Chapter 5: *Wastewater*

5.1. Introduction

5.1.1. Wastewater System Description

Wastewater systems are required to collect and convey wastewater for subsequent treatment and disposal. This section covers the design and construction requirements for wastewater systems that are:

a. Gravity and/or pumped (including Pressure Sewer) reticulation networks to be vested to WDC.

b. Private reticulation systems that discharge into a WDC reticulation system.

c. Private wastewater networks and on-site treatment and disposal systems.

WDC require a proposed development to connect to a public wastewater system if:

a. There is a public wastewater system with sufficient spare capacity available for connection: and

b. WDC considers that it is reasonable or practicable to require connection: or

c. WDC considers that there is a benefit to the operation of the public wastewater system, or there is an environmental benefit to require connection.

Alternative reticulation systems such as solids free systems or vacuum systems shall be considered an Alternative Design (See Section 1.5.1.2 Alternative Designs). Approval of the applicable design and construction requirements shall be at the discretion of the Wastewater Manager.

Where a connection to the public system is not available, or where a public system does not exist, an alternative system shall be provided. This shall consist of wastewater on-site treatment and disposal, either individual or communal in nature. Such systems shall be subject to separate resource consent approvals and shall obtain any necessary NRC consents prior to lodging the consent application to the WDC.

5.1.2. Objectives

a. To provide each property or household unit, a connection to an environmentally sustainable public wastewater system, which produces no objectionable odours, does not overflow, adversely affect receiving environments, and is affordable.

b. To ensure for properties where a public reticulation system is not available, that wastewater is collected, treated and disposed of in a way which is consistent with relevant building and discharge consents.

c. To ensure where properties connect to a sewer network (public or private), that the network meets the WDC's performance standards.

d. The wastewater network shall be cost efficient over its design life while accounting for environmental and community impacts through integrated three waters management and water reuse.

5.1.3. Performance Standards

New wastewater systems shall achieve the following minimum standards:

a. Designed to meet the minimum design life requirement (Refer to Section 5.2.4 Design Life), taking into account internal and external pressure loadings, soil conditions and wastewater characteristics.

b. Minimise the potential for stormwater ingress and wastewater egress through the use of industry best practice for design and construction.

c. Ensure that the performance of the existing wastewater system is not adversely affected by connection of the proposed system.

d. Ensure that the proposed system does not surcharge at the peak design wet weather flow and is designed not to overflow.

e. Provide flow buffering storage only where specifically approved by WDC for the purpose of balancing flows in the existing network. Storage, if approved by WDC, shall clear within 24 hours, or such lesser time as required to prevent sewage turning septic.

f. Reticulation pipelines shall be designed to be self-cleaning.

g. Designed to service the entire catchment area and any future extension of the system.

h. SQEP shall adopt best practice to ensure a system with lowest whole of life cost.

5.1.4. Reference Documents

The following documents are referenced in this Chapter:

Note it is the responsibility of the Developer to ensure the most up to date referenced document is sourced.

5.1.4.1 Statutory

Building Act 2004

New Zealand Building Code

NRC Regional Plans

WDC Trade Waste Bylaw 2012

WDC Wastewater Bylaw 2014

5.1.4.2 New Zealand Standards

AS 1579:2001 - Arc-welded steel pipes and fittings for water and wastewater

AS 2129:2000 - Flanges for pipes, valves and fittings

AS 3996:2019 - Access covers and grates

AS/NZS 1260:2017 - PVC-U pipes and fittings for drain, waste and vent applications

AS/NZS 1547:2012 - On-site domestic wastewater management

AS/NZS 2280:2020 - Ductile iron pipes and fittings

AS/NZS 2566.2:2002 - Buried flexible pipelines - Installation

AS/NZS 2638.1:2011 – Gate valves for waterwork purposes – Part 1: Metal seated

AS/NZS 2638.2:2011 - Gate valves for waterworks purposes - Part 2: Resilient seated

AS/NZS 2980:2018 - Qualification of welders for fusion welding steels – Additional requirements for Australia and New Zealand

AS/NZS 3725:2007 - Design for installation of buried concrete pipes

AS/NZS 4058:2007 - Precast concrete pipes (pressure and non-pressure)

AS/NZS 4087:2011 - Metallic flanges for waterworks purposes

AS/NZS 4130:2018 - Polyethylene (PE) pipes for pressure applications

AS/NZS 4158:2003 - Thermal-bonded polymeric coatings on valves and fittings for water industry purposes

AS/NZS 4671:2019 - Steel for the reinforcement of concrete

AS/NZS 4998:2009 - Bolted unrestrained mechanical couplings for waterworks purposes

AS/NZS 5065:2005 - Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications

BS EN 1124 Series: Pipes and fittings of longitudinally welded stainless-steel pipes with spigot and socket for wastewater systems (BS EN 1124-1:1999 ; BS EN 1124-2:2014 ; BS EN 1124-3:2008 ; BS EN 1124-42013)

ISO 13953:2001 – Polyethylene (PE) pipes and fittings - Determination of the tensile strength and failure mode of test pieces from a butt-fused joint

NZS 3114:1987 - Specification for concrete surface finishes

NZS 4402:1988/1986 - Methods of testing soils for civil engineering purposes

NZS 4442:1988 - Welded steel pipes and fittings for water, sewage and medium pressure gas

5.1.4.3 WDC Documents

Approved Materials List - Wastewater and Stormwater *(To be provided by WDC on request)*

Briefing Document – EES 1: Wastewater Pump Stations Electrical Engineering Standards *(To be provided by WDC on request)*

Coastal Structure Plan - Slope Instability Hazard Potential and Effluent Disposal Potential: Oakura to Langs Beach 2005

WDC Policy #0022 - Building Over or Near Public Sewer and Stormwater Pipelines (2015)

Policy #0056 - Pressure Sewer Policy (2012)

Public Utility Connection/Disconnection application form

Quality Assurance / Quality Control Manual for Vested Assets - Inspection and Handover Procedures (2010)

WDC Urban Design Guidelines

5.1.4.4 Other Referenced Documents

Water New Zealand; New Zealand Gravity Pipe Inspection Manual Fourth Edition, 2019

Water Services Association of Australia, WSA 02-2014 - Gravity Sewerage Code of Australia Version 3.1

Water Services Association of Australia, WSA 04-2005 - Sewage Pumping Station Code of Australia Version 2.1

Water Services Association of Australia, WSA 07-2007 - Pressure Sewerage Code of Australia Version 1.1

5.1.5. Private Wastewater Provision

5.1.5.1 General

Properties not served by a WDC owned and operated, public wastewater system shall be provided with either:

a. Reticulation, and a communal treatment and disposal system: or

b. An individual on-site treatment and disposal system.

All private wastewater systems shall comply with the NRC Regional Plans (or any amendments as applicable) either as permitted activity or by resource consent.

A Site Specific Assessment (SSA) to determine the suitability of waste water disposal to land shall be carried out by a SQEP using Appendix B ES-SEW1 in accordance with the Site-and-Soil Evaluation Procedures of AS/NZS 1547:2012 (or any amendments as applicable). The assessment shall be submitted to WDC with the resource consent application.

In particular, the SSA shall demonstrate compliance with the permitted activity rules of the NRC Regional Plans (or any amendments as applicable) for each lot, and demonstrate for each lot that:

a. The site is suitable for the disposal system proposed.

b. Adequate disposal and reserve area is available.

If the outcome of the SSA is that the activity is not permitted under the regional rules, then consent from the NRC will be required to accompany the consent application to the WDC.

The SSA shall reference the following:

a. The WDC Hazard Plans, e.g. WDC Coastal Structure Plan - Slope Instability Hazard Potential and Effluent Disposal Potential and,

b. WDC's GIS system when submitting designs for on-site effluent systems. In particular, the following GIS layers shall be referenced in the investigation:

   i. Land Resources Aquifers at risk:

   ii. Land resources Streams:

   iii. Hazards Effluent on slope stability:

   iv. Hazards Effluent suitability:

   v. Pressure sewer Location of area of benefit.

5.1.5.2 Council taking over Private Systems

The WDC may agree to take over responsibility for the ownership, management and operation of a private wastewater system (in whole or in part) provided that:

a. The system serves a minimum of 16 lots,

b. The system meets the design and construction standards as described in this Chapter,

c. Adequate provision was made for ongoing maintenance and operation of the system during private ownership,

d. Certified as-built drawings, asset schedules and operation and maintenance manuals are provided (in accordance with the requirements of the ES), and

e. All necessary NRC consents have been obtained and shall be transferred to the WDC.

Existing private systems will not be accepted to vest in WDC unless it is proven that all parts of the system have been designed and constructed in accordance with the ES and referenced Bylaws and policies.

5.1.5.3 Individual On-Site Treatment and Disposal

On-site wastewater treatment and disposal systems require:

a. Net lot size in excess of 2,000 m²,

b. A SSA that determines that effluent can be disposed of to the site, in compliance with the NRC Regional Plans (or any amendments as applicable) permitted activity rules, and

c. Adequate provision for ongoing maintenance and operation of the proposed system.

Note: Approval of an on-site wastewater treatment and disposal systems will be determined by WDC during the consenting phase of a development application.

5.1.5.4 Private Treatment and Disposal

Where site size, ground conditions, topography, etc. limit the ability for individual on-site effluent treatment and disposal, communal systems shall be considered.

These systems may be solids free sewer systems such as septic tank effluent drainage (either septic tank effluent gravity or pump systems, or combination), which discharge to a central treatment area.

The following shall be considered when a private system is proposed:

a. A resource consent from NRC may be required.

b. Whether to have the system made public.

If the system is kept private, the requirements include:

a. A formal legal agreement between all land owners in which each is individually and severally responsible for the maintenance and performance of the system and ongoing ownership of the disposal area. This agreement shall:

   i. Require each landowner to be a member,

   ii. Ensure that obligation under the agreement is transferred to a new owner(s) if the property is on-sold and,

   iii. Identify the share of the land disposal area that is allocated to each owner and restrict owners from exceeding this share.

b. A contract with an approved company is entered into on an ongoing basis to attend to the specified maintenance and any equipment failure,

c. A comprehensive management plan is supplied and approved by the WDC.

If it is proposed to have the system become a public asset, the Developer shall engage with WDC at an early stage in order for WDC to consider the proposal. WDC's specific approval of the design and construction requirements is required to be included in the resource consent conditions.

5.1.6. Upgrading of Existing Wastewater Systems

Connection of a proposed development to an existing wastewater system (public or private) shall not compromise the performance standards of the existing system.

Alteration of the existing wastewater network to achieve the required performance standards shall be at no cost to WDC.

Should the relocation of a WDC main be approved as part of Resource Consent or Building Consent application, a management plan shall be submitted to WDC for approval **before** any works commence. This management plan is to include the construction methodology, assessment of risks and contingency plans for the proposed works.

5.1.7. Connection to Existing Wastewater Scheme

All lots within the 'Area of Benefit' of a sewerage scheme shall be provided with a connection to the WDC system unless WDC confirms in writing that a connection is unwarranted, unavailable or unsuitable.

Where properties are adjacent to an area of benefit, WDC may approve a connection or require that a connection to the system be provided. Refer to Section 5.2.8 Connections for connection details.

5.1.8. Recycled Water

The provision of any recycled water (treated wastewater) system whether public or private shall be subject to specific WDC approval.

Early consultation with WDC will be required to determine the acceptability of a proposed recycled water system, and to assess appropriate consent conditions.

Reticulation of recycled water will require careful consideration of backflow prevention issues, metering, pipe materials and colours.

5.2. Design

5.2.1. Engineering Design approval

5.2.1.1 Content of Design Submission

In addition to the general requirements of Section 1.5.3 Engineering Design Approval, the information submitted for EDA of wastewater designs shall provide (as applicable) the following:

a. That the existing wastewater system that the development proposes to connect to has adequate capacity to serve the proposed development, including treatment capacity and consent to discharge.

b. That the minimum performance standards of the existing wastewater system will not be compromised by the proposed connection.

And EDA application shall also include details of:

a. Pipe sizes, materials, and layout of the reticulation, (including the existing reticulation).

b. Hydraulic design, including providing adequate capacity and self-cleaning velocity.

c. Service connection locations to serve the buildable area where a gravity reticulation system is proposed.

d. Engineering design of pump stations, rising mains and pressure sewer systems (including all calculations).

e. The replacement requirements of system components that have asset lives shorter than the required design life of the system (e.g. pumps, valves, etc.).

