risk of odour problems;
- Ease of maintenance.

### 6.4.2 Future System Expansion

Design the network 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 section 6.5.

### 6.4.3 Reducing Waste

When designing the development, consider ways in which waste can be reduced.

- Plan to reduce waste during demolition e.g. minimise earthworks, reuse excavated material elsewhere;
- Design to reduce waste during construction, e.g. prescribe waste reduction as a condition of contract;
- Select materials and products that reduce waste by selecting materials with minimum installation wastage rates;
- Use materials with a high recycled content e.g. recycled concrete subbase.

See the Resource Efficiency in the Building and Related Industries (REBRI) website for guidelines on incorporating waste reduction in your project www.rebri.org.nz/.

### 6.4.4 Alternative Technology

The Council will consider alternative technologies on a case-by-case basis. Examples of such technologies are vacuum wastewater collection systems and Septic Tank Effluent Pumping (STEP) systems.

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## 6.5 DESIGN PARAMETERS

### 6.5.1 Design Life

All buried wastewater conveyance systems are expected to have a useful asset life of at least 100 years with appropriate maintenance, and must be designed accordingly to minimise life cycle costs for the whole period. Assets designed to minimise capital cost at the expense of overall lifecycle cost will not be accepted.

The developer is advised that certain locations within the District have water and ground conditions that may be detrimental to the durability of some materials and fittings. Upon receipt of the developer's application, the Council may set specific location requirements for such materials and fittings, based on experience and historical performance.

### 6.5.2 Design Flows

Wastewater 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.

Design pipelines with sufficient capacity to cater for all existing and predicted development within the area to be serviced. Make allowance for all areas of subdivided or unsubdivided land that are capable of future development. When calculating the unit average wastewater flow, the net area used includes roads but excludes reserves.

The minimum diameter of public sewer pipelines in residential zones is 150 mm. The minimum diameter of pipelines in commercial and industrial zones is 225 mm.

### 6.5.3 Nomenclature

The following terms and abbreviations are used in this section:

- $PF_{DWF}$ – Peaking Factor (Dry Weather Flow)
- $PF_{WWF}$ – Peaking Factor (Wet Weather Flow)
- ADWF – Average Dry Weather Flow
- PDWF – Peak Dry Weather Flow
- PWWF – Peak Wet Weather Flow
- $D_{pop}$ – Population Density
- $Q_{Res}$ – Residential Flow Rate
- Dwell – No. of dwellings

### 6.5.4 Peaking Factor (Dry Weather Flow)

Use a peaking factor ($PF_{DWF}$) of 2.5 for wastewater reticulation design.

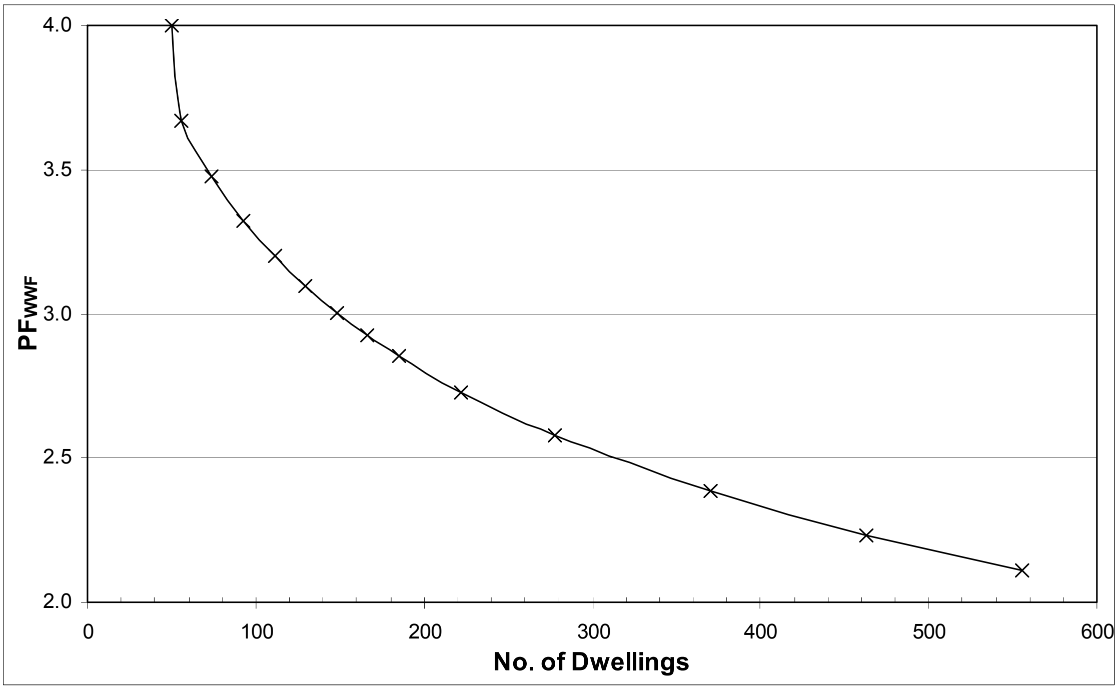
### 6.5.5 Peaking Factor (Wet Weather Flow)

Apply $PF_{WWF}$ to the peak wastewater flow to allow for infiltration and storm inflow in conventional gravity wastewater reticulation systems. 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, illegal stormwater connections, and vented manholes positioned in low areas.

The method of calculating the peaking factor (wet weather flow) varies according to the number of dwellings.

- Where Dwellings ≤ 50, set $PF_{WWF}$ to 4
- Where 50 < Dwellings ≤ 550, use Chart 6.1.
- Where Dwellings > 550, use Equation 6.1.

**Chart 6.1 WDC Wet Weather Peaking Factor (50 ≤ Dwell ≤ 550)**




**Equation 6.1 Wet Weather Peaking Factor (Dwell >550)**

$PF_{WWF}$ = 2.1181 – 0.00006 * Dwell

where Dwell = Potential number of dwellings to be constructed in the development

### 6.5.6 Average Residential Flows

Residential flows are derived from a wastewater use ($Q_{Res}$) of 250 litres per person per day. At an assumed residential population density ($D_{pop}$) of 2.7 people per dwelling, the unit average wastewater flow is given by Equation 6.2 below. The Peak Dry Weather and Wet Weather Flows are calculated by Equation 6.3 and Equation 6.4.

Note that these are the minimum design figures to be adopted; if there are any case-specific reasons why these figures could be higher (e.g. a higher occupancy level) then appropriately higher figures should be used.

**Equation 6.2 Average Dry Weather Flow (ADWF)**

ADWF = $D_{pop}$ x $Q_{Res}$ x Dwell
= 2.7 x 250 x Dwell
= 675 [L/day/dwell] x Dwell
= 0.0078 [L/s/dwell] x Dwell

where ADWF = Average Dry Weather Flow [L/s]
$D_{pop}$ = Population density [p/dwell]
$Q_{Res}$ = Estimated water use per person [L/p/day]
Dwell = Potential number of dwellings to be constructed [dwell]

**Equation 6.3 Peak Dry Weather Flow**

PDWF = ADWF x $PF_{DWF}$

= (0.0078 x Dwell) x 2.5

= 0.0195 [L/s/dwell] x Dwell

where PWDF = Peak Dry Weather Flow, including inflow and infiltration [L/s]

ADWF = Average Dry Weather Flow [L/s] (Equation 6.2)

$PF_{DWF}$ = Dry Weather Peaking Factor (Clause 6.5.4)

**Equation 6.4 Peak Wet Weather Flow**

PWWF = PDWF x $PF_{WWF}$

= (0.0195 x Dwell) x $PF_{WWF}$

where PWWF = Peak Wet Weather Flow, maximum flow expected in a system [L/s]

PWDF = Peak Dry Weather Flow [L/s] (Equation 6.3)

$PF_{DWF}$ = Dry Weather Peaking Factor, (Clause 6.5.4)

$PF_{WWF}$ = Wet Weather Peaking Factor, (Clause 6.5.5)

### 6.5.7 Average Commercial and Industrial Flows

For known industries, base design flows on available water supply and known peak flows.

Ensure that the design flow allows for potential wet industries, using Table 6.2. When assessing whether a wet industry can be reasonably accommodated in an area that is reticulated but not fully developed, leave sufficient flow capacity in the pipeline to serve remaining developing areas at a unit ADWF of 0.15 L/s/ha (provided that no other wet industries are being planned).

