water NEW ZEALAND
The New Zealand Water & Wastes Association Waiora Aotearoa

WATER NEW ZEALAND

PRESSURE SEWER NATIONAL GUIDELINES

Ownership Models, Design Requirements, Technical Specifications and Operation & Maintenance

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Foreword

The demands and expectations of New Zealand wastewater networks systems are increasingly coming under pressure, in some situations the traditional gravity sewer network is no longer the best solution to provide communities the public health benefits that a wastewater network provides.

The changing environment coming at the wastewater sector such as climate change with higher ground water tables; higher public expectation of resilience of infrastructure and increasing demands of system integrity are all reasons for looking at other alternative methods of wastewater transportation from the tried and true methods of the past.

The services that Water New Zealand members provide to New Zealand Inc often goes unnoticed but is greatly appreciated by those that are aware of the risks and the effort required to improve New Zealanders quality of life.

My thanks goes to the Water Services Managers Group for funding this guideline and the value this guideline provides to both utilities and consultants in assessing the pros and cons of wastewater network options that are available in this ever developing technical field.

John Pfahlert
Chief Executive
Water New Zealand

1. Introduction

1.1 Purpose of these Guidelines

It is recognised that alternative technologies, such as pressure sewers can offer benefits over traditional gravity sewers in particular circumstances, including:

- Where gravity sewer is not possible
- Sites with rocky soil or underlying rock
- Sites with high water table
- Areas prone to liquefaction and lateral spread
- Areas with long, flat expanse of terrain
- Hilly or difficult terrain (including islands)
- Locations with slow population growth
- Locations remote from existing infrastructure
- Environmentally sensitive areas
- Replacing problematic septic tanks or on-site treatment systems
- Densification where existing sewers are close to capacity and flows need to be limited or controlled

However, as a relatively new technology, information for designers and infrastructure owners has been limited. This document aims to assist infrastructure owners to understand the key issues to ensure that where pressure sewer is adopted, it is designed and implemented correctly.

1.2 The Guidelines

These guideline consists of four sections.

A – Ownership Models and Practices

B - Design Requirements

C - Technical Specifications

D - Operation and Maintenance

These guidelines make recommendations as to the Design Approaches and Technical Specifications that Council can adopt as part of their formal Design Requirements and Technical Specifications.

The Design Approaches section provides general details on design methodologies for hydraulic design and key aspects for the correct design of a pressure sewer system. The Technical Specifications section covers supply and installation of pressure sewer products, materials and equipment. The Operation & Maintenance section collates and summarises the benefits and issues regarding Operation & Maintenance of pressure sewer systems. Common and suggested mitigation measures and methodologies for managing known issues are documented in these guidelines.

Part A - Ownership Models and Practices

A.1 Case Studies - Ownership Models and Practices

A.1.1 Case Studies - Ownership Models

The two available options for on-property equipment ownership are ‘private ownership’ and ‘Council ownership’. The implications of each ownership model with regards to operation and maintenance (O&M) responsibility is discussed later in this report (section A.3).This section does not set out to determine the most appropriate ownership policy. The appropriateness of a particular ownership policy needs to be assessed in the specific context of each individual territory or situation. The wide range of factors and situations do not permit one effective solution. This report does provide case studies and examples to assist in the informed decision making of Councils who are considering the adoption of pressure sewer.

A.1.1.1 New Zealand Ownership Model Examples

Private Ownership

Three local authorities in New Zealand are known to currently use the private ownership model. These are:

- Watercare Services Ltd (Council Controlled Organisation)
- Waimakariri District Council
- Selwyn District Council

Prior to several local authorities being amalgamated into Auckland Council, Rodney District Council (Rodney) was the only local authority using pressure sewer systems at the time.

Rodney was one of the first two adopters of pressure sewer in New Zealand. Rodney constructed the Point Wells Scheme in 2008, at approximately the same time that Rotorua District Council established their first pressure sewer schemes. The Point Wells Scheme was a ‘backlog’ project, where the community was serviced by existing septic tanks. The topography of Pt Wells is very flat and low lying with a high water table. Pt Wells is surrounded on three sides by the Whangateau Harbour, which has high ecological value. The primary driver for the scheme was the public health risk and environmental impact of failing septic tanks.