Any departures from the ES shall be noted and fully justified. Such assessment shall be carried out by a SQEP who is working within their competencies in accordance with the requirements of Section 1.5.1.3 Risk Based Assessment Framework. The SQEP shall identify the design standards used and certify that the design complies with the referenced standards.

The SQEP shall certify that the works through all stages until completion are in accordance with the requirements of Section 1.5.1.3 Risk Based Assessment Framework.

5.2.1.2 Design Drawings and Specifications

Design drawings complying with the requirements of Section 1.5.3.3.5 Design Statements and Engineering Drawings and Appendix F Drawing Standards shall be provided for approval.

5.2.2. Design Criteria

5.2.2.1 General Requirements

The WDC may specify the diameters and classes of pipes to be used for all reticulation within the development and specify connection points and reticulation alignment.

The WDC will provide (on request) for design purposes, details held by WDC of the existing wastewater reticulation. Where necessary, and at the Developer's expense, WDC may investigate the capacity of the downstream wastewater reticulation and treatment facilities to determine their adequacy.

Design shall consider domestic wastewater, industrial wastewater, and for gravity reticulation, wet weather peaking factors.

Design shall consider the hydraulic adequacy of the network including the specified levels of service, the ultimate service area of the system and impact on the existing network.

All reticulated systems shall have adequate capacity to convey the design flow without surcharging.

Reticulation shall be designed, detailed, constructed and tested to ensure that there is no infiltration at commissioning, and to minimise infiltration/ex-filtration over the life of the system.

The use of sealed maintenance and inspection structures as an alternative to the conventional maintenance structures described in the ES, will require specific approval by the WDC.

Note: Design flow requirements in this section are for reticulated sewers – for onsite systems, design flows are based on AS/NZS 1547.

5.2.2.2 Residential Flows

Table 5-1 shows the minimum inflows to be provided for (depending on the source of the water supply) for various uses related to people-based activities. The flows are average daily dry weather flows (ADWF).

Table 5-1: Design Inflows for Residential Type Activities (Reticulated Sewers only)

Source		Wastewater Flow Allowances (litres / person / day)	
		Tank Supply	Reticulated / Bore Supply
Household		140	200
Hotels / Motels	Guests and resident staff	140	200
	Other Non-resident	30	40
Community Halls	Banqueting	20	30
	Meetings	10	15
Marae	Day only	40	40
	Day / Sleep over	140	140
Restaurant / Bar / Café	Dinner	30	30
	Lunch	25	25
	Bar patron	20	20
Schools	Pupils plus staff	30	40
Camping Grounds	Fully serviced	100	130
	Recreation areas	50	65
Retirement Home	Residents	200	220
	Day staff	40	50

Source	Wastewater Flow Allowances (litres / person / day)	
	Tank Supply	Reticulated / Bore Supply
Hospital / Rest Home	220	250

Where a particular activity is known (such as development in a holiday area), figures specific to the activity shall be used.

Where particular activities are not known or are not being specifically designed for in accordance with Table 5-1, then a default flow of 200 litres/person/day shall be used.

Table 5-2: Peaking Factors to be applied to ADWF Flows

Factor	Gravity Sewer Reticulation
Dry weather peak daily flow	2.5 x ADWF
Peak wet weather flow (PWWF)	5 x ADWF

Additionally:

a. Number of people per Household Unit = 4.0

b. Number of Household Units per gross hectare = 15

These factors are the default figures where there is no additional information available, and shall be applied to the default flow figure. The WDC may consider alternative parameters where these are supported by existing data.

5.2.2.3 Industrial / Commercial Flows

Wastewater system design for any commercial or industrial development, or development that includes future commercial or industrial lots, shall be undertaken by a SQEP.

The SQEP's proposed design assumptions, and parameters for the estimation of design wastewater flows, require specific approval from the WDC Wastewater Manager prior to consent so that these can be included in appropriate conditions of Consent.

For commercial/industrial development of individual lots, specific assessment shall be carried out by a SQEP for the wastewater flows generated by the proposed industry. Where these flows are exceeded or differ from any parameters referenced in the development consent, specific approval to connect is required from the WDC Wastewater Manager.

Provision for liquid trade waste and 'wet' industries shall be considered and provided for by the design.

Provision for trade waste shall be made by arrangement with WDC and shall be subject to the provisions of the WDC Trade Waste Bylaw 2012.

When assessing the ultimate development flows from a wider area, the flow rates in Table 5-3 (Business Dry Weather Flows) may be used as a design basis. The sensitivity of the

pipe sizes and capacity of reticulation components shall be determined to ensure sufficient capacity is available in the event of heavier than-expected flows.

Table 5-3: Design Dry Weather Flow Rates (Business)

Minimum Design Flows	Flow Rates (litres/sec/ha)
Light water usage	0.4
Medium water usage	0.7
Heavy water usage	1.3

Note: These flows include both sanitary wastewater and trade wastes, and include peaking factors, and includes Business 1-4, Marsden Point Port and Airport Environments. Allowance shall be made for inflow/infiltration in wet weather.

5.2.2.4 Hydraulic Design

Unless the catchment is likely to exceed 250 Household Units, and where no industrial or commercial flow, or flow from a pumping station is involved, 150 mm diameter gravity pipes laid within the limits of Table 5-5 (Minimum Grades for Wastewater Pipes) will be adequate without specific hydraulic design.

Where a catchment does not comply with the above criteria, a specific hydraulic design shall be carried out.

Hydraulic design shall be based on either the Colebrook-White formula or the Manning formula. Material coefficients for pipes up to DN 300 are given in Table 5-4. These values take into account joints, slime, debris etc. and apply for pipes up to DN 300.

Pipes exceeding DN 300 require Specific Design by a SQEP.

Table 5-4: Coefficients for Gravity Lines

Material	Colebrook-White K *(mm)*	Manning
PVC	0.6	0.011
PE	0.6	0.011
Cement lining (DI & steel, concrete)	1.5	0.012
PP	0.6	0.011

5.2.2.5 Minimum Grades for Self-cleaning

The minimum allowable self-cleansing velocity in pipelines is 0.6 m/s and shall be calculated using peak dry weather flow.

Minimum pipeline gradients are specified in Table 5-5 below. The Developer shall demonstrate that the design can achieve self-cleansing velocities regardless of the selected pipeline gradient.

Table 5-5: Minimum Grades for Gravity Wastewater Pipes

Pipe Size	Location	Minimum Grade	
		(%)	(Ratio)
Connections and Permanent Ends of Reticulation			
DN 100	Property connection	1.65	1:60
DN 150	Property connection	1.20	1:83
DN 150, 225 & 300	Permanent upstream ends of reticulation with 10 or less residential lots connected	1.00	1:100
Wastewater Pipes – Reticulation with more than 10 Residential Lots (except PE pipelines and pipes installed by trenchless methods)			
DN 150	Recommended minimum grade	0.67	1:150
	Absolute minimum grade	0.55	1:180
DN 225		0.33	1:300
DN 300		0.25	1:400
PE Pipes and Pipes Installed by Trenchless Methods			
All sizes	To suit installation method, but not less than	1.65	1:60

5.2.2.6 Steep Pipeline Grades

Where the pipeline grades are greater than 1:3, and pipes do not exceed 450 mm diameter, anchor and/or anti-scour blocks shall be constructed in accordance with **Sheet 32**. Specific Design by a SQEP is required where pipe diameters exceed 450 mm.

On gradients flatter than above where scour is a problem, stabilisation of the trench backfill is required.

5.2.2.7 Maximum Velocity for Gravity Lines

The maximum design velocity for peak wet weather flow is 2.5 m/s. Where a steep grade that will cause a velocity greater than the maximum allowed is unavoidable refer to guidance in the WSA 02-2014 (or any amendments as applicable) for precautions and design procedures. The WDC's specific approval will be required where this velocity limit cannot be met.

5.2.2.8 Structural Design for Installation of buried Pipes

5.2.2.8.1. Design Guidance

AS/NZS Standards provide methods and data for calculating the working loads on buried pipes due to:

a. The materials covering the pipes:

b. Superimposed loads.

Pipelines shall be designed in accordance with guidance in the applicable AS/NZS standards and as outlined in the following sections.

5.2.2.8.2. PE And PVC Pipes

AS/NZS 2566.2:2002, including the commentary provides the method to assess the pipe selection and embedment method for buried flexible pipelines.

5.2.2.8.3. Concrete Pipes

AS/NZS 3725:2007 provides the basis for determining the vertical working load on concrete pipes under a range of installation conditions. The standard relates these loads to the loads applied to pipes so that the appropriate 'strength class' of pipe can be selected to suit the 'pipe support' method chosen for the particular field application.

The minimum pipe support design shall be 'H' (H1 and H2).

For definitions refer to AS/NZS 3725:2007.

5.2.3. Piped System Layout

5.2.3.1 General Requirements

In general pipes shall be located in road berms, but they may be located in public reserves or on private property (see Section 5.2.3.2 Reticulation on Private Property).

Easements in favour of WDC are required for all public wastewater systems and/or components that are located in private property. This includes easements over proposed systems and components located in property owned by third parties.

The order and layout of pipes and other underground services shall be in accordance with **Sheet 29.** The minimum clearance between wastewater pipes and other services shall be in accordance with **Sheet 30**.

In addition, pipelines and pipe system layouts shall meet the following requirements:

a. Pipelines should have a straight horizontal and vertical alignment between maintenance structures. The WDC's specific approval is required for curved pipeline alignments, and for changes in pipeline gradient that do not occur at a maintenance structure.

b. Where a wastewater pipeline changes location within a street, crossings of roads, railway lines, and underground services shall, as far as practicable, be at an angle of 45 degrees or greater. Pipes shall be located and designed to minimise maintenance and crossing restoration.

c. Valves and fittings on pressure pipelines shall not be located under the formation of a (public or private) road or vehicle access, and the WDC's specific approval is required to locate pipelines under the formation.

d. In steep terrain, the location of pipes shall be governed by topography. The pipe layout shall conform to the existing surface gradients as far as

practicable to remove the need for deep installation due to gravity pipelines operating against the fall of the ground.

5.2.3.2 Reticulation on Private Property

Location of WDC owned reticulation within private property, or down right of ways or private roads, requires specific approval from the Wastewater Manager.

Approval of public reticulation located in private property or right of ways will depend upon:

a. The number and length of connections required: and/or

b. The requirement to provide a service connection to the lots.

If approved:

a. The pipeline shall be parallel to the boundary and no more than 1.5 m from the boundary,

b. An easement in favour of WDC over the private property, right of way or private access is required,

c. Pressure sewer mains shall be laid in a duct, and

d. The required minimum clearances from other services (refer **Sheet 30**) and future buildings shall apply.

The WDC may require the legal width of an access to be greater than the minimum specified in Section 3.2.27 Private Accessways in order to ensure minimum clearances from other services are provided.

5.2.3.3 Minimum Cover

All pipelines, other than those in private property, shall be specifically designed to support the likely loading in relation to the minimum cover to be provided in accordance with the terms of AS/NZS 3725:2007.

The minimum cover over pipes shall be:

a. 600 mm in berms and areas not subjected to traffic loading, or

b. 900 mm under carriageways and trafficked areas.

Any pipelines that cannot achieve the minimum pipe cover requirements shall:

a. Be specifically designed by a SQEP to support the likely loading in relation to the actual cover to be provided, or,

b. Be provided with pipe protection in accordance with the reinforced concrete slab protection shown on **Sheet 32**.

Note: For pipelines in private property the depth of cover is dealt with under the Building Act 2004.

5.2.3.4 Clearance from Structures

Pipes adjacent to existing buildings and structures shall be located clear of the 'zone of influence' of the building foundations. If this is cannot be avoided, a Specific Design shall be undertaken to address the following:

a. Protection of the pipeline through both construction and a lifetime period,

b. Long term maintenance access for the pipeline, and

c. Protection of the existing structure or building.

Any such proposals shall be considered an Alternative Design (Section 1.5.1.2 Alternative Designs). Approval shall be at the discretion of the Wastewater Manager.

Sufficient clearance (a minimum offset of 2 m from any building or structure) for laying and access for maintenance is also required.

