
**CODE OF PRACTICE FOR CITY INFRASTRUCTURE
& LAND DEVELOPMENT**

ENGINEERING STANDARDS MANUAL

SECTION 5

WASTEWATER DRAINAGE

Wastewater Drainage

SECTION 5.0 WASTEWATER DRAINAGE

Note: The adoption of alternative pipeline design standard for the wastewater network which allows curved pipelines, bends, plastic manholes and plastic mini-chambers are presently being developed.

Details of the new design requirements should be finalised during 2008. Council will consider the approval of pilot schemes trialling these new standards in the City in this interim period. Developers are welcomed to discuss these proposals with WCC.

5.1 SCOPE

This Section of the Engineering Standards Manual covers the engineering requirements for wastewater drainage associated with land development projects and provides:

- a) The relevant criteria for performance
- b) Methods for design and construction control
- c) Specifications for materials and structures
- d) Standard details.

5.2 PERFORMANCE CRITERIA

Where provided, a wastewater drainage system shall:

- a) Meet all relevant standards and criteria of the District Plan.
- b) Remove domestic and industrial wastewater in design quantities.
- c) Provide connections for each allotment.
- d) Be compatible with connecting networks
- e) Withstand design loads
- f) Prevent infiltration and exfiltration
- g) Prevent penetration of roots
- h) Maximise the expected design life of the system and minimise long term maintenance.
- i) Be easily maintained
- j) Not interfere with other utilities
- k) Provide for future development

5.3 DESIGN REQUIREMENTS

5.3.1 Capacity

All wastewater drainage networks shall have sufficient capacity to dispose of residential, commercial and industrial wastewater.

5.3.1.1

The minimum flow rates shall be determined as follows:

- a) Residential – Peak flow rate of 1000 l/d/person with 50 people per ha (unless otherwise advised). This is based on an average dry weather flow (ADWF) of 180 l/d/person and an average daily flow (ADF) of 250 l/d/person and a peak flow factor of $ADF \times 4$.
- b) Industrial/Commercial – Peak flow rate of 0.55 l/s/ha.

5.3.1.2

The minimum design capacity shall be the peak flow rate (without surcharge) using the “Colebrook White Formula”, or using graphs or other representations of the same or similar accepted method.

5.3.1.3

A pipe roughness coefficient of $K_s = 1.5\text{mm}$ shall be used.

5.3.1.4

The minimum design gradient shall be 1.0% for 150mm nominal diameter pipeline and the maximum design velocity shall be 4.50 m/s. The maximum and minimum requirement may be exceeded under extenuating circumstances particularly to avoid pumping, subject to specific design approval. Branch lines with less than 3 connections should be steeper than 1.5% for operational reasons.

5.3.1.5

Generally all wastewater sewers, except connections, shall be 150mm nominal diameter except trunk sewers larger than 150mm diameter which shall be subject to specific design and approval.

5.3.2 Layout**5.3.2.1**

Where a piped wastewater drainage system is to be provided it shall provide each allotment with a suitable connection point capable of serving the whole of the potential building area of the allotment. Dispensation for restricted servicing may be granted under extenuating circumstances provided that the extent of the limitation is recorded on the title of the land and on Council’s hazards register.

Allotment refers to each lot whether residential, commercial or industrial use.

5.3.2.2

The piped system shall generally be located in the lowest point of the property. Lines shall be kept clear of building platforms and manholes should be located as close to common boundary lines with the outside wall of the manhole a minimum of 0.5 metres from the common boundary lines.

Note: In industrial areas the Drainage Assets Engineer may give consideration to allowing sewers to be located within the public roadway.

For medium or high density residential, commercial and industrial properties, the pipe system shall not be located in the road carriageway or any location (such as rear or side yards), which may be obstructed by buildings, fences, etc. except with the approval of the Drainage Asset Engineer.

For medium density developments, each dwelling unit shall be provided with a public sewer connection. Two adjacent units may be serviced by a single connection from the public system terminating in a dry chamber constructed in accordance with drawing SD 5.13.

Lines are to be laid so as to be easily accessible and not be obstructed by future buildings and fences.

In the case of medium and higher density residential developments, each dwelling shall be connected directly to a public wastewater line. To facilitate this, adjacent units in terrace type developments may connect to a dry chamber as shown in drawing SD 5.13.