If actual flow use figures are unavailable, use the values in the table below:

**Table 6.2 Commercial and industrial wastewater flow values**

| Land use | ADWF (L/s/ha) | PDWF (L/s/ha) | PWWF (L/s/ha) |
|---|---|---|---|
| Central Business District | 0.4 | 1.0 | 2.0 |
| Commercial | 0.2 | 0.5 | 1.0 |
| Dry Industrial | 0.2 | 0.5 | 1.0 |
| Wet Industrial | 0.3 | 0.75 | 1.5 |

### 6.5.8 Maximum Flows for New Developments

Calculate the maximum flow for new developments using Equation 6.4. The number of dwellings used shall be the maximum possible, considering any reasonable future subdivision.

### 6.5.9 Total Design Flows for Existing Developments

Base the design of major renewal and relief sewers serving older catchments on actual catchment data.

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## 6.6 GRAVITY SEWER DESIGN

The wastewater system shall be designed with sufficient depth not to interfere with other utilities and any future driveway construction.

Refer to Table 6.4 for the pipe cover requirements. Any design involving a cover less than the minimum specified shall be required to demonstrate that compliance is impractical, supported with full calculations.

WDC will approve the final layout. Construction shall not start until this approval has been granted in writing from the Council. All diameters referred to in this section are nominal internal diameters, unless otherwise noted.

### 6.6.1 Hydraulic Design

Base the hydraulic design of wastewater pipelines on the Manning's 'n' or Colebrook White equations. Use a pipe roughness coefficient $k_s$ in the design of 1.5 mm for pipelines 300 mm and smaller, and 0.6 mm for pipelines 375 mm and larger. This allows for long-term grit deposits, slime growth etc.

Size pipelines to cater for future flows from the upstream catchment, when fully developed.

### 6.6.2 Flows

Design wastewater pipelines on a uniform flow basis, without surcharging, so that at times of normal flow (non-peak) there is a uniform airspace for ventilation.

### 6.6.3 Minimum Pipe Sizes

Gravity pipelines maintained by the Council must have a minimum diameter of 150 mm for residential and 225 mm for industrial or commercial applications. Nominal pipe diameters shall be limited to the following standard sizes: 150 mm, 225 mm, 300 mm, 375 mm and 450 mm internal diameter. Any larger pipe sizes shall be subject to specific approval.

### 6.6.4 Private Drains

The minimum size of private sewer drains must be 100 mm nominal internal diameter. For major industrial users, determine the size of the lateral using the maximum flow requirements and the available grade.

### 6.6.5 Pipeline Materials

The following pipe materials currently available in New Zealand are acceptable for gravity wastewater sewers:

- Polyvinyl Chloride: PVC-U;
- Polyethylene (black only): PE100, PE80B, PE80C;
- Reinforced Concrete Rubber Ring Jointed (DN375 and larger only);
- Ceramic (Hepworth or equivalent).

Select wastewater rising main materials in accordance with the pipe selection chart in Appendix B. Interpretation of this flow chart shall be at the discretion of the Council. No new materials may be installed without the Council's prior written approval.

The following pipe materials are acceptable for wastewater rising mains:

- Polyvinyl Chloride: PVC-U and PVC-O;
- Polyethylene (black only): PE 100B and PE 80B;
- Ductile iron (DI);
- Concrete Lined Steel.

Pipes with nominal internal diameters of 100, 150, 225, 300, 375, 450, 525, 600 and 675 mm are readily available and are the sizes approved for use in the Waimakariri District.

Each material has specific design and installation issues, as identified in the manufacturers' design manuals, specifications and other literature. Consider these issues, as listed below, when specifying materials.

- Polyvinyl Chloride: PVC-U
  - UV degradation after more than 2 years' exposure during storage and/or outdoor installation conditions;
  - Depth of scratching, gouging and impact damage limited to 10% of the wall thickness;
  - Careful handling, bedding and installation required to avoid ovality and dips;
  - Can be adversely affected by certain waste chemical characteristics and/or high temperatures.
- Polyethylene: PE80B/C, PE100
  - Sophisticated equipment and highly skilled workers required where fusion-welded joints are required;
  - PE80C not suitable for rising mains;
  - Pipes must be fully restrained at all ends;
  - Depth of scratching, gouging and impact damage limited to 10% of the wall thickness;
  - UV degradation;
  - Good bedding support and careful installation required to prevent excessive deformation.
  - Pulling forces for PE during trenchless installation are not to exceed the manufacturer's recommendations.
  - Can be adversely affected by certain waste chemical characteristics and/or high temperatures.
- Reinforced Concrete Rubber Ring Jointed (RCRRJ) (gravity sewers only)
  - Less suitable for earthquake and/or ground movement situations;
  - Rings may be attacked by certain wastewater types.
  - Concrete pipes 375 mm ID and larger may be used only with approval from the Council and may require an internal sacrificial layer up to 25 mm thick. This layer should not be taken into account in strength calculations. Using additives that promote chemical resistance may be an alternative.
- Ductile Iron (rising mains only)
  - Internal lining and external coatings must be undamaged or fully restored after repairs or fabrication work;
  - Polyethylene bag wrap corrosion protection system must be properly applied;
  - May require special concrete lining composition where $H_2S$ is likely.
  - Potential problems with stray electric currents and bimetallic corrosion.
- Concrete-lined Steel (rising mains only)
  - Internal lining and external coatings must be fully restored after repairs or fabrication work and during jointing;
  - May require special concrete lining composition where $H_2S$ is likely.
- Ceramic (gravity sewers only)
  - Pipes are easily damaged during handling;
  - Can be less familiar to contractors and thus more difficult to lay well.

Gravity sewers may not have nominal stiffness ratings of less than SN6 (6 $kN/m^2$) for flexible pipes, or be less than Class 2 (for RC pipes). Pipe classes on gravity sewers shall not vary between manholes.

Pipes carrying trade waste shall be designed in ceramic or PE materials. If there are circumstances where neither of these is suitable, alternatives such as GRP or similar may be acceptable with the specific approval of Council.

### 6.6.6 Gravity Sewers Immediately Downstream of Pressure Mains

PVC, PE or ceramic pipes shall be used in this situation. Concrete pipes must not be used for the first 90 metres from the discharge point of a pressure main because of the risk of attack from hydrogen sulphide.

Do not specify concrete pipes where it is likely that, in the future, a pressure main will discharge to the top end of a gravity system.

Where a new pressure main will discharge to an existing concrete pipe gravity system, use measures that will reduce the level of dissolved sulphides and remove hydrogen sulphides. These measures could include any one, or a combination, of:

- Laying a length of new gravity main to which the pressure main discharges;
- Lining the first length(s) of the existing concrete gravity mains;
- Installing a biofilter.

### 6.6.7 Minimum Gradients

Design sewer pipes at the steepest grade available, with a minimum velocity of 0.65 m/s, to minimise deposition and transit time of wastewater, while making provision for upstream users. If 0.65 m/s cannot be achieved, due to insufficient grade being available, detail an alternative solution in the Design Report for Council consideration.

The first 25 properties shall be connected to a gravity sewer main that is installed at a minimum gradient of 1:160. The only exceptions to this requirement shall be where the Council agrees that the gravity main will be extended in the future to supply future properties.

As a general philosophy, the Council aims to keep the gradient of sewer mains, other than those serving the first 25 lots, at 1:200 or steeper. However, flatter grades will be permitted where it can be demonstrated that there will be a benefit to the Council in doing so. Table 6.3 sets out the minimum grades for pipes in the District.

Standard A sets the preferred gradient for the stated diameters. All design shall comply with this standard as far as practicable.

Pipes laid to Standard B can only be installed with the specific approval of the Sewer Asset Manager, and may be approved only where:

- There is a section of main above the flat section laid at a minimum grade of 1:160 with at least 25 houses connected; and
- It can be demonstrated that one or both of the following situations applies:
  - It would eliminate the need for a pump station; or
  - It would reduce the maximum sewer depth to less than 4.0 metres, which would make future renewals less difficult.

Where sewer mains are to be extended to service future developments, the need to install the section of 1:160 main with 25 houses may be exchanged for the installation of an appropriately sized flush tank at the top of the main line.

Pipes laid to Standard C can only be installed with the specific approval of the Sewer Asset Manager, and may be approved only where:

- An appropriately sized flush tank is installed at the top of the line to facilitate easy and frequent cleaning of the line; and
- There is a section of main above the flat section laid at a minimum grade of 1:160 with at least 25 houses connected; and
- It can be demonstrated that one or both of the following situations applied:
    - It would eliminate the need for a pump station; or
    - It would reduce the maximum sewer depth to less than 4.0 metres, which would make future renewals less difficult.