5.2.3.5 Aerial Pipes and Pipe Bridges

Any such proposals shall be designed by a SQEP and considered an Alternative Design (See Section 1.5.1.2 Alternative Designs) and approval shall be at the discretion of the Wastewater Manager.

If approved by WDC, the following Specific Design requirements shall be satisfied:

a. Pipe bridges shall be specifically designed for the particular environment.

b. The underside of the pipe bridge structure shall be a minimum of 300 mm above the 1% AEP (+ CC 20%) flood levels.

c. Where existing bridges are not above the 1% AEP flood levels, the pipe shall be located on the downstream side of the bridge.

d. Piles shall be concrete unless specifically approved by the WDC.

e. Pipelines across existing bridges shall be Grade 304 Stainless Steel with an approved corrosion protection coating, if required.

5.2.3.6 Inverted Siphons

Inverted siphon systems shall only be proposed when other alternatives have been exhausted. Any such proposals shall be considered an Alternative Design (See Section 1.5.1.2 Alternative Designs) and approval shall be at the discretion of the Wastewater Manager.

Approval shall be subject to the following design criteria being met:

a. Size the pipes to ensure peak daily velocities of at least 0.6 m/s:

b. The maximum pipeline slopes shall be 45° and 22.5° on the downward and upward legs respectively, with manholes placed to make cleaning easier:

c. Provide isolation valves to help with maintenance flushing unless these are demonstrated as not necessary:

d. Design for potential differential settlement between the manhole and the siphon piping when in difficult bedding conditions:

e. Surround piping with concrete when crossing watercourses that are periodically dredged or are prone to scour:

f. Siphons are not installed on any lateral.

5.2.4. Design Life

All elements of wastewater systems to be vested to WDC shall have a design life expectancy of at least 100 years.

Where components of the wastewater system, such as pumps, valves, and control equipment, require earlier renovation or replacement, it shall be considered an Alternative Design (see Section 1.5.1.2 Alternative Designs) and assessed as a departure from the ES, requiring specific approval by the Wastewater Manager. The proposed wastewater works shall document the asset renewal requirements for each component in the Operations and Maintenance Requirements, which shall be provided with EDA.

5.2.5. Approved Materials

Materials and products used on wastewater networks shall comply with the relevant NZ standards and be from the WDC Approved Materials List – Wastewater and Stormwater.

The use of material not described in the WDC Approved Materials List – Wastewater and Stormwater shall be considered Alternative Designs, refer to Section 1.5.1.2 Alternative Designs

The WDC Approved Materials List – Wastewater and Stormwater will be updated from time to time at the discretion of WDC.

5.2.6. Ventilation and Odour Control

In urban developments, pipes shall be adequately ventilated within private property. However, there are some situations where vent shafts may be required such as:

a. At pumping stations:

b. At manholes where pumping stations discharge to a gravity pipe: and

c. At entrances and exits to inverted siphons.

In such situations vent shafts shall be installed as per the requirements of WSA 02-2014, and WSA 04-2005 (or any amendments as applicable).

Where a vent shaft is required, the Developer shall assess the potential for odours, and the effects of odours on adjacent dwellings. All ventilation and odour control assessment and design shall be undertaken by a SQEP. The assessment shall include calculations to quantify odour generating potential and demonstrate how odour generation will be mitigated. The SQEP shall liaise closely with WDC on proposed ventilation and odour control measures.

Either forced ventilation or passive odour control is acceptable provided it is demonstrated that the proposed odour mitigation system will prevent offensive or objectionable odours from causing an adverse effect to adjacent property.

Where fan forced ventilation is proposed for pump station wet wells, it shall provide a minimum of four air changes per hour, and the vent discharge shall be a minimum of 3.6 m high.

5.2.7. Manholes and Inspection Chambers

5.2.7.1 General Requirements

Maintenance structures shall be provided for access and maintenance of the network, including water jetting and CTTV inspections. Preference will be given to structures that will minimise the potential for infiltration. Types of maintenance structures considered are:

a. Manhole,

b. Inspection chamber / mini-manhole (minimum diameter 600 mm), and

c. Rodding eye.

Maintenance structures shall be located:

a. On WDC property or Transport Corridors whenever practicable. If located within the carriage way, manholes shall be located 2 m out from the kerb.

b. Out of hollows, dips or any area that may be subjected to inundation or identified as a secondary flow path.

c. Clear of all boundary lines by at least 2 m from the outer edge of the manhole chamber plus the height of any nearby retaining walls if they exist.

d. 2 m clear of new structures in private property as per WDC Policy #0022 - Building Over or Near Public Sewer and Stormwater Pipelines.

e. In areas that are foreseeably safe to access for the long term.

f. Flush with the adjacent ground level, subject to specific requirements (below) in flood areas.

If maintenance structures shall be located in areas subject to flooding, all components shall be watertight, tied or fixed together, and covers shall be set 300 mm above the 1% AEP flood level.

Maintenance structures are required at locations in accordance with Table 5-6 below:

Table 5-6: Maintenance Structure Requirements

Maintenance Structure Locations	Acceptable Option		
	Manhole	Inspection Chamber (IC)	Rodding Eye (RE)
Intersection of pipes except for junctions between mains and lateral connections	Yes	No	No
Changes of pipe grade, except where vertical curves are permitted	Yes	For DN150 pipe only using pre-fabricated vertical bend	No
Change of pipe grade at different invert level Changes of pipe invert level	Yes	No	No
Changes of pipe size	Yes	No	No
Changes in horizontal direction Combined changes of pipe direction and grade, except where compound curves are permitted	Yes	Use prefabricated units or bends, max 33° deflection	No
Changes of pipe material, except for repair/maintenance locations	Yes	No	No
Upstream permanent ends of reticulation	Yes	Yes	Yes
Discharge of a pressure main into a gravity pipe	Yes	No	No

5.2.7.1.2. Additional Requirements for Manholes and Inspection Chambers

For infill developments (subject to the restrictions in Section 5.2.8.3 Connection to Trunk and Interceptor Pipelines), manholes are not required at 150 mm branch connections onto 150 mm mains provided that:

a. a manhole exists on the main within 100 m of the connection point: and,

b. an ‘off-line’ manhole is provided on the branch upstream of the connection point: and,

c. the ‘off-line’ manhole is immediately within the boundary of the property being served or within 20 m of the connection point, whichever is the lesser.

Where public manholes are located on private property, the provisions of Section 5.2.3.2 Reticulation on Private Property shall apply.

Manholes are the only option where personnel entry is required.

Inspection chambers 600mm diameter are only permitted for depths not exceeding 1.2 m to invert.

5.2.7.1.3. Additional Requirements for Rodding Eyes

Rodding eyes shall be provided at the end of 100 mm diameter laterals of lengths up to 25 m. For lateral lengths exceeding 25 m, normal requirements apply (i.e. terminating manhole or inspection chamber).

A single lot connection may be made to a rodding eye if required at the terminal end of a lateral.

5.2.7.2 Spacing

Maximum spacing shall be as follows:

a. The maximum distance between any two consecutive maintenance structures shall be 120 m.

b. Where a combination of manholes and inspection chambers are used on the same pipeline, the maximum spacing between consecutive manholes shall not exceed 400 m irrespective of the number of maintenance shafts between the manholes.

5.2.7.3 Allowable Deflection through Manholes

A maximum allowable deflection through a manhole for pipe sizes DN 150 to DN 225 is 90 degrees. The maximum allowable deflection for pipe sizes greater than DN 225 is 110 degrees.

5.2.7.4 Internal Fall through Manholes

The minimum internal fall through a manhole joining main inlet and outlet pipes with the same diameter shall comply with Table 5-7 :

Table 5-7: Fall Through Manholes

Deflection Angle at Manhole	Minimum Internal Fall (mm)
0 - 45	50
>45 - 90	80

Where pipe sizes change at the manhole, the soffit of the inlet pipe should be at least as high as the soffit of the outlet pipe.

Where the minimum internal fall specified above cannot be achieved, e.g. on gradient constrained pipelines, then Specific Design is required.

To avoid excessively deep channels within manholes, steep grades (> 7%) shall be 'graded-out' at the design phase.

Where this is not practicable the following precautions shall be taken:

a. The steep grade of an inlet pipe shall be continuous through the manhole,

b. The minimum depth to invert of the manhole shall be 1.5 m for DN 150 and DN 225 pipes,

c. The minimum depth to invert of the manhole shall be 2.0 m for DN 300 pipes,

d. Change of direction at the manhole is not to exceed 45°,

e. No drop junctions or verticals shall be incorporated in the manhole,

f. Inside radius of channel in the manhole shall be greater than 6 times the pipe diameter, and

g. Benching shall be taken to 150 mm above the top of the inlet pipe.

Note: For further guidance on handling steep grades, see WSA 02-2014.

Grading the channel shall be limited to a maximum fall through the manhole of 150 mm.

Where grading the channel cannot be achieved, then a drop connection shall be provided in accordance with section 5.2.7.8 Connections to Manholes.

5.2.7.5 Size of Manholes

Manholes shall be a minimum of 1050 mm diameter for depths of 1.2 m or more.

5.2.7.6 Materials and Parameters

Pre-cast concrete manholes with external flanged base are acceptable provided that:

a. They shall be installed in accordance with **Sheet 39**,

b. Manholes up to 2.4 m deep shall be constructed using a single riser with a pre-cast external flange base.

c. Manholes in excess of 2.4 m deep shall be constructed using a 2.4 m deep pre-cast riser with external flange base, and then completed to final ground level using no more than a single riser for manholes up to 4.0 m deep.

d. In no case shall a series of short risers be used.

e. The joints of all abutting units shall be sealed against ingress of water:

f. The cover frame shall be set over the opening and adjusted to the correct height and slope using adjustment rings and mortar so as to conform to the surrounding surface.

g. The cover frame shall be held in place with concrete haunching in accordance with **Sheet 39**.

Manholes constructed and installed using alternative materials and methodologies shall be in accordance with WDC Approved Materials List - Wastewater and Stormwater and installation details.

The receiving manhole for discharge from a pressure main into a gravity pipe shall be corrosion resistant and be assessed for ventilation/odour requirements (refer to Section 5.2.6 Ventilation and Odour Control).

5.2.7.7 Manholes Requiring Specific Design

Any manhole with the following parameters shall be subject to Specific Design:

a. Depth greater than 4.0 m, or

b. If affected by the high-water table, or

c. Is bedded in suspected or proven aggressive grounds.

If the manhole is affected by the high-water table, the manhole shall include a factor of safety against flotation of 1.25.

5.2.7.8 Connections to Manholes

The invert of a lateral property connection shall connect to the manhole at a level no lower than the average of the soffit levels of the main inlet and outlet pipes.

The invert of other lateral (pipeline) connections shall achieve the internal fall requirements of Section 5.2.7.4 Internal Fall through Manholes. Maximum angle of deflection of lateral connection into the manhole main channel shall be 90 degrees.

Drop connections at manholes shall be designed as follows:

a. The drop connection shall be constructed as detailed in **Sheet 39**,

b. Internal drop connections shall only be constructed in a 1200 mm or greater diameter manhole,

c. External drops will not be approved,

d. The minimum height for drop connections shall be 600 mm, and

e. Only one drop connection per manhole is permitted.

5.2.7.9 Covers

Watertight manhole covers with a minimum clear opening of 600 mm in diameter, complying with AS 3996:2019, and included on the WDC Approved Materials List - Wastewater and Stormwater shall be used.

'Non-rock' covers shall be used on all State Highway and Level 2 roads (roads with greater than 10,000 vehicles per day).

Hinged covers shall be used in all other areas and shall be oriented with the lid folding flat in the direction of traffic flow.

Class D covers to AS 3996:2019 shall be used in the Transport Corridor, carriageway, commercial and industrial properties and all public areas.

Class B and **Class C** covers to AS 3996:2019 shall only be used on residential properties.

Note: bolted down covers shall not be used.

5.2.7.10 Manhole Steps

All manholes deeper than 1.2 m shall be provided with manhole step rungs that are in accordance with **Sheet 40**. Encapsulated rungs with galvanized steel or stainless-steel core shall be fully coated with industrial grade PE or an approved alternative may be used. Approved products are as per the WDC Approved Materials List- Waste Water and Stormwater.

Manhole steps shall be provided in accordance with **Sheet 39** and **Sheet 40**.