Where pipelines are laid in either private yards or communal or public accessways, they shall be so sited as not to have other utility services or extensive networks of private drainage laid parallel to and above them. A minimum corridor of one metre shall be allowed to permit on-going clear physical access to the buried lines.

5.3.2.3

A piped system shall consist of pipelines of a minimum nominal internal diameter of 150mm and shall be laid straight horizontally and to a constant grade vertically (90% visible bore) between manholes located at each change in grade and direction. Wastewater lines of 150mm diameter or greater shall join the main line at a manhole junction.

5.3.2.4

Pipelines shall cross roadways as near to right angles as possible to the centre line of the road with a minimum cover of 1200mm.

5.3.2.5 Dry chambers

A dry chamber as detailed in drawing SD 5.13 may be used as a terminal point for connecting up to two residential units to the public wastewater system. This approach may also be used for one into two to lot subdivisions provided that the connection to the second lot is covered by a drainage easement in favour of the lot to be so served.

Where depth from the invert of the dry chamber to the point of connection on the public pipeline is to be achieved, the use of heavy duty long radius bends manufactured by Solo Plastics is acceptable. The maximum curvature shall be 22.5deg but more than one bend may be used.

5.3.2.6 Pipe bridges

Pipe bridges elevated more than 2500mm off the ground at their highest point shall be subject to specific design. Particular attention is to be paid to bridges crossing streams to ensure that the effects of stream scour and local subsidence in the stream banks is adequately catered for.

All bolted systems and exposed surfaces shall also be wrapped with Denso Petrolatum System – refer SD 6.09.

As an alternative to the detail shown in SD 5.06 an enclosed timber structure carrying a SN 16 uPVC pipe may be approved.

5.3.3 Materials

5.3.3.1 Pipes system

5.3.3.1.1

All pipes laid in trench shall be plain wall uPVC SN 16 or twin extruded uPVC SN16 SC-Solid complying with AS/NZS 1260 with a minimum wall thickness of 4.1mm for 100mm nominal id and 6.3mm for 150mm nominal id pipes. SN16 is a minimum

requirement, however specific design check is required to confirm if SN16 or higher SN rated pipe is required. All pipes are to be rubber ring jointed. The use of solvent welded joints is not permitted.

Note: PVC is currently the only standard approved pipe for wastewater systems. The use of any other material will be subject to specific design and approval.

Gravity pipes used in directionally drilled or other approved trenchless methods for wastewater application shall be HDPE minimum SDR 17 co-extruded jacketed skin polyethylene pipe (black outer/white or brown inner) complying with AS/NZS 5065 for all gravity applications. For pressure applications the pipe used in directionally drilled or other approved trenchless methods shall be PE80 minimum SDR17 polyethylene complying with AS/NZS 4130. All joints shall be made by a butt-welding process carried out by a certificated operator.

A higher SDR rated pipe may be required in specific cases. All PE pipe wall thickness (SDR rating) shall be determined/selected and selected to withstand the thrust, pullback forces and the torque of the drilling or online replacement machine and to suite the flexibility requirements.

The internal bead formed by the welding process is to be removed prior to final installation.

The use of vitrified clay pipes in industrial areas may be allowed subject to specific prior approval of the Drainage Asset Engineer.

Steel pipes shall conform to NZS 4442:1988 and shall have a wall thickness of 4.2mm for 150mm nominal id pipe. Pipes shall be wrapped in black or blue jacket polyethylene (for in ground use) or epoxy/enamel coated (for out of ground use) or wrapped with the Denso Petrolatum System (or similar approved protection system) should ground conditions require – refer SD 60.9.

5.3.3.1.2

Pipe sizes shall be as follows:

Nominal Pipe Size	Minimum Wall Thickness (mm)	Nominal External Diameter (mm)
100	4.1	110
150	6.3	160
200	8.0	225
225	8.9	250

5.3.3.1.3

All joints on pipes and fittings shall be factory made spigot and socket flexible type with 'Z ring' sealing rings, and conform to the following.