As the existing community of Pt Wells were using septic tanks, they could be considered relatively ‘well educated’ with the requirements of owning and maintaining on-property wastewater equipment. The maintenance responsibilities of a single wastewater pump could be considered significantly easier than the maintenance responsibilities of an onsite wastewater disposal system. In this context the community was accepting of the ownership responsibilities of onsite pressure sewer equipment.

Since the Pt Wells scheme and the adoption by Rodney of the ownership model, pressure sewer schemes have been established in a number of other catchments, including urban environments such as Millwater, Kumeu, Huapai and Riverhead. Initially, pressure sewer was rolled out to existing communities using septic tanks, such as Riverhead and parts of Kumeu and Huapai, all suburbs of Auckland. Greenfield development is now occurring around those centres with wastewater service by pressure sewer and with the same private ownership model.

To date, Watercare has identified that they have had no cause or need to instigate a review of the current ownership model, i.e. there has not been any issues encountered that have warranted a review of the ownership model.

Waimakariri District Council initially adopted pressure sewer to service the Pegasus development. It is understood this was initially developer-lead. The ownership model has now been extended to a second large development, and to a septic tank replacement project at the settlement of Ohoka. The Waimakariri District Council now has a reasonably large number of properties serviced by pressure sewer.

The Selwyn District Council only has a very small number of properties serviced by pressure sewer: one development of 20 properties, and one or two other developments of a similar number. It is understood that Selwyn District Council does not have the quantum of properties serviced by pressure sewer to warrant the establishment of various management systems and O&M capabilities, and that the schemes are semi-rural in nature indicating that users of the wastewater systems can be considered 'well educated' with regards to onsite wastewater systems and requirements.

Council Ownership

Water authorities that have adopted pressure sewer and maintain ownership of the on-property equipment include:

- Far North District Council
- Whangarei District Council
- Kaipara District Council
- Waikato District Council
- Rotorua District Council
- Tauranga City Council
- Western Bay of Plenty District Council
- Manawatu District Council
- Porirua City Council
- Tasman District Council
- Marlborough District Council
- Christchurch City Council
- Dunedin City Council

As demonstrated by the number of New Zealand local authorities who own on-property equipment in comparison to those that have adopted a private ownership policy, it can be seen that the Council ownership model has a wide adoption base and is generally the preferred policy option within New Zealand.

A.1.1.2 Australian Ownership Model Examples

Australian water authorities who have adopted pressure sewer systems (PSS) have been identified in Table 1. The ownership models identified are:

1. Public ownership (Water Authority) of on-property equipment.
2. Private ownership of on-property equipment, but the Water Authority maintains the equipment.

3. Private ownership of on-property equipment.

Table 1 identifies the design policy adopted by each water authority, being the Pressure Sewer Code of Australia (WSA-07) or a locally applicable supplement to WSA-07. For information, the current status of pressure sewer adoption is also given.

Table 1 Australian water authorities with pressure sewer networks

Water Authority	WSA-07 adopted	Ownership	Status / Comments
South East Water (SEW)	Yes - with MRWA amendment	Public	PSS since 2004, with >15,000 household units operating.
Hunter Water Corporation (HWC)	No - In-house design standard	Public	Recent PSS
Wagga City Council (WCC)		Private ownership with public maintenance	Generally not allowing PSS
Sydney Water Corporation (SWC)	Yes – with Sydney Water supplement	Public	Recent PSS – priority sewer program
Bega Valley Shire Council (BVSC)	Yes	Public	unknown
City West Water (CWW)	Yes – with MRWA supplement	unknown	unknown
Yarra Valley Water (YVW)	Yes – with MRWA supplement	Public	Recent PSS
South Gippsland Water (SGW)	Yes – with MRWA supplement	Public	Recent PSS
Gold Coast Water (GWC)	Yes - with SEQ amendment	Private	No specific PSS. SEQ design policy states PSS not recommended by service provider, only limited extensions of existing systems will be considered.
Queensland Water Utilities (QUU)	Yes – with SEQ amendment	unknown	
South Australia Water (SA)	Yes - with SA supplement	unknown	No PSS in last few years. Currently reviewing if SA will retain PSS as alternative to gravity.
Power and Water Corporation (PWC)	Yes - with PWC supplement	unknown	No PSS in the last 20 years

*South East Queensland Water (SEQ), Melbourne Region Water Authorities (MRWA)

Of those water authorities identified, the majority own and maintain the pump and collection tanks. The minority use a private ownership model, with Wagga City Council carrying out maintenance responsibilities on privately owned equipment.