Manhole steps shall be provided at 300 mm centres vertically. The top step shall not be more than 450 mm below the top of the top slab, and the lowest step shall be not more than 375 mm above the bench, or such lower level if specified by manufacturers of proprietary manholes.

The manhole steps shall be located over the downstream pipe.

5.2.8. Connections

5.2.8.1 General Requirements

Before connecting to the public wastewater system, the WDC's Public Utility connection process as per Public Utility Connection/Disconnection application form shall be completed by the Developer and the WDC's approval obtained. This applies to all:

a. New service connections and disconnections from private property:

b. Connections of new wastewater reticulation to the existing public wastewater system:

c. Connections where trade waste will be discharged, and compliance with the WDC Trade Waste Bylaw 2012. is required.

The lateral connection shall be designed to suit the existing situation and any future development.

The lateral shall be positioned so that the private section of the connection with each lot can be constructed in accordance with the Building Act 2004. This should be at the lowest location in the lot.

Lateral connections may be made to any maintenance structure, or at any point along a main using a proprietary junction, subject to the requirements of Section 5.2.7.8 Connections to Manholes.

Lot connections shall be made directly to the maintenance structure where practicable.

5.2.8.2 Design Criteria

The following design requirements shall be met:

a. The minimum sizes of lateral connections shall be in accordance with Table 5-8.

b. Each connection shall be capable of serving the whole of the lot by gravity, allowing for minimum pipe gradients within the lot (see Table 5-5), and allowing for depth required for gully traps.

c. The standard depth of a new connection at the boundary is 1.2 m (range 0.9 - 1.5 m).

d. Where the depth of a connection at the boundary is deeper than 1.2 m, the service pipe shall be extended into the property on grade, or by use of a ramped riser, to the extent that its terminal end is no deeper than 1.2 m.

e. Where practicable, connections should be made directly to manholes.

f. Connections which shall be made directly to the line shall be designed using a prefabricated ‘wye’ or ‘lunden-junction’ and shall be watertight.

g. Connections should enter each lot from the road frontage. Where a property has no road frontage, pipes shall be located within that property's legal access (right of way).

h. Where practicable:

   i. Private pipes shall not cross property boundaries

   ii. Existing private connections crossing boundaries shall be replaced by a public connection.

Table 5-8: Minimum Pipe Sizes for Property Connections

Pipe	Minimum Size ID *(mm)*
Connection serving 1 household unit, UNLESS WDC requires a larger size connection to be provided. Connection to in-fill development, serving up to 3 household units, via an inspection chamber (subject to WDC specific approval).	DN 100
Connection serving more than 1 household unit Connection serving commercial and industrial lots	DN 150

Pipe size shall not be reduced on any downstream section.

Note: See WDC Wastewater Bylaw 2012 for details of points of discharge with a range of property ownerships and public and private sewer locations.

5.2.8.3 Connection to Trunk and Interceptor Pipelines

Connections to wastewater trunk pipelines shall be at manholes.

A reticulated pipe connection to a wastewater interceptor shall only be designed in conjunction with WDC. No individual lot connections are permitted into an interceptor.

5.2.8.4 Connections to Deep Lines

Where an existing or proposed wastewater pipe is more than 5.0 m deep to the top of the pipe, or where required by the ground conditions, a manhole shall be constructed on the shallower line. This should be 5 m from the deep line and ramped down to it.

5.2.9. Building Over or Adjacent to Pipelines

The following is not permitted without the WDC's specific approval (refer to WDC Policy #0022 - Building Over or Near Public Sewer and Stormwater Pipelines):

a. Building over or within a horizontal distance of 2 m outside of the pipe:

b. Building within the zone of influence of the pipe:

c. Building within 2 m horizontally of the outside of any maintenance structure (manholes, lampholes, maintenance shafts and sewer dead ends):

d. Driven piles shall not be installed closer than 5 m from any pipe unless documentation is provided to the WDC's satisfaction showing that the proposed works will not damage the asset.

5.2.10. Pump Stations

5.2.10.1 General Requirements

The design of public pump stations and components require Specific Design and WDC's specific approval. Pump stations in a gravity reticulation system, shall only be approved if it is demonstrated that a gravity connection is not practicable, and that the pump station is the most practicable option.

The following requirements shall apply for public pump stations:

a. Pump stations shall be provided with all-weather vehicle access and provision for parking and manoeuvring of maintenance vehicles:

b. Public pump stations and associated vehicular access shall be located within a separate lot vested in WDC and shall not be located where they may adversely affect pedestrian or vehicular traffic.

c. Temporary pump stations may be located within an easement registered in favour of WDC, rather than a separate lot.

d. Valve and pump station lids shall be kept clear of carriageways, footpaths and driveway locations.

e. Modular/Package pump stations shall be constructed of GRP or PE that comply with the ES, unless site conditions or Specific Design requirements preclude their use.

f. Pump station bases shall be used in accordance with WDC Approved Materials List - Wastewater and Stormwater.

g. Electrical and control systems shall comply with the WDC Briefing Document – EES 1.

h. Fencing around the pump station may be required.

Note: Pump stations serving less than six household equivalents shall not be taken over by the WDC.

5.2.10.2 Design Criteria

Pump stations shall meet the following criteria (refer to **Sheet 42** and **Sheet 43**):

a. Consist of an underground pump well, a separate valve chamber that can drain into the pump chamber, emergency storage, a water supply and electrical control cabinet.

b. Designed for all imposed loads, including floatation.

c. Designed to ensure that no stormwater enters either through the wall or the roof and lid.

d. Lids and the electrical control cabinet shall be a minimum of 150 mm above the adjacent ground level, with the surrounding ground graded away from the station.

e. Located free of secondary flow paths for 1% AEP flood level, and the pump station lid levels shall be provided with a minimum freeboard of 300 mm above the estimated 1% AEP flood level.

f. The bottom of the control cabinet shall be provided with a minimum freeboard of 450 mm above the estimated 1% AEP flood level.

g. Pump wet well, valve chambers and storage chambers shall have sealed, lockable lids and safety grills that are in accordance with WDC Approved Materials List - Wastewater and Stormwater, and can be readily opened by one person. Openings shall be a minimum of 900 x 900 mm.

h. All lifting chains, guide rails, fittings, connections, nuts, bolts etc. in the pump station shall be 304 stainless steel.

i. Pump chamber pipe work shall be stainless steel (316) or fiberglass.

j. Concrete in pump stations shall be suitable for sewer pump stations, and shall be lined with an epoxy or similar lining. The concrete strength, admixtures and lining specification shall be supplied in the design submission.

k. Pump impellors shall be hard iron. Impellor types shall be;

i. For rising main diameters of 90 mm or greater - an Open Self Cleansing channel impeller. Shredded single or multichannel impellers shall be capable of passing a 75 mm diameter solid.

ii. For rising main diameters of less than 90 mm - grinder cutter pumps shall be used.

l. The pumping system shall:

i. Have a minimum of two pumps (duty and standby) in all pump stations, with automatic changeover of the pumps if the duty pump blocks or breaks down,

ii. Each pump shall be capable of discharging the design peak wet weather flow rate from the catchment

iii. Include sufficient well volume to operate under normal conditions without surcharge to the incoming wastewater network

m. Access to pump stations shall be suitable for vehicles with a lifting gantry to install or remove pumps and equipment.

n. Float cables and lifting chains shall have hook plates.

o. Non-return and isolating valves for each pump shall be located in the valve chamber. The isolating valve shall be a resilient seated gate valve complying with AS/NZS 2638.2:2011 (anticlockwise closing) installed downstream of the non-return valve. Non-return valves shall be ball-valves with full-bore opening or swing check valves with external handles.

p. The capacity of the wet-well between start and stop levels shall be such as to limit pump starts to no more than fifteen per hour.

q. Pump Stations shall have emergency storage in case of mechanical or electrical failure or blockage of the pumps or rising main. The storage shall be located at such a level as to prevent overflow from any manholes, gully traps, pump station lids or any other outlet from the system. Storage tanks shall be provided with a lockable, hinged, watertight lid with a minimum opening of 900 x 900 mm, and able to be opened by one person by hand.

r. Pump stations and rising mains shall be designed to provide for the peak wet weather flow from the ultimate catchment development, without utilising the required emergency storage capacity.

s. Variable speed drive is required for pumps over 5kW.

t. Shielded power supply cables are required on all pumps exceeding 5 kW.

u. All pump stations shall be reviewed for the potential for odours in accordance with Section 5.2.6 Ventilation and Odour Control.

v. The electrical supply shall be underground.

w. Lighting shall be provided to illuminate the control cabinet. A 10A single phase power socket shall be provided in the cabinet with RCD protection.

x. Suitable low maintenance landscaping may be required on the pump station site around the wet well area.

y. Fencing may be required where the pump station is exposed to traffic etc.

z. An Operating and Maintenance Manual shall be provided that covers all aspects of the design and operation of the stations including:

i. Design calculations, including pipe and fitting head-loss assumptions and pump curves

ii. A plan of the design catchment

iii. As-Built Plans including circuit diagrams and switch locations

iv. Pump details, pump duty information, float switch levels

v. Contingency measures for emergency overflows

vi. Operation and maintenance procedures

vii. Other relevant data and information.

viii. Guarantees and warrantees

aa. Pump stations shall be tested and commissioned in the presence of a WDC representative strictly in accordance with the WDC Briefing Document – EES 1 and the WDC QA/QC Manual 2010.

5.2.10.3 Sizing

5.2.10.3.1. Pump Station Sizing

Pump stations shall provide pumping velocities in the rising main in the range 0.6 to 2.5 m/s.

Where practicable, the rising main should be sized, and the pump controlled, such that the volume of the rising main is pumped at least once each day, preferably each pump cycle. If there is insufficient inflow into the pump station to achieve this, then odour measures (see Section 5.2.6 Ventilation and Odour Control) shall be incorporated into the design unless the results of a ventilation and odour control assessment demonstrate that these are not required.

Where the pump station discharges into a common pressurised main that is used by other pump stations, variation in head conditions caused by the operation of the other stations shall be taken into account. Supporting information shall be provided to demonstrate satisfactory operation of the network for all pumping scenarios.

A pump station design shall document the effluent volumes and associated pump requirements for the fully developed catchment and at commencement of operation.

The calculation of flow shall follow the design criteria in Section 5.2.2 Design Criteria. These projections will be described as

a. Average Dry Weather Flow:

b. Peak Dry Weather Flow:

c. Peak Wet Weather Flow:

d. Peak Daily Flow.

If the station catchment shall be fed by other pumping stations, then these flows shall be calculated for the direct gravity catchment as well as the direct plus contributing catchment.

All calculations shall be submitted in the EDA and all assumptions, design variables etc. shall be clearly documented.

5.2.10.3.2. Flow Meter Sizing

Pump stations with an ultimate design flow of 10 l/s or greater shall be provided with magnetic flow meters on the rising main, connected to WDC's telemetry system. The system shall record instantaneous flow and totalised flows.

The flow meter shall be from WDC Approved Materials List - Wastewater and Stormwater potted for IP68 which is required to be factory 'Finger printed' and appropriately sized for the rising main.

The pump station design shall ensure the flow meter is fully charged during non-pump operation.

The transmitter shall be located in the cabinet with analogue and digital information connected to the WDC's telemetry system.

Where the meter is positioned within the designated site and free of roading or concrete cover then the meter may be buried or otherwise housed within a 1050 mm manhole with 400 mm clear of the invert of the meter. Both installation types are to connect to the cabinet by ducting. Where buried the end of the duct shall be sealed to prevent ingress of soil and moisture.

5.2.10.4 Layout and Access

The site layout shall comply with **Sheet 41**.

The alignment of the pump station shall be set out with reference to permanent land transfer pegs or temporary boundary marks, placed by the licensed cadastral surveyor responsible for the final land transfer pegging.

The site design shall include a paved all-weather access road, with a minimum width of 3.5 m, and have provision for parking and manoeuvring of maintenance vehicles. The centre line of the parking space shall be no greater than 4.0 m in plan from the distal pump and no greater than a 0.5 m difference in elevation between the parking area and lid elevation.

Where the access way is longer than 30 m, a turning point for a light commercial vehicle shall be provided at the well. The gradient of the access way shall not exceed 1 in 6, and all turning radii comply with light truck tracking curves.