- uPVC AS/NZS 1260

5.3.4 Structural strength, bedding and protection

5.3.4.1

All pipes shall be designed for load bearing capacity in relation to their installation condition in accordance with AS/NZS 2566.1 Buried flexible pipelines – Structural design, AS/NZS 2566.2 Buried flexible pipelines – Installation and AS/NZS 3725 Design for installation of buried concrete pipes as appropriate. Temporary construction loading and cover over all the pipes shall be considered and appropriate protection shall be provided for the pipes.

5.3.4.2

All pipes shall be bedded and haunched in accordance with drawing SD 4.01. The bedding material shall be SAP 7.

5.3.4.3

All pipe lines steeper than 10% shall be laid in accordance with SD 4.02.

5.3.4.4

The minimum cover over pipelines shall be 750mm under usual conditions and 1200mm under carriageways.

Where these minimum covers cannot be achieved then the pipelines shall be protected in accordance with SD 4.01.

Where the pipe may be subject to additional loadings such as traffic, tree roots or buildings, specific engineered bedding and protection may be required.

5.3.4.5

Trenched pipelines under carriageways, private ways, or other trafficked areas shall be backfilled with approved compacted hard fill to sub grade level. Such backfill shall extend a minimum of 500mm beyond the paved areas in accordance with SD 4.08.

5.3.5 Manholes**5.3.5.1**

Manholes shall be provided at each change in direction and grade and at each branch line connection and at a spacing not exceeding 100m, or within 25 metres of the end of any line.

Note: Wastewater manholes to be constructed on the existing network shall be constructed by the Council's maintenance contractor at developer's cost.

5.3.5.2

Wastewater manholes shall be constructed in accordance with SD 5.01. Manholes up to 2400mm deep shall be constructed using a single riser with a pre-cast external flange base. The depth of the throat shall not exceed 250mm for light duty lids or 350mm for heavy duty lids as measured from the top of the cast lid to the underside of the pre-cast concrete lid.

Manholes in excess of 2400 deep shall be constructed using a 240mm long pre-cast riser with external flange base and then completing to final ground level using no more than a single riser for manholes up to 5000 deep and three risers for manholes in excess of that depth. In no case shall a series of short risers be permitted.

Light duty frame and lid may be used in areas which will not be subject to traffic loading, however, heavy duty frame and lids must be installed for all manholes in road reserves, accessways and in any other area where the manhole may be subject to traffic loads.

In the event that an existing manhole has to be raised to conform to a revised ground level and that manhole has a short riser on top of the base riser, then the short or shorts shall be removed and a single riser placed to bring the manhole up to final ground level.

All holes into manhole liners shall be made using either drills or power saws. The use of hammers to break into manholes is not permitted. All holes so cut or drilled shall not exceed a diameter 50mm greater than that of the incoming pipe. All holes shall be sealed using an approved epoxy mortar.

5.3.5.3

The fall between any inlet and the outlet invert of a manhole shall be not less than 50mm and not more than 100mm.

Note: 150mm HDPE may use uPVC connectors.

5.3.5.4

Internal drop connections to wastewater manholes shall be a minimum of 600mm measured from invert of incoming line at the London Junction to the bottom of the bend in the manhole channel in accordance with drawing SD 5.04.

5.3.5.5

The channel in the manhole shall be constructed as per SD 5.01 using ceramic tiles and bends neatly cut and jointed using a minimum of mortar. There shall be a minimum of 75mm of 17.5 MPa concrete under the invert of the tile. The geometry of the channel shall be so arranged as to provide the maximum of sweep through the manhole for all incoming lines. The leading edge of any incoming line shall terminate no closer than 250mm from the outlet of the manhole.

The channel for the main flow shall be sited so that the centre line of the channel is not more than 130mm off set from the centre line of the manhole.

Where the service connections are made to the manholes, the channel for this connection shall be epoxy mortared on the existing benching. Breaking into the existing benching is not permitted. The channel for the service connection shall be constructed to direct flow in the direction of the flow in the main channel. The step irons shall be situated clear of any inlet or outlet pipe.

5.3.5.6

All new manholes which are required to have internal drop connections from mainlines (150mm nominal id or greater) or two or more private connections (100mm nominal id) shall be a minimum of 1200mm internal diameter.