**Table 6.3 Minimum Gradients**

| Nominal Pipe Diameter (mm) | Standard | | |
|---|---|---|---|
| | A | B | C |
| 150 | 200 | 250 | 300 |
| 225 | 300 | 350 | 400 |
| 300 | 400 | 450 | 500 |

For pipe sizes larger than 300 mm, discuss the design with the Sewer Asset Manager.

Sewer mains installed at grades flatter than 1:200 will require careful attention to installation and quality control to ensure the grades are achieved and no low points are present.

It is not acceptable to increase pipe diameter beyond the required size to achieve a flatter grade.

### 6.6.8 Pipe Protection and Cover

For standard compacted metalcourse trench backfill, Table 6.4 gives the minimum cover to wastewater reticulation from finished ground level in different locations. The pipeline should be designed such that these dimensions are generally achievable. This requirement is intended to provide a minimum depth-to-invert that enables a lateral to service any building site on an allotment.

**Table 6.4 Minimum cover above the crown of sewer pipes**

| Location | Minimum Cover (mm) |
|---|---|
| Private property at boundary | 1000 |
| Carriageways, driveways, road reserve and parking areas | 1200 |
| Berms and footpaths | 900 |
| Public land – reserves and parks | 750 |
| Lateral at kerb – measured from kerb fender | 800 |

Note that pipe depth at the boundary of a private property must be sufficient to adequately service the entire lot at an appropriate grade, potentially increasing the minimum cover required for this situation.

Where the minimum cover specified in Table 6.4 is not available, specify pipe protection to SD 600-342. Variations from Table 6.4 will only be permitted where no other alternative is available, and will require written approval from the Council.

For lightly trafficked areas such as footpaths, residential driveways, and under kerbs and channels (except commercial crossings) specify a plain concrete surround. For areas subject to normal or heavy traffic, specify a reinforced concrete surround. In both cases, pipe protection must comply with SD 600-342. Allow sufficient cover for road surfacing above the protection.

Pipelines with cover exceeding 4.0 metres in depth require specific structural design.

### 6.6.9 Joints

Gravity mains shall be connected with flexible joints, such as rubber-ring or z-joints. Solvent-cement joints are not acceptable on Council assets.

### 6.6.10 Manholes

Manholes shall be positioned on roadways or where there is vehicle access, clear of ponding, flooding, and overland flow paths.

Manholes shall be located at each change of direction, grade or pipe size, and at the end of all terminal pipelines greater than 50 m long, and locations approved by Council.

The table below specifies the range of maximum spacings.

**Table 6.5 Spacing for manhole covers**

| Diameter in mm | Maximum spacing (m) |
|---|---|
| 150 – 225 | 90 |
| 300 – 900 | 120 |
| 1050 – 1500 | 150 |

Vented manholes are designed to serve as intakes for fresh air, which passes through the sewers and laterals to the main vents on individual houses, disposing of corrosive and foul air in a way that causes minimal offence. However, occasional temperature inversions cause the air to flow in reverse, therefore inlet vents should also be located so that any foul air coming from them causes minimal offence to neighbouring properties.

Use vented manholes on each alternate manhole and place them where there is minimal turbulence, to avoid undue odours. Avoid situations such as angles, junctions, and pressure main outlets.

To avoid surface water entry and the associated flooding of pipelines, site vented manholes away from areas where ponding of stormwater is likely to occur, including secondary flow paths. Likewise, avoid road intersections because gravel and grit entry is greater at these locations.

Special consideration must be given to large trunk sewers (larger than 450 mm ID) as these may be inadequately vented by house connections. To ensure that air movement adequately serves all parts of a sewer, it may be necessary to use special air inlets, special vent stacks and/or a forced draught with designed circulation, possibly in conjunction with odour control (Refer to clause 6.11 – *Odour Control Design*). Note that siphons cut off all airflow, unless special air ducting is incorporated.

Pre-cast concrete manholes with integral flanged bases shall generally be used in the Waimakariri District. Manholes manufactured from other materials, such as PE, may be accepted but shall require specific approval from the Council. Cast in-situ manholes may be used only in special circumstances with specific approval from Council.

Manholes must comply with SD 600-302A/B, 600-303A/B, or with other Council approved designs. Provide yield joints between manholes and pipes in accordance with SD 600-341A/B/C. Manholes shall be constructed from the longest available risers relative to the depth of the manhole, in order to reduce the number of joints

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).

Design of manholes shall include an assessment of flotation and settlement potential. The factor of safety against flotation should be at least 1.2 excluding skin friction in the completed condition, with an empty manhole and water table at ground surface. Counter increased forces resulting from greater depths and spans by thicker walls and/or floors, and/or larger base flanges. Detail the calculations in the design report.

Design small structures to withstand a wheel load of 70 kN, taking into account an impact factor. The impact factor reduces linearly with depth of fill, from 1.30 for zero fill to 1.00 for one metre of fill.

Unreinforced vertical concrete panels, provided for future connections in manholes or other underground structures, which are subject to soil and traffic loading should be specifically designed. Alternatively, in the case of a square panel, ensure that the length of the side does not exceed seven times the panel thickness.

Design structures to withstand all loads, including hydrostatic and earth pressure and traffic, in accordance with the TNZ *Bridge Manual*. Design structures exposed to traffic for HN-HO-72 loading.

Consider the foundation conditions as part of the design. If there is a possibility of soft ground, carry out ground investigations and a full foundation design.

Drop manholes are a potential source of blockages and odour-causing turbulence. Lay pipelines as steeply as possible to avoid any need for a drop, noting the material requirements outlined in clause 6.13. This may require an additional manhole to be installed.

Where drop inlets are unavoidable, specific design is required for the approval of Council.

The minimum fall in the invert of angled wastewater manholes is set out in the table below.

**Table 6.6 Minimum fall in manhole**

| Angle of deviation | Minimum fall (mm) |
|---|---|
| 60° - 90° | 20 |
| 30° - 60° | 10 |
| 0° - 30° | 5 |

Half-round former pipes shall be used in the invert to construct the manhole benching.

When there is an increase in the pipe size at a wastewater manhole, the pipes should be aligned soffit to soffit.

### 6.6.11 Flush Tanks

Flush tanks are required at the upstream end of wastewater lines wherever pipe gradients preclude self-cleaning (Refer to clause 6.6). They may also be required in staged developments or for larger pipes as a temporary measure, when initial flows are substantially lower than design flows.

Avoid the use of flush tanks by grading the upper manhole lengths of sewer at 1:160. In general, 25 dwellings connected to the 1:160 graded section of pipe are sufficient to generate a self-cleaning flow, provided the downstream grade is not flatter than 1:300. Temporary flushing may be required in some areas until sufficient dwellings are completed.

Construction of flush tanks must comply with SD 600-311A/B. The location of the flush tank is to be determined in conjunction with other utilities.

Air gap separators on the water supply connection point are required at all flush tanks and must be located in accordance with SD 600-313. The air gap separator shall have an isolation valve fitted inside a toby box between the separator and water supply point.

A flush tank feeding into a 150 mm pipeline shall have a minimum usable storage capacity of 3 $m^3$. Flush tanks for pipes of larger diameter shall be subject to specific design and approval from the Council. The factor of safety against flotation should be at least 1.2, excluding skin friction, in the completed condition with an empty chamber and water table at ground surface.

Flush manholes do not have sufficient capacity for normal flushing, so restrict their use to temporary dead ends, alterations because of roadworks, and other similar situations.

### 6.6.12 Inverted Siphons on Wastewater Lines

Inverted siphons are generally not acceptable on Council wastewater pipelines. Where there are no other practical options, a specific design and Council approval shall be required.

### 6.6.13 Laterals

Design the lateral grade and invert level to serve the lot adequately. If there could be conflict with other services, it may be necessary to lower the lateral.

Each front lot must be provided with a separate lateral connection to the wastewater main.

For infill developments, the Council may consider sharing an existing lateral where, in the Council's view, providing a new connection to the main is impractical or inefficient. Prior to approving such connections, the developer will be required to provide evidence (including CCTV camera survey) that the lateral is in good condition and has adequate grade. If approved by the Council, the common lateral shall comply with the requirements of clause 6.7.3.

Easements must be created where legally possible (parent block and subdivided properties)

Pumped lots are not counted when setting the required grade, but the maximum number of lots (pumped and un-pumped) on a common main is always five.