The control cabinet shall be located with the switch gear facing the wet well and placed no closer than 2.5 m to any well or valve chamber lids and no further than 5.0 m. This is to provide safe working room between an open lid and the cabinet.

The above ground structures, including but not limited to control cabinet, odour control and RPZ, shall be positioned such that any 'out of control' vehicles leaving surrounding public roadways are unlikely to damage these structures. Protection such as guardrail or posts and rails may be required.

An area of 5.0 x 5.0 m shall be available to accommodate an odour biofilter, either at the time of construction or in the future.

5.2.10.5 Pump Station Inlet

The floor of the pumping station shall be set at such a level below the inlet pipe so that the inlet pipe will not surcharge during the normal pump operation cycle, which includes standby pump operation.

5.2.10.6 Wet Well

5.2.10.6.1. Diameter

The minimum diameter of the pump chamber shall meet both the minimum separation distances of the pump supplier, and provide sufficient operational capacity to meet the maximum number of starts per hour (refer Section 5.2.10.2 Design Criteria) but be no less than 1.8 m deep.

5.2.10.6.2. Depth

Sufficient depth shall be provided in the pump chamber such that:

a. For a gravity inlet pipe, the inlet shall have a minimum of 100 mm free board to surcharge during operation of the duty pump,

b. For a rising main inlet, the inlet shall be below the pump stop level,

c. The minimum distance between duty pump start and stops levels is 400 mm, and

d. The design stop level is 50 mm above the pump manufacturer's minimum continuous operating levels.

5.2.10.6.3. Structural Stability

The pump station wet well shall be designed to have negative or zero buoyancy. Accordingly, the chamber may require mass concrete in the bottom to counter buoyancy forces. The depth and extent of mass concrete shall be as specified on the Engineering Drawings.

The ground water level shall be assumed to be at ground level unless an actual level is established by geotechnical investigation and approved as suitable for this purpose by the WDC.

The mass of the wet well structure included in the stability analysis shall not include the associated mechanical and electrical components of the pump station nor can the soil friction forces of backfill around the wet well chamber be taken into account. The proposed pump station drawings shall provide dimensions of the extent of mass concrete needed to counter buoyancy of the chamber.

Foundation design of wet wells requires Specific Design by a SQEP in accordance with the design considerations in Section 5.2.7.7 Manholes Requiring Specific Design.

5.2.10.6.4. Valve Chamber

The valve chamber shall be attached to the pumping chamber. Where the delivery point is within close proximity to the pumping station the valve chamber may be dispensed with and a separate rising main from each pump laid to the delivery point. Where this occurs land shall be allocated for a valve chamber to cater for any future operational changes.

The layout of the pumping chamber, valve chamber and pipe work shall be similar to that shown on **Sheet 42** and **Sheet 41**.

5.2.10.6.5. Lids

Lids shall be of a standard design as per the WDC Approved Materials List - Wastewater and Stormwater.

For any well or chamber where the depth is greater than 2.0 m, secondary lids are required to satisfy health and safety requirements.

5.2.10.7 Emergency Storage

See also 5.2.10.8 Compliance with the NRC Regional Plan for Northland.

Pump stations shall provide for wastewater storage in the event of pump failure through electricity outage.

5.2.10.7.1. Sizing

A minimum of 4 hours emergency storage based on average dry weather flow, or minimum specified in the NRC Regional Plans (whichever is greater) shall be provided prior to emergency overflow occurring. The storage volume should be measured between the high-level alarm and the point of overflow.

The required storage volume shall be provided by:

a. The volume of the wet well, plus

b. Any additional ancillary storage chambers.

The wet well volume below the high-level alarm level shall be excluded from the calculation of available storage volume.

5.2.10.7.2. Layout

A site-specific layout design is required.

Preferably the storage volume shall be provided in the pumping wet well structure and upstream pipelines.

Any pipe or chamber (whose sole purpose is for the provision of storage capacity) can be connected directly into the pump chamber. It shall be benched such as to direct all flow to the outlet point.

For all other sole purpose storage facilities, the benching shall be at a minimum gradient of 1 in 3 to allow self-draining. A central channel within the storage well shall be at a minimum of 1% gradient.

If the storage chamber is provided with an automated wash down facility following storage use the minimum grade can be reduced to 0.15%.

Where storage is developed within the upstream pipework and carries wastewater flow, these structures shall have the haunching constructed to cater for the normal operation, with a seamless progression to the haunching required for the free drainage post emergency.

5.2.10.7.3. Structural Stability

The foundation and buoyancy of the storage chambers shall be determined and designed for as per the methods used in Section 5.2.10.6 Wet Well.

5.2.10.8 Compliance with the NRC Regional Plan for Northland

Pump stations shall comply with the requirements for a controlled activity in the Rules for Sewage Discharges in the NRC Regional Plans, and any necessary resource consents for its installation and use shall first be obtained by the Developer.

Note: Where particular constraints exist – e.g. a sensitive receiving environment such as a bathing area or marine farm, the consent conditions may require a greater storage capacity.

5.2.10.9 Electrical and Control

The Developer shall determine adequacy of any existing supply and arrange for the power supply to a pump station. The power supply for public pump stations shall be transferred to WDC following successful testing and commissioning of the pump station.

The electrical switch box shall be located in a safe position as close as practicable to the pump chamber. It shall be fabricated Aluminium or Stainless Steel, or Aluminium Montrose type. Vents etc. should be incorporated in telemetry masts.

The electrical and control system shall strictly comply with the WDC Briefing Document – EES 1.

5.2.10.10 Telemetry

All pump stations and treatment facilities shall be connected to WDC's telemetry system. WDC shall confirm whether satisfactory radio network communications are available at the site. If not, an alternative communication system (e.g. telephone landline with autodialer, or cell phone) shall be provided.

5.2.10.11 Water Supply

Where a WDC reticulated water supply is available, fresh water shall be supplied from a standard 25 mm. ID connection at a minimum static pressure of 250 kPa. A standard hose connection shall be fitted.

If the water supply is taken from WDC's drinking water network, backflow prevention shall be provided in accordance with the NZ Building Code Approved Documents for a high-hazard installation (RPZD) and **Sheet 44**.

The backflow preventer shall be positioned next to the electrical control cabinet and the water connection outlet shall terminate in the pump chamber.

The Developer shall apply to WDC for the connection (including the meter and backflow preventer), pay all costs and provide as-built details including all requirements of Section 6.1.7 Connection to Existing Water Supply System.

5.2.10.12 Pump Design

5.2.10.12.1. Pump Selection

Pumps shall be three phase submersible type design selected, from WDC Approved Materials List - Wastewater and Stormwater.

Pump jackets shall be stainless steel.

The pumps shall be connected by way of a 'duck foot' discharge pedestal to enable the removal and manipulation of the pump from the top of the wet well.

In selecting the appropriate pumps, the operating conditions shall correspond as closely as practicable to the point of maximum pump efficiency. Final pump selection shall be approved by WDC in order to facilitate standardisation of pump model and impellor sizes.

In calculating the system head losses, allowances shall be made for all bends and fittings beyond the pump discharge bend together with the rising main friction losses.

The system static head shall be based on the difference in level between the centreline of the inlet face for the pump discharge bend and the highest point on the rising main system.

The rising main system curve shall be modelled using the Colebrook White formula. Calculations of friction loss should be carried out based on roughness 'k' values of 1.5 m and 0.5 mm to ensure that the selected pump is capable of operating over this range of duty points.

5.2.10.12.2. Risers and Valve Sizing

The pumpset riser is defined as all pipework between the discharge bend to the inlet of the rising main isolation valve.

Internal pipework for each pumpset shall be at a minimum of that determined by the pump discharge bend. Where there is a difference in the size between the discharge bend and subsequent steelwork the reducer shall be immediately post discharge bend and/or prior to isolation valve if needed.

The valve installed along the pump set riser shall be of a similar dimension to the pipework.

Isolation valves for each pump set shall be of a quarter turn eccentric plug type with ability to lock in either open or close position using a standard padlock.

5.2.10.12.3. Non-Return Valves

The installation of a non-return valve on each pump set is required to ensure the pumps are protected from reverse flow and that flow from a pump is not returned to the well through the standby pump reducing operational capacity.

Where the dynamic head for a pump is less than 15 m, as measured at the location of the non-return valve, a ball type valve can be used. For those stations that experience levels greater than 15 m a resilient seated rubber flap check valve shall be used. Flap check valves shall be installed with an external indicator arm.

For those stations where the total head is above 30 m a detailed engineering design solution shall be provided showing the limitations on the system for water hammer following the controlled shutdown of pumps (excluding power failure).

5.2.10.13 Private Pump Stations

Private pump stations are permitted where it is not practicable or economic to provide a gravity connection to a public sewer. A proprietary packaged pump station, with grinder pumps, shall be used and shall comply with the NZ Building Code. Private pump stations will not be accepted as vested assets. Connection of private pump stations to public gravity networks shall be in accordance with **Sheet 38.**

5.2.11. Rising Mains

5.2.11.1 General Requirements

Rising main design requires specific approval from the WDC. All design works of rising mains shall be undertaken by a SQEP and shall meet the following requirements:

a. Fully account for the characteristics of the system in question including pump characteristics, surge, flow regimes and fatigue.

b. Minimise the time wastewater spends in a rising main and maintain self-cleansing velocities.

c. Be designed to withstand normal operating pressures, including short duration surge pressures from normal cycling and special events (such as power failure).

d. Be designed for connection to a WDC approved location on the existing wastewater network.

e. The SQEP shall consider the hydraulic adequacy of the network, including the specified levels of service and impact on the existing network.

f. 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). WDC's specific approval is required for pipe sizes exceeding 150 mm.

Note: WDC may specify the diameters and classes of pipes to be used and the alignment of the rising main.

For design purposes, and subject to availability, WDC may:

a. Provide details of the working pressure of the existing network, or of pressures at the approved connection point, and

b. Provide details of the capacity of existing network.

Where this information is not available from WDC records, or further information is required for the design, the Developer shall consult with WDC regarding the completion of any investigations. Investigations shall generally be carried out at the cost of the Developer.

5.2.11.2 Maximum Operating Pressure

The components of a pressure pipeline shall be designed to withstand a maximum operating pressure that is greater the following:

a. 400 kPa (note that this is not the minimum pipeline pressure class),

b. 1.5 x (static head + friction head),

c. Pump shut off head,

d. Positive or negative surge pressures.

External loads on the pipeline shall be included in all load cases, especially when pressure testing large diameter pipes. A factor of safety of at least 2 against buckling under negative or external pressures shall be allowed for. 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 during service may require that a higher nominal pressure rating is specified, which shall be the greatest of the following:

a. The maximum calculated operating pressure,

b. The equivalent operating pressure based on a surge & fatigue analysis.

To calculate the equivalent operating pressure (P_{eo}) the methodology described in Appendix A Design for Surge and Fatigue shall be used.

5.2.11.3 Pressure Surges

Design for pressure surge in pump rising mains shall be undertaken by a SQEP in accordance with the principles detailed in Appendix A Design for Surge and Fatigue.

In addition to the considerations in Appendix A Design for Surge and Fatigue, the SQEP shall also consider:

a. Soft closing, non-return valves for installations in high head situations as well as variable speed controls:

b. Allowance for Operation and Maintenance requirements:

c. Failure of any mechanical surge protection measures and protection from damage during these situations.

5.2.11.4 Velocity

Pressure mains shall have a minimum velocity of 0.75 m/s, and a maximum velocity of 2.5 m/s.

The preferred velocity range is 0.8 m/s to 1.2 m/s. Velocity shall be confirmed in the design submission.

5.2.11.5 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 scour valves respectively. The final profile will be a balance between the minimum depth of main and number of valves.

Rising mains shall be graded continually upwards from the pumping station to termination and designed to keep the pipe full and prevent sudden discharges of foul air at pump start.

If a summit is unavoidable:

a. Automatic air release valves shall be provided,

b. Air valves shall be design specifically for wastewater operation

c. Air valves shall be mounted vertically above the pipeline to which the air valve is connected.

d. An isolating gate valve shall be fitted between the air valve and the vented pipeline and the valves shall be mounted in a concrete valve chamber.

The valve chamber shall 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, drain valves and chambers shall be provided 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 practicable to drain directly to a nearby sewer (subject to the WDC's confirmation of suitability and availability of capacity).