Manholes deeper than 4.5 metres shall have a minimum of 1200mm internal diameter and manhole ladder as per SD5.11. Refer to SD5.09 and SD5.12 for manhole detail.

5.3.5.7

Where manholes are laid through areas of extensive vegetation not subject to subsequent development, the manholes are to be finished 500mm above existing ground level.

5.3.6 Branch lines**5.3.6.1**

A branch line is defined as a 150mm pipe originating from a manhole and terminating in a blank cap that:

- a) Does not exceed twenty-five metres in length;
- b) Serves no more than two residential lots of not more than four dwelling units capacity.

5.3.7 Connections**5.3.7.1**

A connection is defined as a 100mm nominal id pipeline:

- a) Not more than six metres long;

- b) Passing not more than five metres through an adjacent lot measured from the point of connection on the main line.
- c) The minimum level of the private system overflow (e.g. gully trap) shall be 1.2m from the service connection invert at the Council pipelines or manholes. At the time of subdivision, there shall be at least a 1.2m fall from the lowest ground level within the building site to the service connection invert.

Note:

- a. *Nominal 100mm diameter wastewater line connections to the existing network shall be constructed by the Council's maintenance contractor at developer's cost.*
- b. *Nominal 100mm diameter wastewater connections on existing manholes shall be constructed by the subdivider under Council's supervision or by Council's maintenance contractor at developer's cost.*
- c. *The costs for 100mm diameter connections by Council's contractor will be in accordance with the schedule of fees current at that date. The current fee structure is available from EcoWater.*

Where a connection exceeds these criteria it must originate from a manhole and be in 150mm nominal id pipe.

Each dwelling or site shall be provided with a connection as defined above, adequate to service the whole of the building platform site in accordance with SD 4.04.

Dwellings in medium and high density residential developments and one into two lot developments, may be served in accordance with 5.3.2.5 using a dry chamber.

5.3.7.2

Connections shall be made to manholes wherever practical.

5.3.7.3

Each commercial/industrial allotment shall be provided with an individual 100mm diameter connection unless prior approval has been given for a trade waste discharge.

5.3.7.4

All connection points shall be extended to within 1.0m of the final ground level using a ramped riser in accordance with SD 4.04.

5.3.7.5

Connections to the main line and manholes shall be permitted only where the crown of the main line is not deeper than 2500mm.

5.3.7.6

Connections shall be terminated with a screw on blank cap. The screw cap shall be painted red inside and outside. The use of solvent welded caps is prohibited. Connections shall be marked with a 25mm PVC duct painted red and projecting 600mm above ground level.

5.4 CONSTRUCTION REQUIREMENTS

5.4.1 Pipeline construction

All pipelines shall be constructed in accordance with the requirements of NZS 7643: 1979, AS/NZS 2566, AS/NZS 2032 and AS/NZS 2033 as appropriate.

5.4.2 Bad ground

Where pipelines, manholes or structures are to be constructed in soft or unsuitable ground, they shall be subject to specific design and approval.

Note: Soft ground shall generally be that with a bearing resistance of less than 40kPa.

5.4.3 Close Proximity

5.4.3.1 General

Building over or close to will only be permitted if diversion of the pipeline or modification of the building footprint is not practicable or where significant additional infrastructure will be created.

Building over or close to structures can and does restrict the ability of the network operator to maintain the network. The costs of maintaining the network can be very significantly increased particularly where the pipeline is at some depth and/or the soils on the site are difficult to work in. In consequence design and installation of temporary or permanent sheet piling of trenches may be necessary where it is essential to excavate down to the pipeline. Similarly the use of concrete slab construction on hardfill places different constraints on subsequent excavation to pipelines. For this reason the minimum or in some specific instances greater separation distances will be applied.

Any diversion of public wastewater pipelines shall be carried out in accordance with the Council's Code of Practice for City Infrastructure and Land Development.

Special design and approval will be required when building over or in close proximity to public drains. This will need to be dealt with in conjunction with any building consent applications.

Note: A counter handout is available from Council's Service Centre (Civic Centre)

5.4.3.2 Building and Structures

Building over or close to public wastewater pipelines may be permitted for:

- a) Wastewater gravity pipelines less than and equal to 150mm internal diameter.

Building over or close to public wastewater pipelines is generally **NOT** permitted for:

- a) Wastewater gravity pipelines larger than 150mm internal diameter.