If the lateral is over 50 m long an accessible inspection chamber is required at the junction of the last two laterals.

Lay laterals at least 1.0 m clear from property side boundaries, to terminate at least 1.0 m inside the net site area of the lot and within 1.0 m of the final ground level. Where possible, the connection point of a lateral to each lot shall be located such that the available building area is maximised, and on the low side of the proposed site.

Where ground contour and available pipe grade prevents a service connection depth of 1m at the boundary, then the allotment shall be identified on the subdivision proposal plan. That allotment's title should include a notice stating the extent of restricted service, together with the allotment area available for a building site and the floor level that can be adequately serviced, or note that a pumping system is required.

On sewer renewal work, when a lateral is identified for renewal and runs close to trees, either reroute the lateral around the tree by repositioning the junction on the main, or use pipe bursting or similar techniques to relay the lateral in its present position. Specify jointing in accordance with CCC *CSS: Part 3* clause 11.1.

Haunch laterals laid as part of a development in accordance with this Part of the CoP. All materials used must be Council-approved.

Where manholes are conveniently located, lateral connections shall outfall to those manholes.

If manhole connections cannot be used, then manufactured junctions, London junctions, or Fernco or Flex-seal fittings are required. Saddle connections are not permitted on PVC or PE mains.

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Where the depth to soffit of the main sewer is more than 2.0 metres, risers may be used, subject to the requirements of other services and land levels. All other junctions must be side junctions. Do not lay junctions on pipelines deeper than 4.0 metres.

Form all junctions with a Y or riser junction so that the side flow enters the main at 45°, to reduce deposition of solids. Gravity connections shall be provided for all new subdivision lots.

Gradients are subject to BIA Regulations, but the minimum gradient for a 100 mm diameter pipe in roads is 1:60. Do not install inverted siphons on any lateral.

For allotments where further development potential exists, junctions at the terminal ends of lines may be replaced by the inclusion of a rodding eye approved by Council. This replacement will be subject to approval by the Council, and in lieu of junctions.

The end of each lateral shall be marked by a 50x50 timber stake (H3 or equivalent treated post) embedded at least 600 mm in the ground and extending 600 mm above ground level with the top painted red. The measurement to the invert of the pipe shall be clearly marked on the peg.

All new or additional lateral connections to the existing sewer main shall be carried out by WDC authorised contractors at the cost of the applicant(s). The applicant(s) shall obtain prior approval of the Council for the connection.

### 6.6.14 Gully Traps

The minimum level for a gully trap is calculated as shown below in Equation 6.5:

**Equation 6.5 Minimum level for gully trap**

$$L = S + R + C$$

where $L$ = minimum gully trap level

$S$ = soffit level of main

$R$ = rise on gradient to furthermost likely head of drain (m)

$C$ = minimum cover over lateral as set in BIA regulations (m)

Gully traps must be at least 1.0 metre above the soffit level of the sewer main, and at least 200 mm above the crown of the road.

### 6.6.15 Temporary Ends

Extend wastewater sewer mains to the upstream boundary of new developments, to allow for connection of any future upstream catchments. This may require temporary flush tanks to be installed.

### 6.6.16 Restraint

Where polyethylene pipes are used for gravity sewers, they shall be fully restrained against movement from thermal effects. Typically, this will require each end to have a puddle flange which is cast into concrete at the manhole.

## 6.7 NETWORK LAYOUT DESIGN

### 6.7.1 Location and Alignment

Lay gravity pipelines in straight lines and at a constant gradient between access points such as manholes and inspection chambers.

Locate gravity wastewater pipes in the centre of the road in general; with a minimum vertical cover of 1.2 metres to the crown of the pipe. This makes the sewer equidistant from the properties it serves and, being at a relatively high point on the road surface; vented manholes are less subject to surface floodwater entry.

In curved roads, straight lengths of wastewater pipelines must clear kerbs by two metres and manholes should be on the centreline in all cases.

Lay rising mains in straight lines and at a constant gradient between air valves and scour valves. Locate rising mains generally in the grass berm, for convenient positioning of air valves and scour valves, clear of any street trees. The final alignment shall require the specific approval of the Council.

The Council will generally not accept ownership of drains in private property unless there is no other practicable alternative. Where public drains do occur in private property then an easement-in-gross is required in favour of the Council. The easement shall be 3 m wide, and the pipe shall be at the centre of the easement. The easement shall confer rights for access, conveyance and maintenance.

### 6.7.2 Clearances

CoP Part 9: *Utilities* summarises clearances for utility services. Confirm these clearances with the network utility operators before deciding on any utility layout or trench detail. Maintain the clearances unless the utility operator grants approval otherwise.

### 6.7.3 Common Drains

A common drain is a wastewater pipeline through privately owned land, shared by more than one property and not vested in the Council. A sewer main installed in private property as part of a development and that serves only that development will be a private common drain.

Each lot shall have a single connection to the common drain. Each future lot will require a new connection.

Table 6.7 specifies the requirements for new common laterals.

**Table 6.7 Requirements for existing common laterals (addition to existing subdivision)**

| No. of Lots | 1 | 2 | 3 | 4 | 5 | 6+ |
|---|---|---|---|---|---|---|
| **Ownership of Pipe** | Private Lateral | Common Lateral | Common Lateral | Common Lateral | Common Lateral | Public Main |
| **Status of Corridor** | - | - | Easement | Easement | Easement in corridor of right-of-way | Easement-in-gross |
| **Minimum Grade** | 1:120 | 1:100 | 1:100 | 1:80 | 1:60 | 1:160 |
| **Access to Pipe** | - | - | - | Access points at < 50 m intervals and at bends | Access points at < 50 m intervals and at bends | Manholes at terminal points and changes of direction & grade. |
| **Condition** | - | Good | Good | Excellent | Excellent | - |
| **Diameter** | 100 | 100 | 100 | 100 | 100 | 150 |

Notes: - Minimum Grade: Applies to the number of properties connected to any given section of pipeline
- Access to Pipe: Where depth to invert is greater than 1.5 m, manholes shall be used in place of access chambers
- Condition: Shall be as scored from CCTV inspection using the NZ Pipe Inspection Manual 3rd Edition

The following conditions apply:

- Each dwelling shall have only one discharge point into a common drain;
- Each discharge shall include an accessible junction, e.g. inspection point or chamber;
- An easement shall be created over common laterals where legally able to do so.

### 6.7.4 Building over Pipelines

No building shall be built over a public rising main or closer than 1.5 metres from the centre of any rising main. Subject to WDC approval, a building developer may divert the public rising main (including any valves and fittings) in accordance with Council standards, and at their own expense.

The Council prefers not to have public gravity wastewater mains under buildings because of the potential difficulties with maintenance, replacement and repairs. In some situations it is permitted to construct buildings over the wastewater mains, however, this will be considered on a case-by-case basis. The approval of the Sewer Asset Manager must be in writing for each case.

Approval may be given provided:

- There is no reasonable alternative for the property owner; and
- The existing sewer is not greater than 225 mm diameter; and
- The length under the building is minimised; and
- That the sewer main has a CCTV inspection before and after any work is done; and
- The Council is advised and approves each individual proposal, in writing, prior to obtaining a building consent; and
- One of the following solutions is used:
    - The length of pipe under the building is replaced with an equivalent diameter PVC main laid inside a carrier pipe of the next appropriate larger size or as specified to facilitate future renewal or upsizing. Manholes are to be placed on each side of the building, with enough clear space to be accessible by a truck-mounted water blaster. No lateral connections permitted along the length of pipe between these manholes. The foundations of any building must be designed and constructed so that no additional load is placed on the sewer. All backfill must be thoroughly compacted and certified by an appropriately competent person; or
    - There is still access for repairs or replacement without disturbing the building, e.g. high open foundations on poles or cantilevered with a minimum of 2 metres vertical clearance from ground level and 1.5 metres horizontal clearance from the centreline of the sewer main.

Where the pipeline is covered by an easement, the property owner shall:

- Where there is no subdivision planned, request a waiver letter from the WDC seeking permission to encroach upon the easement; or
- Where a subdivision is planned, adjust the easement document to record the encroachment and pay associated costs.

## 6.8 PUMPING STATIONS

Where a proposed development cannot be adequately serviced by a gravity system, a public wastewater pump station will be considered, provided it is located and designed to service the area of land beyond the reach of the existing gravity system with the potential for further development. Note that this shall also include land outside the current development.