5.2.11.6 Cover over Pressure Pipes

The minimum cover over the top of the pressure pipe to finished ground level shall comply with the requirements of section 5.2.3.3 Minimum Cover.

5.2.11.7 Flanges

All valves and fittings shall be flanged to either AS 2129:2000 Table D/E or AS/NZS 4087:2011 Class 16, alternative flange standards will not be approved. All mating flanges shall be compatible.

Note: This also applies to items such as flow meters and check valves

5.2.11.8 Sluice Valves

All valves and fittings shall be in accordance with WDC Approved Materials List - Wastewater and Stormwater, and meet the following requirements, as applicable:

a) Valves shall be ductile iron Metal Seated valves to AS/NZS 2638.1:2011 and fully polymetric coated to AS/NZS 4158:2003.

b) Valves shall have a minimum pressure rating of PN16.

c) Spindle shall be non-rising.

d) Spindle seal shall be non-asbestos gland box or O-ring that is accessible for replacement under full operating pressure.

e) Valve operating torque shall not exceed 125 Nm at the fully unbalanced allowable operating pressure, otherwise geared operation, motorised valves or a valve bypass arrangement shall be specified.

f) Valves shall be clockwise closing and supplied with triangular spindle cap, which shall be coated fusion bonded polymer complying with AS/NZS 4158:2003. Colour shall be red

g) The valve operating direction shall be permanently marked on the valve, gearbox, spindle cap or hand-wheel.

h) Flanges shall be in accordance with Section 5.2.11.7 Flanges.

Use of butterfly valves is subject to Specific Design and approval shall be at the discretion of the Wastewater Manager.

5.2.11.9 Scour Valves

Scour valves are required on the low point of all rising mains.

Valves shall be the same size as the main, but no greater than 150 mm in size.

Scour valves shall be installed at the lowest point between isolating valves, and discharge to an approved chamber.

5.2.11.10 Air Valves

Air can accumulate at high points when it is drawn into the system.

It is preferred not to have any high points in wastewater rising mains. If this cannot be achieved, mains should be laid evenly to grade between peaks to ensure all practicable locations of potential air pockets are well known.

The need for air valves at all high points shall be investigated, 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.

Air valves shall be sized for peak flow rates and located as required for surge protection.

Air valves shall also be located on long horizontal runs at a maximum interval of 800 m.

Only air valves on WDC Approved Materials List - Wastewater and Stormwater shall be used.

5.2.12. Pressure Sewer Systems

5.2.12.1 General Requirements

Several areas within the Whangārei District are serviced by pressure sewer systems. Pressure sewer systems consist of a small pumping unit installed on each property which pumps sewage into a small diameter pressure pipe network which then discharges either to the downstream gravity sewer network or into a communal pump station. The manner in which the pressure sewer system shall be used or applied in the district is described in the WDC Policy #0056 – Pressure Sewer Policy.

The design of a pressure sewer system shall be in accordance with WSA 07-2007. References in WSA 07-2007 to the “Water Agency” shall be taken to mean the WDC.

In addition to those set out in WSA 07-2007 the sewer system shall meet the following objectives:

a. All domestic wastewater is catered for.

b. All stormwater is excluded from the sewer system.

c. Minimum 12 hours of emergency storage is provided within the pumping station.

All design works of pressure sewer systems shall be undertaken by a SQEP (See Section 1.5.1.3 Risk Based Assessment Framework).

Note: Septic tank effluent pump (STEP) systems are not an approved pressure sewer system. Refer to Section 5.1.5.4 Private Treatment and Disposal for considerations regarding STEP systems.

5.2.12.2 Design Requirements

Pressure sewer design shall be separated into the following two components:

a. Reticulation design (design of the actual pressure sewer system) which includes:

   i. Reticulation pressure pipes,

ii. laterals,

iii. boundary kits, and

iv. appurtenances (e.g. valves and flushing points).

Note: Boundary valve kits shall be installed by the Developer at the time of construction of the pressure sewer reticulation

b. On-property design – (design of the property discharge line), which includes:

i. collection tank/pump unit,

ii. control/alarm panel, and

iii. electrical cables.

Note: The on-property design takes place after the reticulation has been designed and installed.

The following requirements for pressure sewer system design shall be met in addition to, and shall take precedence over those set out in WSA 07-2007:

5.2.12.2.2. Environmental Considerations

In addition to meeting these design standards, the Developer's design shall comply with the requirements of resource consent conditions, archaeological requirements, and district & regional plans.

5.2.12.2.3. Design Inputs and Outputs

During the design process, the Developer shall confirm with the WDC, the nominated discharge point on the WDCs existing system that the Developer needs to convey sewage to.

The WDC may direct the SQEP to increase the diameter of pressure sewers to account for adjoining developments or based on its own operation experience.

5.2.12.2.4. Odour Control

Ventilation and odour control shall be in accordance with Section 5.2.6 Ventilation and Odour Control.

5.2.12.2.5. Design tolerances

Design Tolerances shall be in accordance with Section 3.2 of WSA 07-2007 for reticulation design and Section 6.1.2 for on-property design. Reference to MGA, GDA and AHD is removed.

5.2.12.2.6. Survey Co-ordinates and Levels

Survey co-ordinates and levels shall be provided in accordance with Section 1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals and Appendix F Drawing Standards

5.2.12.2.7. On-property Components

All on-property items shall be located within the property boundary of the property being served.

Easements are generally not required over the property discharge pipeline, but the owner is to provide a clear and direct alignment for the discharge pipeline to connect to the reticulation in the street.

5.2.12.2.8. Clearance from Structures

To enable future maintenance and protect the system, a minimum offset of 2 m from any building or structures is required. The sewer reticulation main shall not be constructed through private land.

5.2.12.2.9. Septicity

Calculation of sewage age shall take into account the staging of the development.

5.2.12.2.10. Sanitary Flows

Sanitary flows shall be determined in accordance with Section 5.2.2 Design Criteria.

5.2.12.2.11. Infiltration and Inflows

The pumping unit shall be designed to prevent infiltration and inflows. Existing houses will not be connected to the system until all private drains discharging into the system have been inspected and pass the building consent requirements. The pumping unit shall be separated from any stormwater drainage pipes.

5.2.12.2.12. High Water-use Appliances

High water-use appliances shall not discharge to the pressure sewer system unless appropriate flow restrictors are installed to ensure the discharge rate does not exceed the capacity of the pump station.

5.2.12.2.13. Design Flows

Design flows shall be calculated in accordance with 5.2.2 Design Criteria.

The probability design method is an acceptable method for designing grinder systems unless the limitations noted in section 4.4.4.1 of WSA 07-2007 apply. The EDA shall include calculations of the design flows adopted for each pressure sewer line.

5.2.12.2.14. Alignment of Pressure Sewers

90° bends shall be avoided, where practicable, when aligning pressure sewers. Alternatives include use of 2 x 45° bends or bending the pipe within the manufacturers allowed limit.

5.2.12.2.15. Flow meters

The WDC shall determine whether flow meters are required and their location. Where specified, the flow meter shall be in accordance with Section 5.2.10.3.2 Flow Meter Sizing

5.2.12.2.16. Collection Tank and Pumping Units

Only pumping units (including collection tanks) in the WDC Approved Materials List - Wastewater and Stormwater and the associated purchasing specifications shall be used.

5.2.12.2.17. Boundary Valve Kits

Individual boundary valve kits shall be provided to serve each lot. They shall be installed at the time of construction of the pressure sewer reticulation and shall be located outside the property boundary, unless it is more prudent to locate it inside the property which the unit serves. In all cases the location shall facilitate access to the valves and shall not be installed in a trafficable area. The boundary kit is to have a bright red coloured lid with the colour homogeneous in the lid material.

Boundary Kits shall be provided at each vacant lot to facilitate connection of new houses to the system after the pressure network becomes live.

5.2.12.2.18. Isolation Valve Location

Isolation valves shall be installed at incoming reticulation pressure lines, i.e. at Tees, and one upstream and one downstream of scour valves.

Isolation valves shall be fusion bonded epoxy coated and resilient seated gate valves.

Isolating valves shall be constructed in accordance with the detail in **Sheet 49**, located in surface boxes, circle lids painted with red colour homogeneous in the lid material. The valve shall also be identified using a grey marker post with letters “SSV” (for “Sewer Sluice Valve”)

5.2.12.2.19. Air Release and Vacuum Break Valves and Chambers

Only air release valves authorised by WDC and listed in the WDC Approved Materials List - Wastewater and Stormwater shall be used.

Proximity to properties, venting requirements, and aesthetics shall be considered when determining the location of the air release valves

Air release valves shall be in covered concrete chambers so as to provide adequate clearance for servicing/replacement of the valves (**Sheet 51**).

The chamber shall be adequately vented for effective operation of the valve. Any odour issues associated with the venting shall be addressed in the design.

Air valve shall be identified by a grey marker post and have a letters "SAV" (for “Sewer Air Valve”).

5.2.12.2.20. Discharge Manholes

Where the receiving manhole is substantially deeper than the normal depth of the pressure main, the pressure main shall be graded out to enter the base of the manhole in such a way that it can discharge directly towards the downstream gravity pipe, minimizing disturbance to flows and the likelihood of creating gases. If grading out the pressure main is not practicable an internal manhole drop shall be designed in such a way that the flow is discharged directly towards the downstream gravity pipe as above.

Where required, venting shall be provided to the receiving manhole.

Consideration shall be given to protecting the receiving structure by, replacing it with corrosion resistant chamber or coating internal exposed surfaces (if approved by WDC).

The receiving structure should be located as far as practicable from residential properties.

5.2.12.2.21. Property Discharge Line

Pressure sewer laterals shall only be directly connected to pressure mains that are DN225 or less. Where a connection to mains greater than DN225 is necessary, a new pressure main will be required.

5.2.12.2.22. Pipework and Fittings for Pressure Sewer System

The pressure sewer pipes and fittings shall be constructed using PE100 SDR11 (PN16) suitable for jointing with electrofusion fittings or butt fusion welding. Refer to Section 5.3.5.1 Rising Mains.

The minimum pipe size for reticulation is DN50 (50 mm OD).

Property discharge line for a standard house connection is usually DN40 (40 mm OD).

Only black polyethylene pipes with off-white (cream) stripe shall be used.

5.3. Construction

5.3.1. Pipeline Installation

The installation of pipelines shall be carried out in accordance with AS/NZS 2566.2:2002 (where applicable) and **Sheet 31** and **Sheet 32**.

5.3.2. Materials

Materials shall be in accordance with the requirements of Section 5.2.5 Approved Materials.

5.3.3. Pipe Installation by Trench

5.3.3.1 Pipe Embedment and Marking

5.3.3.1.1. Embedment

Where a pipeline is to be constructed through areas with unsuitable foundations, such material shall be removed and replaced with approved material. Alternatively, other methods of construction may be carried out with approval from WDC to ensure adequate foundation and side support is provided.

Pipe bedding and protection must be specified on the design drawings and shall be in accordance with **Sheet 31** and **Sheet 32,** AS/NZS 3725:2007, and the manufacturer's specifications.

The trench design shall be of sufficient width, and in accordance with **Sheet 31**, to allow pipes to be safely laid and all embedment material properly compacted.

Embedment and fill shall be installed so that not more than 15 m of pipes shall be left exposed in the open trench at any time.

The trench's subbase shall be able to support all expected design loads over the pipe. Geotechnical investigations and report by a SQEP are required for all pipes laid in known weak grounds and/or any pipe with a diameter greater than 600 mm.

A SQEP shall inspect and record the trench ground condition before embedment material is placed or pipes are laid.

Where pipelines have protruding projections such as sockets, flanges or couplings, a suitable recess shall be provided, in the supporting material, to ensure the pipeline is fully supported along the pipe barrels.

Pipes made of plastic materials shall be laid with product labelling uppermost in the trench.

All trenches over 1.5 m depth shall be secured from collapsing.

5.3.3.1.2. Pipeline Marking

Detection tape shall be laid directly above all rising mains and above new sewers. The tape shall have 'sewerage' written on it in white and be located at a depth of between 200 and 250 mm above the pipe crest.

Where the pipe is not laid in a straight line between manholes the tape shall contain sufficient metal to be detectable from the surface by a standard metal detector.