Building over public wastewater pipelines and related infrastructure will **NOT** be permitted for:

- a) Any wastewater rising main;
- b) Any service connection; and
- c) Any wastewater manhole or other structure. No building will be permitted closer than one metre from the outside of a manhole or other surface chamber.

If building over a pipeline is approved then the following requirements shall be met:

- a) If bridging is proposed over the existing earthenware or asbestos concrete pipes, the pipeline shall be upgraded by the developer at the developer's cost to the required Council standard for the length that may be influenced by the new building work. The pipeline shall be video checked after the works and submitted to Council.
- b) For all other pipeline material, the pipeline shall be video checked before and after the works. If the pipeline is found to be in poor condition in the pre-construction video, it shall be upgraded by the developer at the developer's

expense to the required Council standard for the length that may be influenced by the new building work.

- c) The minimum length of pipeline to be replaced is the full length under the building footprint, including decks plus a minimum distance of 2 metres or distance equivalent to the depth to invert of the pipe from the finished ground level, beyond the outer line of the foundation wall/piles, whichever is greater.

Where casing pipe is required as per SD 5.17, the casing pipe shall be constructed to a minimum distance of 2 metres or distance equivalent to the depth to invert of the main pipe from finished ground level, beyond the outer line of the foundation wall/piles, whichever is greater. The main pipe shall be replaced longer than casing pipe to enable jointing of the pipes outside the casing pipe. The pipeline shall be video checked after the works and submitted to Council.

- d) Horizontal or vertical curvature of pipelines under building platforms is **NOT** permitted.
- e) Long section drawing for the pipeline showing the levels of the underside of the foundation along the pipe shall be provided to Council. The distance between the top of the pipe and the under side of the foundation and foundation beams shall be provided clearly in the long section. Cross section details for all structures, beams, footings, piles within 45° zone shall be provided along the length of the pipe replaced.
- f) The support structure for the building must be totally independent of the pipeline so no additional loading is applied to the pipeline.
- g) Piles shall be constructed where there is a need to bridge the pipeline. No pile ramming is permitted within 5 metres from the wastewater pipe centreline and within the 45° envelope. Piles within 5 metres must be drilled.

Refer to SD5.15, SD5.16 and SD5.17 for bridging details for buildings and structures built over or close to public wastewater pipelines.

- h) The pipe shall be reconnected to the existing pipeline using approved shear band couplers.
- i) All buildings, especially raft foundation structures shall be protected and isolated from the effects of the trench and any damage caused by future pipe bursting construction techniques.
- j) Any damage to public pipeline (including public pipelines upgraded with the building over) identified from post-construction video as a result of the development work will require repairing or replacing at developers' cost to the Asset Engineer's satisfaction.
- k) Where existing connections are under the proposed footprint of the building, they shall be located outside the footprint a minimum distance equivalent to the depth of the pipeline (from finished ground level) clear outside of the footprint at the developer's expense. For pipes that are shallower than 1.5m depth, the minimum distance shall be 1.5m. **Note** – there are limits to the minimum approved clear distance between the top of casing pipe and underside of the foundations. Refer to SD5.17.
- l) Where a connection to an adjoining site is located under the proposed footprint the cost of relocating the connection and diverting the service back to the boundary line to reconnect the existing service is to be borne by the developer. This section of pipeline is deemed to be public and shall be constructed as required in the Council's Code of Practice.

5.4.3.3 Retaining walls

Where it is intended to construct a retaining wall of any description within five metres of a wastewater pipeline the details must be submitted to Council for approval prior to the construction of the wall.

Whether the wall requires a building consent or not is irrelevant as the constraints imposed on the infrastructure will need to be assessed.

Matters to be considered will include but not be confined to:

- a) Type of wall i.e. cantilevered timber, gravity, cantilevered masonry
- b) Separation distance from pipeline
- c) Existing depth of the pipeline
- d) Surcharge placed on pipeline and increased stress to the pipe
- e) Whether the wall crosses the pipeline diagonally or at right-angles
- f) Pipe material
- g) Pipe class

5.5 PUMPING STATIONS AND RISING MAINS

(General guidelines)

5.5.1

The pumping of wastewater shall be permitted only when gravity options are not feasible.