Pump stations shall be located to provide the utility service provider unobstructed and perpetual access from a road reserve without the requirement for key or card access.

The design of a wastewater pump station will vary depending on the size, criticality and location. The Council has a number of typical pump station designs, and these are available on request to assist with the design of new pump stations.

### 6.8.1 Conditions for the Council taking over Pumping Stations

The Council will generally take ownership of wastewater pumping stations, providing the following conditions are met.

1. That the pump station is designed and constructed to the standards in this document or as approved by the Sewer Asset Manager. Engineering drawings of the proposed pump station shall be submitted for approval prior to the commencement of construction. As a minimum, the pump station shall incorporate the following:

- Duty & Standby pumps (same size);
- Concrete or GRP pump chamber including a Flygt TOP base;
- Concrete valve chambers, housing isolation and non-return valves;
- Canal gate valve on the upstream manhole;
- Pedestal type Flygt pumps;
- Multitrode level control system;
- A Datran eXcel SCADA RTU connected and configured to Council's Telemetry System complete with the following I/O (where appropriate):
  - Low level alarm
  - High level alarm
  - Battery backed emergency high level alarm (separate multitrode or float switch, set 1000mm below the overflow point or 200mm above the normal high level, whichever is lower)
  - Pump 1 Run
  - Pump 1 Fault
  - Pump 1 Seal Fault
  - Pump 1 VSD Speed
  - Pump 2 Run
  - Pump 2 Fault
  - Pump 2 Seal Fault
  - Pump 2 VSD Speed
  - Wet Well Level
  - Generator Run
  - Generator Fault
  - Odour Filter Run
  - Odour Filter Fault
  - Mains Power Fail
  - Instantaneous Flow L\s
  - Accumulated flow pulse $m^3$

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- A Magmaster electromagnetic flow meter installed on the rising main;
- Emergency Storage of 8 hours at Average Dry Weather flow (including reticulation storage as described below)
- Terminal connection for the WDC portable generator;
- Electrical controls approved by Council's electrical subcontractor;
- Access and sealed parking area for a sucker truck, utility vehicle, and generator;
- Potable water supply & appropriate backflow prevention device (RP03 BSP, complete with frost protection);
- All workmanship shall be to best trade practice;
- Strategic pump stations may require permanent generators and/or a control building. The Council will advise which pump stations are considered strategic. Factors the Council will consider in determining whether a pump station is strategic include:
  - Proximity to nearest available portable generator;
  - Reliability of power supply;
  - Available storage at ADWF;
  - Size and capacity of electrical controls (≤ 7.5 W pumps);
  - Remoteness;
  - Requirement for odour control unit
  - Environmental conditions (e.g. coastal area).

2. The pump station shall be situated on a separate title, land to be vested in the Council;

3. A summary of calculations shall be submitted to Council with the following information:

- Peak and average daily inflows;
- Pump duty point with one pump running;
- Pump duty point with two pumps running;
- Demonstration of a maximum of 10 pump starts per hour.

4. Certified as-built information of the completed sewer pump station shall be provided, including drawings, specifications, and Operations & Maintenance manuals for all reticulation, civil, mechanical and electrical works, and the lowest overflow point (e.g. gully trap, manhole, or pump station) shall be clearly marked on the plans. This information is to be provided to and approved by the Sewer Asset Manager before s224c certification will be issued.

5. The pump station and associated rising main shall be fully commissioned in the presence of a Council representative. The commissioning shall include the following minimum checks and measurements:

- Each pump running;
- Level controls;
- Alarms and telemetry are working and set correctly, including the acknowledgement of alarms;
- Motor currents;
- Pump pressures when running and under closed valve conditions and surge simulation;
- Flow rate of each pump operating individually;
- Flow rate of both pumps operating simultaneously;
- Flow monitor check and calibration;
- Odour control running and alarms checked;
- Generator run with all equipment checked to ensure that it will work as designed. Where a generator is not installed, then a WDC portable genset will be used instead. The contractor shall pay all costs associated with the equipment check;
- All valves shall be opened fully and closed;
- Pressure gauges working and calibrated;
- A full commissioning report of the above shall be forwarded to the Council by the developer.

6. The pump station shall be designed and tested to achieve a preferred velocity in the rising main of 0.8-1.2 m/s, with an absolute minimum velocity of 0.6 m/s and a maximum velocity of 1.5 m/s.
7. A maintenance check shall be undertaken immediately prior to Council taking ownership of the pump station. All defects shall be made good by the developer prior to Council taking ownership.

Council will take ownership when all of the above conditions have been met and each pump has operated satisfactorily for a minimum of 10 minutes per day over a 30 day period. The developer shall contact Council 24 hours prior to the 30 day testing period to ensure that all telemetry and monitoring equipment is operating satisfactorily. The testing period shall not commence until after the pump station has been commissioned in the presence of a Council representative (ref condition 5.).

The 30 day testing period shall be managed by Council's Water Unit but costs shall be borne by the Developer. The testing period shall incorporate weekly site inspections and response to any alarms or faults. Responses shall be invoiced on a time and disbursements basis.

The 8 hours' storage at average daily dry weather flow may incorporate storage in the pump station, manholes, and reticulation. The storage must be provided with a minimum of 500 mm freeboard to the lowest ground level on the proposed building sites, or 200 mm freeboard to the lowest manhole lid or pump station lid, whichever provides the least storage. The average daily dry weather flow shall be calculated as outlined in Section 6.4 above. Calculations shall be submitted showing how the emergency storage volume has been derived.

## 6.9 RISING MAIN DESIGN

Rising mains shall be designed to fully account for the characteristics of the system in question including pump characteristics, surge, flow regimes and fatigue. The design shall minimise the time wastewater spends in a rising main, to avoid septicity and odour problems, and maintain self-cleansing velocities. Both these objectives can be achieved by minimising the length and diameter of the pipe. The pipeline will also need to withstand normal operating pressures, including short duration surge pressures from normal cycling and special events (such as power failure).

The general requirements of CoP Part 7 – *Water Supply* regarding water supply pressure mains shall also apply to wastewater rising mains.

### 6.9.1 Maximum Operating Pressure

Design the components of a pressure pipeline to withstand a maximum operating pressure that is greater than all of the following:

- 400 kPa (note that this is not the minimum pipeline pressure class);
- 1.5 x (static head + friction head);
- Pump shut off head;
- Positive or negative surge pressures.

Ensure that external loads on the pipeline are included in all load cases, especially when pressure testing large diameter pipes. Provide a factor of safety of at least 2 against buckling under negative or external pressures. All fittings shall have a pressure rating equal to or greater than the pressure rating of the associated pipeline, or PN12, whichever is the greater.

For plastic pipes, fatigue effects may require a higher nominal pressure rating, which must be the greatest of the following:

- The maximum calculated operating pressure; or
- The minimum pressure rating in the table below; or
- The equivalent operating pressure based on a surge & fatigue analysis.

To calculate the equivalent operating pressure ($P_{eo}$) use the methodology described in CoP Part 7 Appendix C – *Design for Surge and Fatigue*.

**Table 6.8 Minimum Pressure Rating for Rising Mains**

| Material type | Pressure rating (kPa) |
|---|---|
| PVC-U | 1200 |
| PVC-O | 1000 |
| PE 80B | 1000 |
| PE 100 | 1000 |
| DI | 3500 |

### 6.9.2 Pressure Surges

Pressure surges can arise from a number of different operations, e.g. the sudden starting or stopping of a pump or closure of a non-return valve. Surges can be critical in pumping systems, especially in large diameter mains and high static head systems.

The designer shall submit the design for rising mains, including levels and layout, with the engineering drawings. Submit a detailed hydraulic surge and fatigue analysis report, including all assumptions and all calculations.

When choosing the pipe class for rising mains, ensure that the effect of surge and fatigue from the projected number of cycles over a 100-year lifecycle is taken into account. For details on surge and fatigue see Part 7 Appendix C.

Consider soft closing, non-return valves for installations in high head situations as well as variable speed controls.

Allow for issues such as operation and maintenance and consider failure of any mechanical surge protection measures and protection from damage during these situations.

### 6.9.3 Minimum Pipe Sizes

Pressure pipelines maintained by the Council must have a minimum nominal diameter of 50 mm. PVC pipe diameters shall be limited to the following standard sizes: 50 mm, 100 mm, 150 mm, 200 mm, and 300 mm nominal bore (internal diameter). Any larger pipe sizes, or alternative PE pipe sizes, shall be subject to specific approval.