Tracer cable shall also be attached to all pump riser mains and pressure sewer mains. This wire shall take the form of a continuous 2.5 mm multi strand (polythene sleeved) cable, strapped to the pipe wall by means of a minimum of two complete wraps of heavy-duty adhesive tape, at a maximum of 3.0 m intervals.

The tracer cable shall be connected to all surface boxes, and electrically tested for continuity by a registered electrician following installation and backfilling. Records of the electrical continuity test shall be provided by the contractor.

5.3.3.2 Tolerances

Pipes shall be accurately laid to the lines, levels and gradients shown on the approved drawings using pipe-laying laser equipment. The allowable tolerances are shown in Table 5-9.

Table 5-9 Tolerances

Alignment	Tolerance
Vertical Alignment	There shall be no steps at the junctions between successive pipe segments and no point in the pipeline shall be lower than any downstream point.
Horizontal Alignment	± 100mm
Invert levels (IL)	± 50 mm, subject to the downstream IL being lower than upstream IL.
Gradient	± 20 mm from a straight line between the inverts of successive manholes.

Where the installed pipes exceed the tolerances in Table 5-9, WDC may order the removal and relaying of any affected pipes

5.3.3.3 Backfilling and Reinstatement

5.3.3.3.1. General

The trench or embankment fill material and trench reinstatement shall be as specified on the approved drawings and in accordance with **Sheet 31**.

Trench bedding and backfill material shall be compacted in layers to the designed ground level.

In public areas, backfilling shall be installed so that no more than 15 m of trench is open at any time.

Mechanical compaction of the backfill material directly above the pipe shall not be applied until sufficient cover is reached above the pipe to prevent damage to the pipe.

Displacement of the laid pipes during backfilling and compaction shall be prevented. Compaction or vibration equipment which can produce horizontal or vertical forces, which can cause damage or excessive distortion of the pipeline, shall not be used.

The Contractor shall reinstate trenches within seven days of backfill completion unless agreed otherwise by a SQEP. The surface level of the reinstated trench shall match the surrounding surface level.

Compaction test results shall be submitted to WDC for approval, as applicable.

5.3.3.3.2. Backfill Materials

Selected material excavated from the trench may be used for backfilling trenches subject to SQEP approval.

In roads and paved areas, where material excavated from the trench cannot meet the compaction standards in Section 5.3.3.3.3 Compaction, imported granular material shall be used.

Surplus and unsuitable material from the excavation shall be appropriately disposed of.

5.3.3.3.3. Compaction

Within the Transport Corridor

Trenches in the Transport Corridor, or under private access or paved (vehicular) areas, shall be backfilled and compacted in layers of thickness commensurate with the compaction equipment to a density of at least 95% of the maximum dry density. Field compaction shall be tested as follows:

a. For cohesive soils - New Zealand standard compaction test, nuclear densometer and shear vane.

b. For non-cohesive soils - New Zealand standard compaction test, nuclear densometer or dynamic cone penetrometer (Scala Penetrometer).

Testing by other means shall be subject to the approved ITP or conditions of the EDA.

Compaction testing of sub-base and base course shall be in accordance with requirements 3.3.4 Pavement Testing.

The SQEP shall specify a testing regime to verify the compaction effort meets the density specified to support the designed traffic loading.

The Contractor shall undertake tests in accordance with the approved ITP or conditions of the EDA, to demonstrate that the specified compaction standards have been achieved throughout.

Outside of the Transport Corridor

Trenches not in roads or paved (vehicular) areas shall be backfilled and well compacted with mechanical equipment in layers not exceeding 300 mm thick to the specified finished level.

Under no circumstance shall the bearing capacity of the backfill material be less than that of the material prior to excavation, for the full depth of the trench. Scala Penetrometer tests may be used to establish the criteria for compliance, with a minimum of one test per 50 m of trench or 50 m³ of trench backfill, whichever is greater.

Compaction testing of fill material shall be in accordance with NZS 4402:1988/1986.The Contractor shall undertake tests to demonstrate that the specified compaction standards have been achieved throughout.

5.3.4. Trenchless Construction

5.3.4.1 General

Trenchless technology may be preferable or required as appropriate for alignments passing through or under

a. Environmentally sensitive areas:

b. Built-up or congested areas to minimise disruption and reinstatement:

c. Railway and major road crossings:

d. Significant vegetation:

e. Vehicle crossings.

Trenchless construction shall only be used for applications in which the specified tolerance can be achieved.

Pipes used for trenchless installation shall have suitable mechanically restrained joints, specifically designed for trenchless application, which may include integral restraint, seal systems, or heat fusion welded joints.

Any trenchless technology and installation methodology shall be chosen to be compatible with achieving the required gravity pipe gradient.

5.3.4.2 Installation Methods

Trenchless installation methods for new pipes include

a. Horizontal directional drilling (HDD) (PVC with restraint joint/fusion welded PE):

b. Uncased auger boring/pilot bore microtunnelling/guided boring (PVC with restraint joint/fusion welded PE):

c. Pipe jacking (GRP/ reinforced concrete).

5.3.5. Joints

5.3.5.1 Rising Mains

Joints between fittings and pipes on rising mains shall be made using the most suitable of the following methods:

a. Socket & spigot (except for PE pipes) only where the socket is designed specifically for the spigot outside dimension:

b. Bolted unrestrained mechanical couplings (except for PE pipes/tension systems) where the coupling is either of the multi-fit type or specifically designed for the outside diameters of the items to be joined. Bolted unrestrained mechanical couplings shall not be used where the step difference exceeds 10 mm:

c. Flange-sockets to AS/NZS 2280:2020 or flange coupling adaptors to AS/NZS 4998:2009 (except for PE pipes):

d. Butt-welded jointing (PE pipes DN160 and larger only) by a specialist contractor only (see below):

e. Electrofusion (see below):

f. Mechanical couplers (full restraint type – PE pipes only):

g. Welding (concrete lined steel only):

h. Threaded connections to BSP (only for pressure tappings or similar):

i. Solvent-cement joints are not permitted without WDC's specific approval.

5.3.5.2 Gravity Mains

5.3.5.2.1. General

Specification of joints on gravity mains shall be as follows.

a. All pipes shall have flexible joints of an approved type, such as Rubber ringed joints:

b. Steel pipes shall be flexibly jointed (bolted unrestrained mechanical coupling 'denso' wrapped and sealed with approved outer wrapping or approved rubber ring):

c. Joints shall be provided adjacent to manholes to the requirements of AS/NZS 2566.2:2002 with the exception of PVC where proprietary connections may be used.

5.3.5.2.2. Rubber Ring Joints

Rubber ring joints shall be installed in accordance with the manufacturer's instruction. Care should be taken to ensure that the rubber rings are located evenly around the joint with no twists in them. The pipe shall be pushed up firm and tight to the joints.

5.3.5.3 Welding PE Pipes

Butt or electrofusion jointing of PE pipes shall be undertaken by a WDC approved contractor using calibrated and data logging butt fusion or electrofusion machines. Only employees of an approved contractor who have successfully completed a Water New Zealand approved butt fusion or electrofusion jointing course for polyethylene pipe, or re-fresher in the past two years, shall be permitted to physically undertake welding.

Prior to commencing work, the following shall be provided:

a. Copy of current calibration certificate(s) of the butt fusion or electrofusion machine (not more than 12 months old)

b. Registration number of the fusion technician, and current certification (not more than 24 months old).

All jointing of PE pipe shall be data logged.

Fusion jointing shall take place in a covered environment to avoid contamination of weld faces and prepared pipe.

For all electrofusion joints, including tapping saddles, a mechanical scraper with winding mechanism shall be used to ensure even finishing. Hand scraping of pipe ends, with the appropriate tools, will only be permitted if mechanical scraping is not practicable and with

prior permission from the Distribution Engineer. Electrofusion joints shall be undertaken using clamps and the equipment correctly calibrated.

5.3.5.3.2. Butt Welded Jointing

The certifying organisation shall satisfy the requirements of Section 5.3.5.1 Rising Mains.

In addition, welders may be required to carry out satisfactory test welds for each joint type and to stamp the welder's number on each joint. Butt welds shall be at least 90% of the tensile strength of the parent pipe material, when tested in accordance with ISO 13953:2001.

All internal weld beads shall be removed in an approved manner, to be smooth and flush with the pipe inner surface, without compromising the strength of the pipe joint.

5.3.6. Manholes

5.3.6.1 Channels and Benching

A semi-circular channel shall be formed in the concrete floor of the manhole. Benching shall then rise vertically from the spring line of the pipe to the height of the soffit and then be sloped back at a gradient of 1:3 (refer **Sheet 39**). A U3 standard of finish as specified in NZS 3114:1987 shall be achieved.

The flow channel shall be formed so that it presents an evenly curved flow path through the manhole. The cross section of the flow channel shall be uniform. In wastewater pipelines the main channel shall be lined with ceramic half pipes. Ceramic half pipes shall be saw cut to form mitred joints around bends.

Benching shall be floated to a dense, smooth hard surface using 3:1 sand cement mortar and a steel float. Side branches shall be similarly formed with a smooth bend into the main channel.

Use of pre-formed benched manhole bases from WDC Approved Materials List - Wastewater and Stormwater is an acceptable alternative to formed in-situ benching.

5.3.6.2 Manhole Throats

The maximum depth of throat on all manholes shall be 450 mm.

5.3.6.3 Flexible Joints

All pipes, other than PE pipes, shall have a flexible joint adjacent to the manhole on all incoming and outgoing pipes not more than 600 mm away from the manhole wall. The upper part of the pipe inside the manhole shall be cut back to the wall, the reinforcement cut out and the ends plastered with a cement mortar to a neat finish. Where the pipe is cut using a power saw the ends of the steel reinforcement shall be protected from corrosion by the application of epoxy before rust has a chance to develop. Refer to **Sheet 39**.

5.3.6.4 PE Pipe Connections

PE pipe shall be connected to the manholes with sliding joints, as per **Sheet 33**.

5.3.6.5 Sealing of Manholes

Where precast manhole units are used, the joints of abutting units shall be sealed against ingress of water with an approved sealant and with epoxy mortar on the inside and outside of the joints.

Plastic manholes shall be sealed, where required, in accordance with the WDC Approved Materials List - Wastewater and Stormwater.

5.3.6.6 Manhole Steps

The steps shall be bolted through the walls using properly formed and recessed bolt holes.

The step shall have a washer welded to it on the appropriate angle to seat flush against the inside of the manhole chamber.

Prior to tightening, BM100 shall be placed around the stainless-steel shank both inside and outside the manhole riser. After the steps have been tightened in place the outside recess which houses the nut shall be sealed with Expocrete 'UA' or acceptable equivalent in accordance with the manufacturer's directions. Plastering of the recess will not be approved. The sealant shall be applied at least 48 hours before the manhole risers are required for construction.

5.3.6.7 Concrete

All concrete used for manufacturing manholes shall have a minimum crushing strength of 20.0 MPa at 28 days, unless otherwise specified or detailed by WDC.

5.3.7. Connections

Connections will preferably be made into manholes.

Direct connection of a minor pipeline into a major pipeline shall be in accordance with the following:

a. The minor pipe diameter shall not be greater than half of the major pipe diameter:

b. Connection is made via a suitable prefabricated junction or saddle:

c. The distance between the pipeline connection and the closest inspection point shall not exceed 25 m:

d. Saddling of catch-pit leads into primary lines is permitted provided that the connection is made at 45º or less to the direction of primary flow:

e. Saddling of double catch-pits is not permitted:

f. Connections shall be sealed with removable caps until required.

g. Connection locations and depths to invert shall be accurately measured and shown on As-Built Plans in accordance with the requirements of Section

1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals:

h. The connection position shall be marked with a wooden stake (100 x 50 mm) with 'WW' painted/fixed onto the stake and extending from the invert of the connection to a minimum of 600 mm above ground level.

Connections shall be constructed as per **Sheet 37**.

All connections to WDC piped network or work on WDC piped network shall be undertaken by a Licensed Contractor.

5.3.8. Pump Stations

5.3.8.1 Wet Well and Valve Chamber

Care shall be exercised to ensure that the wet well chamber is vertical and set to the correct levels before the station floor is poured.

Bases in accordance with WDC Approved Materials List - Wastewater and Stormwatershall be used.

Flotation of the chamber shall be prevented.

Pipe joints shall be sealed and made watertight.

5.3.8.2 Foundations

The wet well pump station foundation shall be constructed as specified on the approved drawings (**Sheet 42** and **Sheet 43**).