5.5.2

The pumping of wastewater shall require the specific approval of the Drainage Assets Engineer. The capacity of the receiving gravity network to which the pump station discharges shall be able to accommodate combined peak flows from both the pump station and adjoining gravity system.

5.5.3

Pumping stations and rising mains shall be subject to specific design and approval and shall be provided in accordance with SD 5.07. They shall be connected with Council's telemetry system which is to be provided at the developer's expense. The rising main shall have gradient that eliminates or minimises over verticals and under verticals.

The rising main shall terminate at a discharge manhole on the main pipeline.

Where a private pump station is permitted, the rising main shall be connected to the public system through a manhole on the main line or into a private manhole or chamber with a gravity pipe connection to the main pipeline.

5.5.4 Design requirements

5.5.4.1 Pump

5.5.4.1.1

The make and model of the pump to be used shall be agreed with the Drainage Assets Engineer so as to fit in with the operation of other stations. In flows shall be based on a peak flow of 1000 l/d/person.

Two pumps shall be installed in the pump station (i.e. duty and standby) while a third identical pump shall be supplied to Council as a back up.

5.5.4.1.2

Minimum – 6 start/stops per day, 10 minute duration
 Maximum – 6 start/stops per hour, 40 minutes duration

5.5.4.1.3

Storage of 24 hour ADF shall be provided.

5.5.4.2

Rising mains

5.5.4.2.1

A friction coefficient of $K_s = 1.5\text{mm}$ shall be used for calculating the flows in rising mains.

5.5.4.2.2

The maximum velocity shall be 4.5m/s.

5.5.4.2.3

Generally the maximum rise shall be 20.0m.

5.5.4.2.4

The maximum working pressure shall be 200 kPa.

Note: A resource consent from Council will be required before installing a pumping station.

5.5.5

The developer shall supply all electrical equipment which will be installed by the Council's nominated contractor.

The electrical equipment together with the telemetry equipment shall be installed in a proprietary aluminium outdoor enclosure finished in a polyester paint of olive green. The cabinet shall be mounted on a concrete plinth adjacent to the wet well.

5.5.6

Pump stations shall be provided with:

- a) A standard 1.8 metre high wooden perimeter fence.
- b) A 2.5 wide concrete driveway, 200mm thick with 1 layer of 665 mesh.
- c) Its own water connection with a tap and back flow preventer in accordance with the SD 5.08.
- d) Its own power supply.
- e) On a separately titled lot.
- f) Where the length of the accessway exceeds fifty metres, the accessway shall be provided with a turning area by the wet well to allow use of a gully emptier.
- g) The wet well shall be provided with a suitable lifting arm for servicing the pumps.

5.6 TESTING AND INSPECTION**5.6.1**

All lines and manholes shall be cleaned out and flushed prior to testing and inspection. The final test will not be carried out until the Network Utility Operator has been provided with the 'As-built' plans and satisfactory results from the CCTV inspection. On receipt of these the operator will instruct its agent to undertake the necessary testing which will normally be undertaken within 10 working days.

5.6.2

Each section of line (including branch lines and connections) shall be tested with compressed air to a pressure head of 300mm of water. The test shall be observed for 5 minutes over which time the maximum allowable drop in head shall be 50mm. There shall be no observable gain in pressure (which may indicate infiltration is occurring).

5.6.3

All new systems shall be tested for infiltration. The lowest point in the new system shall be sealed for 5 minutes and the maximum rate of infiltration shall be 600 millilitres per 25mm of pipe diameter per 100m of pipe. There shall be no visible flow in any part of the system.

5.6.4

All manholes shall be inspected. There shall be no visible infiltration.

5.6.5

All pipelines shall be inspected, at the expense of the developer, on receipt of the "As Built" plans, using a closed circuit television process in accordance with the New Zealand pipeline inspection manual, carried out by an operator certificated in terms of the manual.

The results of the survey shall be submitted to the Drainage Assets Engineer in a format compatible with and for direct loading into EcoWater's MITS-Hansen Asset Management System.

5.7 MAINTENANCE AND REPAIRS

The maintenance of, and repairs to, the public wastewater network shall be carried out in accordance with the operational contractual agreements.