### 6.9.4 Velocity

Pressure mains shall have a preferred velocity of 0.8-1.2 m/s, with an absolute minimum velocity of 0.6 m/s, and a maximum velocity of 1.5 m/s. The velocity shall be confirmed in the Design Report.

### 6.9.5 Gradients

The profile of rising mains shall be designed to minimise the number of high and low points, which require the installation of air and sluice valves respectively. However, the final profile will be a balance between the minimum depth of main and number of valves.

Where possible, rising mains shall be graded continually upwards from the pumping station to termination. Design to keep the pipe full and prevent sudden discharges of foul air at pump start. Avoid creating summits since they trap air, reducing capacity, and allow the build up of sulphides, which convert to droplets of sulphuric acid and may cause pipe corrosion.

If a summit is unavoidable, provide automatic air release valves. Design the air valves specifically for wastewater operation. Mount air valves vertically above the pipeline to which the air valve is connected. Fit an isolating gate valve between the air valve and the vented pipeline and mount the valves in a concrete valve chamber. The chamber must be large enough to allow easy access for maintenance staff to operate the isolating valves or remove all valves from the chamber.

At low points, provide drain valves and chambers such that the contents of the entire main can flow into the chamber and the contents be collected by a sucker truck. Alternatively, it may be possible to drain directly to a nearby sewer (subject to specific Council approval).

### 6.9.6 Cover over Pipes

The minimum cover over the top of the pipe to finished ground level shall be:

- 600 mm in berm, footpath or behind carriageway or kerb & channel;
- 750 mm under carriageways or areas where the Council proposes carriageways.

Where the minimum required cover is not available, specific design is required.

### 6.9.7 Joints

Joints between fittings and pipes on rising mains shall be made using the following methods (where appropriate):

- Socket & spigot (except for PE pipes) only where the socket is designed specifically for the spigot outside dimension);
- Gibault (except for PE pipes) where the gibault is either of the multi-fit type or specifically designed for the outside diameters of the items to be joined. Gibaults may not be used where the step difference exceeds 10 mm;
- Flange-socket or flange-gibault adaptors (except for PE pipes);
- Butt-fusion welding (PE pipes DN160 and larger only) by a specialist contractor only;
- Mechanical couplers (full restraint type – PE pipes only);
- Welding (concrete lined steel only);
- Threaded connections to BSP (generally only for pressure tappings or similar)

Electrofusion and solvent-cement joints are not permitted without specific approval by Council.

### 6.9.8 Flanges

All valves and fittings shall be flanged to either AS2129 Table D/E or AS4087 Class 16. It is the developer’s responsibility to ensure that all mating flanges are compatible. Note that this also applies to items such as flow meters and check valves, and that alternative flange standards (such as ANSI or DIN) will not be accepted. If higher pressure ratings are required, these will be subject to specific Council approval.

### 6.9.9 Sluice Valves

Attach sluice valves to flanged fittings rather than plain-ended fittings.

The force required to open or shut a manually operated valve, using a standard valve key, with pressure on one side of the valve only, must not exceed 15 kg on the extremity of the key. Specify geared operation, motorised valves or a valve bypass arrangement, to reduce pressure across the valve, if the allowable force cannot be met.

### 6.9.10 Scour Valves

Scours are required on the low point of all rising mains. Generally, valves should be the same size as the main, but no greater than 150 mm in size. Install scour valves at the lowest point between isolating valves, and discharge to an approved chamber.

### 6.9.11 Air Valves

Air can accumulate at high points when it is drawn into the system. It is preferred to have no high points in wastewater rising mains wherever possible, and thus little or no requirement for air valves. If this cannot be avoided, mains should be laid evenly to grade between peaks to ensure all possible locations of potential air pockets are well known. Investigate the need for air valves at all high points, particularly those more than 2 m higher than the lower end of the section of main, or if the main has a steep downward slope on the downstream side.

Air may also come out of solution in the wastewater due to a reduction in pressure, such as when wastewater is pumped uphill. Air valves may be required to allow continuous air removal at these locations.

The number and location of air valves required is governed by the configuration of the reticulation, in terms of both the change in elevation and the slope of the mains. Install air valves in a secure enclosure, with an isolating valve to permit servicing or replacement without needing to shut down the rising main. Air valves shall be specifically designed for use on wastewater, and attention paid to venting, odour and noise control.

### 6.9.12 Non-Return Valves

Non-return valves are required on all private laterals and at pump stations. HDL or SOCLA ball-check valves shall be used.

### 6.9.13 Thrust Blocks on Mains

Design thrust blocks for all fittings and valves, to withstand the maximum operating pressure and test pressure.

Where required, thrust blocks shall be constructed so as to be clear of pipe joints and fittings.

Cast in-situ concrete thrust blocks shall be provided at all points where an unbalanced thrust occurs. Anchors and thrust blocks shall be appropriately designed and installed clear from connections and fittings. Concrete shall:

- Be a minimum of 20 MPa at 28 days;
- Surround not more than 180 degrees or 50% of the fitting or pipe barrel;
- Be insulated from the reticulation using an appropriate flexible membrane.

The precast thrust block detailed in SD 600-405 may be used if all of the following criteria are met:

- It must have a minimum surface area of 0.18 $m^2$ in contact with an undisturbed trench wall;
- The fitting or valve is up to and including 150 mm diameter;
- The maximum operating pressure is up to and including 700 kPa;
- The trench ground conditions can sustain a safe bearing capacity greater than 150 kPa, as established by testing.

Design and detail thrust blocks individually for any of the following situations:

- The fitting or valve is over 150 mm diameter;
- The maximum operating pressure is greater than 700 kPa;
- The ground bearing capacity is less than 150 kPa.

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

### 6.9.14 Restrained Joint Wastewater Mains

Restrained joint wastewater main systems may be used in place of thrust and anchor blocks to prevent the separation of elastomeric seal-jointed pipelines.

Restrained joint systems include welded steel joints, flanged pipes and fittings and commercial mechanical restrained joint systems. Specify details of commercial restrained joint systems on the engineering drawings, including the:

- Length of restrained pipeline and adjacent fittings required to ensure the transfer of thrust forces to the ground strata;
- Requirement for placing suitably worded marking tape in the trench over the pipeline to define the limits of the restrained joint system;
- Requirement for details of the commercial restrained jointing systems to be shown on the as-built drawings, including the location of restrained portions of pipelines.

## 6.10 WASTEWATER TREATMENT & DISPOSAL

Where new treatment facilities are required, these shall be designed, constructed and tested to demonstrate compliance with the Resource Consent conditions. The approval process will depend on a number of factors including:

- The size of scheme;
- The complexity of treatment process;
- The quality of the treated effluent;
- The sensitivity of the receiving environment; and
- Whether the scheme shall be vested in the Council.

Contact the Council to discuss the approval process when details of the treatment and disposal systems are known. Each new treatment facility requires approval on a case-by-case basis.

### 6.10.1 Private Septic Tanks and On-Site Wastewater Treatment Systems

In rural residential areas, where ground conditions and terrain are suitable, wastewater disposal may be provided by on-site septic tanks or wastewater treatment systems.

The *Natural Resources Regional Plan (NRRP)* contains policies and rules relating to the discharge of wastewater effluent.

If compliance with the *NRRP* rules is not achieved, a resource consent is required from Canterbury Regional Council (Environment Canterbury). Contact Canterbury Regional Council for information on their requirements.

In all instances, obtain a Building Consent and a Landuse Consent from the WDC to install, modify or renew an on-site wastewater treatment and distribution system.

## 6.11 ODOUR CONTROL DESIGN

A biofilter is a device used to treat odours arising from the wastewater system.

The usual form of biofilter used in sewerage systems is a media bed, through which the odorous gas is passed. The principal odour component of sewage 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.

The biofilter media is commonly bark nuggets but can be a variety of materials, which possess a high surface area and resistance to breakdown and in which the bacteria can thrive.

Typically, the situations where odours cause nuisance are where the wastewater is more than eight hours old, held in anaerobic conditions in rising mains and where there is high turbulence that encourages $H_2S$ to come out of solution.

Consider the following factors in the design of a biofilter: site, airflow rate, location of air extraction point, air velocities, filter media depth, filter media, air distribution, textile filter fabric, underdrain, irrigation.

### 6.11.1 Biofilter Site

Locate the biofilter at a minimum distance of 100 m from houses or retail type commercial development. Biofilters can be very effective but total odour control at all times cannot be guaranteed.