Where not specified on the approved drawings, the SQEP shall investigate the foundation soils and determine a suitable foundation in accordance with Section 5.2.10.6 Wet Well and Section 5.2.7.7 Manholes Requiring Specific Design). The WDC shall not be responsible for delays to the construction resulting from approval of designs.

5.3.8.3 Painting and Lining

Any block work mortar joints shall be pointed inside and outside, and all cores filled with grout.

The outside of the block work shall be painted with a waterproofing membrane and the internal walls of the well and valve chamber shall be painted with a sealant. The products shall be approved by WDC before use.

5.3.8.4 Top Slab

The placement of reinforcement shall be carefully controlled to ensure adequate cover. The lids and frames shall be carefully set into the concrete upstands so that they fit flush with the finished upstand level. All concrete shall be ordinary grade 20 MPa crushing strength.

The lid and frame shall be as per WDC Approved Materials List - Wastewater and Stormwater. All reinforcing steel bars shall be grade 300 deformed bars complying with AS/NZS 41671:2019 . All nuts, bolts and washers shall be grade 316 stainless steel with an appropriate releasing agent applied prior to setting any nut. Where concrete shall be poured around high-density polyethylene pipe, the pipe shall be first wrapped with 1.5 mm thick butynol sheeting.

5.3.8.5 Well and Chamber Lids

The primary covering lids shall be as per WDC Approved Materials List - Wastewater and Stormwater as appropriate for the pump size selected at full development.

a. All stainless welds shall be AS/NZS 2980:2018, pickled to prevent corrosion. All metal to metal fasteners shall be coated with an appropriate releasing agent before installation:

b. All fasteners shall be 316 stainless steel:

c. All edges shall be made clean of burs or sharp edges:

d. Secondary Safety Lids are required where depth is greater than 2.0 m.

5.3.8.6 Cable Bracket

The float and motor cables shall be secured by a grade 316 stainless steel bracket with ceramic insulators. The bracket shall be mounted in such a position as to be easily accessible from the lid opening as shown in **Sheet 42** and **Sheet 43**.

5.3.8.7 Pump Discharge Bends

The pump discharge holding down bolts shall be grouted in place and accurately positioned so that the 50mm dia. pipe guide rails stand vertically between the guide rail brackets and the discharge connection. Care shall be exercised in grouting in the bolts to ensure that they will not vibrate loose with use.

5.3.8.8 Guide Rails

Guide rails shall be fixed to the edge of the well, using stainless fittings with the guide rails installed vertically using the Flygt guide rail bracket. The guide rails shall be 316 schedule 10 stainless steel tube and each guide rail shall be of a single continuous pipe run with no joins.

5.3.8.9 Riser

Each pump installed shall be fitted with an individual riser manufactured from 316 schedule 10 stainless steel tube. All welds shall be to AS/NZS 2980:2018, pickled to prevent corrosion. All flanges shall be of Table E.

Where a flange is installed on a horizontal pipework, the two bolts shall be placed so they are level at the top. On vertical sections the two bolts shall be perpendicular to the discharge bend inlet coupling base.

The riser for each pump consists of three major components:

a. The pump lift,

b. Valve wall penetration, and

c. Non-return valve connector.

5.3.8.10 Pump Lift

The pump lift component consists of a vertical section of pipe from the bellows located on the discharge bend to the valve set elevation. The section is to contain a single 90-degree bend.

If the design requires that the pump lift component shall be connected to a discharge bend of a smaller diameter, this is to occur by way of a reducer fabricated into the base of the vertical riser and the bellows sized to meet the discharge bend.

Where the pump lift component riser is greater than 3.0 m, additional support brackets shall be installed at 2.0 m intervals, measured down from the centre line of the valve wall penetration.

5.3.8.11 Valve wall penetration

A flange shall be installed prior to entering into the valve chamber wall, no closer than 200 mm to the wet well wall facing. The penetration through the valve wall shall be horizontal and centred vertically over the pipe discharge bend. No partial bends for realignment shall be used without specific authorisation from WDC.

Where the pipe penetrates the valve wall, a square stainless-steel flange shall be welded to the pipe and bolted to the wall with dimensions at least 2.5 times the external pipe diameters and fixed with M16 stainless steel Chemset studs. The penetration hole for the riser to pass through shall be approximately 20 mm larger than the external diameter of the pipe and extend a sufficient length to the cut off to fully allow the bolted unrestrained mechanical coupling connection to slide fully onto this length of pipe work to release all downstream pipework.

A non-return valve connector shall be fitted with a length no less than 100 mm plus 60% the overall length of the bolted unrestrained mechanical couplings. It shall be fitted with a Table E flange and welded as per the required specifications and a 15 mm BSP threaded socket welded to the centre line of the pipe with a stainless steel plug no closer than 50 mm to valve flange.

5.3.8.12 Non-Return Valve and Riser Isolation Valves

The non-return and isolation valves shall be installed as per the manufacture’s requirements, post isolation valve.

5.3.8.13 Inlet

The inlet to the overflow pipe shall be baffled to restrict the entry of floatable solids and constructed in 316 stainless steel bolted to the wall. The baffle shall extend from 200 mm below the invert of the overflow pipe to 150 mm above the obvert of the overflow pipe. The cross-sectional area enclosed by the baffle shall be (at a minimum) 1.5 times the overflow

pipes cross sectional area. The baffle shall be design such as to not impede the movement or operation of the pumps, level floats or ultrasonic level control.

5.3.8.14 Collection Manifold

The individual riser shall be joined together by a collection manifold which continues through the exterior valve wall including puddle flange over each pipe. On leaving the valve chamber, the individual risers shall be joined together using 45-degree connections. On collection of all individual risers the manifold is to proceed with a minimum straight length, free of fittings, for a distance of no less than five times the diameter of the pipe, prior to termination in a flange, for connection to the flow meter. The downstream section of the flow meter is to continue in stainless steel without fittings for at least 2 diameters, until either a rising main bypass tee fitted or the isolation valve.

All fastening bolts are to have a releasing compound applied prior to installation.

5.3.8.15 Emergency Storage

The Emergency Storage chamber shall be constructed in accordance with the approved drawings.

The entire storage tank shall be painted as per the requirements of the wet well.

Any washing fixtures are to be constructed using 304 Schedule 10 Stainless Steel pipe and fixtures.

5.3.8.16 Odour Control

Odour control shall be provided as specified on the approved drawings.

Where not specified on the drawings, provision of space free of services shall be provided in case of future installation, as shown in **Sheet 41**.

5.3.8.17 Electrical Cabinet Plinths

The electrical cabinet plinth shall be constructed as per WDC Briefing Document – EES 1.

5.3.8.18 Direct Buried Cable

Where specified cables are laid directly in the ground, they shall be located not less than 0.6 m below ground on a 50 mm thick bed of clean sand. The trench shall be backfilled with a 75 mm thick layer, measured from the top of the cable, of clean sand. Lengths of ‘Mag- Slab’ cable cover shall then be laid end to end to provide cable protection. The trench shall then be further backfilled with clean sand or soil, free from rock, stones or other debris, to a level 200 mm below the surface. Orange PVC signal tape shall then be laid and backfilling completed, the surface being restored to Council’s satisfaction.

5.3.8.19 Cable Ducting

The following cable ducts are required

a. One pump cable duct and one control cable duct of 100 mm dia. shall be installed from the base of the electrical control cabinet concrete plinth to the pump station chamber:

b. One 100 mm duct shall be installed in the plinth for the mains cable:

c. A 50 mm duct shall be installed from the electrical control cabinet concrete plinth to the flow meter:

d. A further 50 mm duct shall be installed for each of the emergency storage spray wash control solenoid and/or a distal float overflow if fitted:

Each cable duct shall be fitted with a pull cord for future cable repair works and shall be sealed, to restrict corrosive fumes entering the electrical cubicle, by way of expanding foam encased in a plastic liner to allow ease of future removal.

5.4. Completion of Works

5.4.1. Testing and Inspections for Pipelines

All wastewater mains and branch pipelines, including extended connections, shall be inspected during construction. On completion of all other engineering work within the development, there shall be a final test conducted.

Where the reticulation shall be vested in WDC, this final test shall be carried out in the presence of a WDC representative. If the reticulation is to remain private, this test shall be carried out in the presence of a SQEP who shall certify the test and forward the results to a WDC representative

New sewer reticulation shall be completely and permanently isolated from the WDC's ‘live’ sewer reticulation until such time as all tests are passed, and written authority from WDC to connect to the live sewer is obtained. Connection shall only be carried out by a Registered contractor, and the connection shall be inspected by a WDC representative before the connection is backfilled.

A minimum of 24 hours’ notice is required to be given to WDC before any tests are carried out, so that arrangements for a representative can be made. The Developer/Contractor shall provide all fittings and materials to carry out any tests.

5.4.1.1 Inspections

The Developer/Contractor shall ensure that inspection and subsequent approval is granted before continuing with the installation. Failure to follow this process may result in the Developer/Contractor removing items or excavating a competed work to allow inspection. The progress inspections include:

a. Set out:

b. Excavation and bedding:

c. Backfill:

d. Pre-pour Form and Reinforcing:

e. Pre-Cover Installation:

f. Water Tightness:

g. Rising Main Pressure Test:

h. Electrical Inspection.

5.4.1.2 Low Pressure Air Test

The materials and workmanship used shall pass a low-pressure air test.

a. Introduce air to the pipeline till a pressure of 300 mm of water is reached. (This shall be measured by a manometer such as a 'U' tube, connected to the system):

b. Wait until the air temperature is uniform (indicated by the pressure remaining steady):

c. Disconnect the air supply:

d. Measure pressure drop after five minutes:

e. The pipeline/manhole is acceptable if the pressure drop does not exceed 50 mm.

Note: The pipeline shall be sealed with suitably restrained plugs at both ends and at branch connections. The pipes should have the voids filled by soaking for 24 hours prior to testing.

5.4.1.3 Manhole Leakage Tests

The materials and workmanship used shall pass a low-pressure hydraulic test.

Manholes shall be watertight and tested by plugging and filling the manhole with water (allowing sufficient time for absorption).

During the test, the level of water in the manhole shall not drop more than 5 mm in 10 minutes.

5.4.1.4 Rising Main Test

Rising main pipeline and welds shall be tested in accordance with Section 6.3.3.1 Testing of Welds and Section 6.3.3.2 Pipeline Pressure Testing.

5.4.2. CCTV Inspections

5.4.2.1 General Requirements

CCTV inspection shall be carried out on every new system to vest in WDC. The timing of CCTV inspection shall be determined by WC.

CCTV inspections and deliverables shall be in accordance with The New Zealand Gravity Pipe Inspection Manual, Fourth Edition.

All defects shall be remedied to the satisfaction of WDC. Where defects are found and repaired the section of pipe shall be re-filmed to ensure that there are no further problems.

CCTV inspection shall be carried out for all existing wastewater pipes before and after the construction works, which may affect the pipes by either directly interfering with the network or indirectly by using machinery and/ or plant at the site which may impose heavy loads and vibrations onto the wastewater network.

CCTV inspection shall be carried out in dry weather and where there is no flow which may affect the quality of video and still images.

If there are pipe blockages and debris found the contractor shall apply to WDC to flush the pipe with water prior to the CCTV being completed.

The CCTV camera shall travel upstream.

CCTV maps with log sheets (showing the pipe GIS identification references, still images of critical locations with distances form the stat node, and indication of defects types and severity) shall be submitted to the WDC.

The following deliverables are required:

5.4.2.2 Deliverables

The following deliverables are required.

a. As-built plans and/or WDC GIS maps for existing assets, showing pipes and nodes being inspected.

b. Computer generated log sheets showing the pipe identification references for new and existing assets; still images of critical distances from the starting node; and indication of defect types and severity.

c. CCTV inspection record in digital video format.

d. CCTV footage shall also be referenced to the node unique numbers and shown on As-Built Plans and/or WDC GIS maps.

e. Still images shall be in a source file and a PDF format.

f. CCTV inspection summary sheets in a PDF digital format.

5.4.2.3 Header Information Required

Refer to WDC QA/QC Manual 2010 for CCTV header information requirements.

5.4.3. Pump Station Commissioning

Refer to WDC QA/QC Manual 2010 for pump station commissioning requirements.

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