Consider the prevailing wind directions at all sites. The worst conditions are warm and very light winds.

Where the site must be very close to houses, businesses or sensitive environmental areas, consider an activated carbon filter installation. Balance the constraints of the location against the higher running costs for high $H_2S$ removal using a carbon filter.

### 6.11.2 Bark Bed Type

Generally, for odour control on an existing sewer well away from a nearby pressure main discharge, use an airflow rate equal to the sewer pipeline’s normal air space at a velocity of 1.0 m/s. For turbulent situations, particularly when deliberately induced to reduce dissolved sulphide levels, consider the length and size of the pipeline from which it is desired to extract the gas.

Consider whether excessive moisture in the sewer could be controlled by increased forced ventilation. Corrosion rates are more rapid in condensing atmospheres and ventilation can help dry the air.

For gravity sewers at pressure mains discharges, extract the gas at the first manhole downstream of the discharge point, to collect as much $H_2S$ coming out of solution in the sewer as possible.

Air velocity through the filter media governs the bed area. The required detention time (determining the average velocity in the bed) is dependent on the following factors:

- Depth of the media;
- Concentration of $H_2S$ gas;
- Degree of the nuisance odour risk to the nearby population.

For a conservative design, use a velocity of 5 m/hour (calculated using the air flow rate divided by total bed area). Note that the actual velocities within the bed are much higher, due to the relatively low void ratio.

For air flows greater than 0.2 $m^3/s$ and/or average $H_2S$ concentrations greater than 5 ppm measured at those air flow rates, use velocities up to 10 m/hour to reduce the bed installation costs but consider the increased risk of odour in the immediate vicinity.

To minimise gas short circuits within the bed and to provide the maximum detention time, use 1.0 m depth of filter media and, where the site allows, slope the sides at 45°. Vertical sides can allow gas to escape if any media shrinkage occurs.

Use premium medium grade bark mulch as specified in CCC *CSS: Part 1*.

Ensure even air distribution in the biofilter bed. For example, in a rectangular bed feed air from the centre of a bed of crushed metal (CCC GC 14-10) to a uniform layout of perforated (drilled PVC or subsoil drain) pipes at 1.5 m centres.

Do not place textile filter fabric above the air distribution granular fill.

In most locations an underdrain in the biofilter is necessary, to collect acidic leachate and drain it out to the sewer. Include an impermeable membrane at the base of the air distribution system.

The efficient operation of biofilters relies on keeping the media moist. This aspect is very important and **irrigation controlled by a moisture sensor and timer is required on all biofilters**.

The natural bacteria in the media may not be sufficient to control odour on start-up, therefore airflow rates should start low and be increased gradually as the bacteria colonies develop. Confirm the development of the colonies during this process through testing whether odour can be detected.

### 6.11.3 Activated Carbon Filter Type

Proprietary Activated Carbon Filters shall be designed to meet the following requirements:

- Design life of 25 years;
- Constructed from non-corrosive materials;
- Vandal-proof;
- Meet the District Plan maximum noise control of 45 dBA at the property boundary at all times;
- SCADA monitoring of running and fault conditions;
- Comprehensive design report that includes the following:
    - Contaminant removal rates;
    - Life cycle costs;
    - Operational and maintenance costs
- Comprehensive Operating & Maintenance manual (including manufacturer's contact details for all equipment.

### 6.11.4 Monitoring

Biofilter operation should be monitored on a regular programme. The programme can be very simple - from smell inquiries of nearby residents for installations with low $H_2S$ concentrations to comprehensive airflow and gas concentration measurements for critical installations.

Regular inspection of the mechanical equipment is essential.

## 6.12 ALTERNATIVE CONVEYANCE SYSTEMS

### 6.12.1 Septic Tank Effluent Pump (STEP) Systems

Where a proposed development cannot be adequately or cost-effectively serviced by a gravity system, a STEP system may be considered. The design of the STEP system must give due consideration to servicing beyond the immediate area.

A STEP system may be appropriate if:
- The development has a low population density;
- Lot areas are between 0.5 and 1.0 hectares;
- It would avoid the need for a pump station;
- There is a high groundwater table.

A specific design shall be provided to Council for approval, prepared by an appropriately qualified or experienced professional. This shall include plans for operation and maintenance, and ongoing costs.

The system as a whole, and discharge points in particular, shall be designed with the following considerations:
- Odour control;
- Aeration;
- Minimising septicity, $H_2S$ generation and corrosion;
- Low maintenance;
- Minimal disruption in case of emergencies;
- Any other potential hazards

The following parameters shall be incorporated in the design:
- K = 0.3 mm
- The design flow rate shall be calculated as outlined in section 6.4, with an estimated wastewater use of 1000 L/property/day;
- Main pipes shall have an internal diameter of 50, 65, 75, 90, 100, 125, or 150 mm. PE80B may be used for all sizes, while PVC or PE100 may be used for pipes with a diameter of 100 mm or greater;
- Private laterals shall be 50 mm NB diameter, including a non-return valve and isolation valve housed in a toby box at the road boundary;
- Maximum total head shall be 16 m;

All tee-intersections on the mains shall incorporate an isolation valve and emergency discharge point.

STEP systems shall not be used for commercial or industrial systems.

The on-site treatment system shall be designed to achieve the following minimum effluent quality:
- BOD ≤ 30 $g/m^3$;
- Suspended solids ≤ 10 $g/m^3$;
- Total Nitrogen ≤ 10 $g/m^3$.

The on-site treatment system is required to have the following components, as a minimum:
- Multi-chamber septic tank;
- Suitable biological outlet filter (refer SD 600-355);
- Non-return and isolating valves at the pump station;
- High level alarm (audible & visual).

Tanks shall be sealed watertight, sized and constructed in accordance with AS/NZS 1546:2008. If existing septic tanks are to be incorporated into the system, the tanks shall be tested for compliance with the appropriate standard and upgraded or replaced if not adequate. The tanks must be large enough to provide 24 hours of emergency storage capacity above the high level alarm. This may include septic tank freeboard capacity, if effluent will remain below ground and below the lowest gully trap.

Provisions for ventilation shall be provided for all pump tanks with the vent opening located above the 100-year flood elevation.

An isolation valve shall be installed at each point of supply.

Pumps shall be appropriately sized for the system and designed for frequent cycling. The recommended pump to design the system around is the Lowara GLM-55-WDC, with a minimum 0.3 L/s flow rate. All pumps in a single STEP system shall be the same model and size. The pump shall be easy to access and remove from site, to facilitate installation and maintenance.

The property owner shall be responsible for the safe and adequate operation, maintenance and liability of the septic tanks, pumps and laterals, unless the Council approves otherwise.

### 6.12.2 Common (Private) Pressure Main Systems

A common drain is a wastewater pipeline through privately owned land, shared by more than one property and not vested in the Council.

Common pressure main systems are subject to Council approval and will only be considered if a normal gravity system is not practicable. For private common systems in public land, a license to occupy is required.

Size the pressure main to achieve a pipe-flushing velocity at the ultimate design flows. In larger systems it is normal to vary the pipe size along the length of the pipeline, according to the number of connected pumps.

The diameter of the common pressure main at the point of connection must be larger than the diameter of the lateral connecting the pipe from each pump to the common pressure main.

Design of common pressure main systems should take account of the average retention times. Retention times of up to six hours will not normally cause odour at the discharge point; however, if the average retention time is over eight hours odour is likely to occur. If retention times are expected to exceed this, then it may be necessary to install a biofilter where these systems discharge to the gravity system to avoid odour and hydrogen sulphide problems.

## 6.13 MATERIALS

The Council is currently in the process of developing an approved materials specification. The following brief outline is provided as guidance, specific details are available from the Council on request.

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.

Where a material or product is proposed that is not approved or previously used in the district, the Council may require assurance that demonstrates the durability of that material prior to approval. Where there is no current standard, the manufacturer will be required to supply copies of their Quality Assurance procedures and producer statements to support their performance and composition claims for the products concerned. This must be approved in writing by the Council before work commences.

### 6.13.1 Pipelines

All pipe materials must comply with their respective current NZS or AS/NZS standard.

PVC-M pipe will not be accepted.

### 6.13.2 Reticulation Fittings

Nylon coated ductile iron fittings complying with AS/NZS 2280 shall be generally used. Where socketed fittings are used, these shall be specifically designed for Series 1 or Series 2 pipe as appropriate (i.e. fittings that use adaptor rings are not permitted). Fabricated fittings shall not be used without specific Council approval.

### 6.13.3 Sluice Valves

Sluice valves used for scour or isolation purposes shall be resilient-seat and clockwise-opening, with non-rising spindles. They shall be of nylon coated ductile iron construction suitable for buried service, and comply with AS/NZS 2638. Sluice valves shall have dual shaft seals and be of the removable bonnet type (i.e. unitary construction valves are not permitted).

### 6.13.4 Small Diameter Valves & Fittings

Small diameter (i.e. threaded) valves and fittings shall be constructed of either bronze or 316 stainless steel and be suitable for wastewater applications. Buried valves shall be of the metal gate type, with conventional (anti-clockwise) opening and installed such that the operating wheel can be operated from the surface by hand.

Ball valves shall not be installed where there is potential for freezing. Female threaded connections on polymer fittings must have a stainless steel reinforcing ring or similar to prevent splitting.

### 6.13.5 Air Valves

Air valves shall be dual-acting air valves, incorporating a kinetic air valve (large orifice) and a dynamic air valve (small orifice) in a single unit. They shall be specifically designed for wastewater application and provided with an isolating valve. The nominal size of the large orifice of air valves must be 50 mm.

### 6.13.6 Haunching, Bedding and Backfill

A geotechnical investigation shall be carried out as part of the design. If there is a possibility of soft ground that was not identified initially, further ground investigations may be required.

Design haunching, bedding and backfill for the specific installation location. The material used must be capable of achieving the backfill compaction requirements set out in CCC *CSS: Part 1*. Specify haunching and bedding for pipes to comply with CCC *CSS: Part 3* clauses 8.5 and 8.6. Earth loads on deep pipelines can significantly increase when pipes are not laid in narrow trenches. Increase the strength of pipelines by concrete haunching, as detailed in SD 600-344A/B.

All mains installed by trenching shall be thoroughly bedded, haunched and surrounded in accordance with AS/NZS 2032:2006 and AS/NZS 2566.2:2002. Refer also CoP Part 8: *Roading* Appendix B – *Road Openings* (QP-C843) for trenching in the road. Other forms of installation utilising trenchless technology may be used subject to Council approval.

Use Type M and P (aggregate) haunching, as detailed in SD 600-344A/B, where there are no special scour, aggressive groundwater or bedding problems. Unless otherwise stated, the following shall be used:

- AP20 bedding and surround for pipes less than 1500 mm diameter;
- AP40 for pipes greater than greater than 1500 mm diameter;
- AP65 for all drainage structure foundations, including manholes, anchor blocks and any other structures.

However, where there is a danger of the surrounding soils or backfill migrating into the haunching or foundation metal, protect the haunching and foundation metals with an approved geotextile.

Replacing highly compressible soils (such as peat) with imported granular fill material can cause settlement of both the pipeline and trench surface, because of the substantial increase in weight of the imported material.

Haunching and backfill in these areas may need to be wrapped in filter cloth to stop the sides of the trench pushing out into the softer ground. Wherever the ground bearing strength is less than 50 kPa, design structural support for the pipe and any structures.

Consider using a soft beam under the pipe haunching for support or using a flexible foundation raft. Retain joint flexibility. Difficult bedding conditions may warrant the use of piling, in which case smaller pipes may require some form of reinforced concrete strengthening to take bending between piles.

### 6.13.7 Corrosion Prevention

The developer will be required to submit for approval their proposed list of materials such that the Council can determine material suitability.

Potential problems may include:

- Mildly corrosive soils;
- Septicity & $H_2S$ generation;
- Potential for liquefaction and/or earth movement

Corrosion can be caused by hydrogen sulphide, aggressive groundwater, saltwater attack, carbon dioxide or oxygen rich environments. **Before** specifying concrete pipes within potentially corrosive areas, test the groundwater to check whether concrete piping is appropriate. Regard groundwater as aggressive to ordinary Portland cement if any of the criteria in Table 6.9 are met.

**Table 6.9 Criteria for Aggressive Groundwater**

| Options | Measure | Condition |
|---|---|---|
| 1) | Calcium carbonate alkalinity | $CaCO_3 > 35$ ppm |
| | Aggressive carbon dioxide | $CO_2 > 90$ ppm |
| 2) | Calcium carbonate alkalinity | $CaCO_3 < 35$ ppm |
| | Aggressive carbon dioxide | $CO_2 > 40$ ppm |
| 3) | Acidity | pH < 6 |
| 4) | Sulphate | $SO_4 > 1,000$ mg/L |

Design to minimise corrosion through:

- Selecting materials which will resist corrosion, such as PE manholes in place of concrete;
- Designing in an allowance for corrosion over the 100-year life-cycle of the asset;
- Providing protective coatings, such as polyethylene film or coal tar epoxy;
- Increasing cover to reinforcing;
- Laying concrete pipes in concrete haunching (see SD 600-344A/B Type C or H).

Bolts and fittings must be hot dip galvanised and incorporate zinc anodic protection. Do **not** use stainless steel where it may fail as a result of crevice corrosion in the presence of sulphides and chlorides.

### 6.13.8 Surface Boxes and Markers

All valves shall be provided with an approved surface box and a vertical section of 150 mm minimum diameter PVC-U pipe from the valve bonnet to 50mm below the finished surface. The pipe shall be installed so as not to transfer surface load to the reticulation main (refer also SD 600-406).

Surface boxes shall finish flush with the final ground surface. Valve boxes shall be painted white.

Permanent marker posts or plates shall be installed for all valves DN100 and larger. The marker shall identify the size of the valve, and the distance to the valve (to 0.1 m accuracy). The post shall have a permanently formed ‘LV’ (for line valves) or ‘SV’ (for scour valves).

Riser spindles will be required on valves that are greater than 750 mm deep to the valve dolly.

## 6.14 TRENCHLESS PIPE INSTALLATION

When working in high volume roads, public areas, adjacent to trees, or through private property, consider using trenchless pipe installation 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;
- On-line replacement;
- Caseless microtunnelling;
- Pipe relining;
- 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.

### 6.14.1 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.

### 6.14.2 Cured-In-Place Pipe Relining

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 WIS 4-34-04.

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.

### 6.14.3 Directional Drilling and Guided Boring

Restrict sewer installation using guided boring or directional drilling to instances where their construction tolerances are acceptable.

Take into account 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.

An adequate survey and/or investigation during the design phase are important to the success of this technique. Investigate the separation from existing services carefully.

### 6.14.4 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 CCC *CSS: Part 3*, clause 7.3. The number and frequency of lateral connections may influence the economical 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.

## 6.15 INSTALLATION

### 6.15.1 Authorised Installers

Only Waimakariri District Council Authorised Drainlayers are permitted to install pipework that will be vested into the Council and any pipework that is located within legal roads. A full list of authorised drainlayers and conditions of approval may be obtained on request from the Council.

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

Wherever works are installed within existing legal roads, a Road Opening Notice (RON) must be obtained for that work. The work must comply with requirements as set out in the Council standard specification QP-C843 for this type of work.

No work may start until the RON has been approved in writing by the Council.

### 6.15.2 Handling

The engineer, developer and 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 pipe must not exceed 12 months. Store fittings under cover at all times.

### 6.15.3 Approved Plans

The contractor shall work from the most up-to-date, Council-authorised plans.

### 6.15.4 Confined Spaces

Contractors shall work within the Council's *Guidelines for Entering and Working within Confined Spaces* (QP-C606). Contractors that do not hold the relevant qualifications shall not work within confined spaces.

## 6.16 TESTING & COMMISSIONING

### 6.16.1 Testing

Testing of all pipelines, manholes and other structures must be carried out as specified in CoP Part 3: *Quality Assurance* in the presence of Council staff.

Pumping stations shall be tested & commissioned as required in Section 6.8.1.

### 6.16.2 Connecting into existing system

Only Council approved contractors may make connections to the Council utility system. Connection of any part of the works into the Council system shall only be made with prior approval of Council in writing.

New pipe work must not be connected to the Council reticulation until after the mains have passed a pressure test.

### 6.17 AS-BUILT INFORMATION

Present as-built information which complies with CoP Part 12: *As-Builts* and this Part.

## 6.18 ASSOCIATED DOCUMENTS

| | |
|---|---|
| Appendix A | Wastewater Disposal System Selection (QP-C815-AA) |
| Appendix B | Pipe Materials Selection (Wastewater – Pressure) (QP-C815-AB) |