A.1.1.3 Advantages and Disadvantages of Different Ownership Models

According to the information presented in the previous sections, it is clear that the majority of Councils in New Zealand and Water Authorities in Australia favour the public ownership model. This model has a number of benefits as outlined below:

- Centralised procurement of pump equipment, including technical specifications and technical appraisal, cost advantages via increased quantum of units, and competitive tendering practices of centralised agencies (Local Authorities) over individual householders or disparate developers or house builders;
- Efficiencies in operation and maintenance practices, including integration into existing O&M contracts and Council operations such as Customer Contact Centres;
- Standardisation of equipment across a network, for consistency in hydraulic profiles, ease of network design and for maintenance efficiencies;
- The ability to introduce 'Smart' pressure sewer capabilities with the consequent benefits in flow control (peak flow suppression and automated system flushing), remote alarm monitoring and reduced O&M costs.
- On an alarm being raised due to pump issues, if council owned, the contractor may remove the pump and replace with another pump from "stock". The removed pump is then taken to the workshop for service, whereas, if privately owned, the pump is either serviced onsite or a loan pump is placed in the tank while the original pump is brought to a service centre for service, then replaced once fixed. Servicing of a privately owned pump outside of its warranty would result in a charge to the property owner, which could delay work if payment was not ready available.
- Ability to ultimately finance pump replacement: On ultimate pump failure, the pump effectively needs to be replaced within 24 hours (based on the pump chamber holding 24 hours of flow). Under a private ownership model the householder (or landlord) would need to pay the commercial entity for the replacement of the pump prior to the pump being replaced. A number of scenarios can be envisaged where this would not occur: if the landlord is not available / contactable immediately; or if the householder does not immediately have access to cash (~$2,000) or credit facilities. It is envisaged that this would result in the council, or a council controlled entity, being required to undertake (or finance) the replacement and seek to recover the cost from the property owner. This is considered to be problematic.

However the private ownership model should not be discounted entirely. There are situations where the private ownership model is the most appropriate. The concept of 'educated' customers with regards to wastewater equipment applies. This is most commonly communities that are familiar with the requirements of onsite treatment systems (septic tanks), and in particular, retrofit areas where existing communities are provided wastewater reticulation in the form of pressure sewer to address environmental issues from septic tanks. In general terms these are smaller rural or semi-rural communities, rather than larger urban areas.

The benefits of the private ownership model are as follows:

- Removes liability from Council of the ongoing operation and maintenance of on-property equipment (other than when property owners are unable to fund pump replacement costs as identified above);
- Removes the need for interaction with private property owners and the requirement for Council-owned asset on every private property serviced by pressure sewer;
- As the property owner is responsible for the operation and maintenance of the pump, there is a financial incentive to avoid flushing elements that could damage or block it, which also reduces the overall risk to the system;

- In theory provides greater flexibility in pump selection and the action of market forces with regard to costs, however, care must be exercised to control minimum standards and maintain hydraulically compatible pump models.

A.1.2 Practices Adopted by Local Authorities

A.1.2.1 Access

The research conducted for this report has not identified any local authority that has adopted legal easements for maintaining access to on-property pressure sewer equipment.

The options for obtaining access to Council-owned equipment on private property are to rely on the provisions of the Local Government Act Section 181, or to incorporate access terms into the terms and conditions of wastewater supply agreements.

Local authorities can incorporate mechanisms within the terms and conditions of wastewater supply agreements for the recovery of costs where property owners abuse and damage on-property equipment. No information is available on the extent or frequency of cost recovery, although anecdotally it is reported that cost recovery has not been put into practice. This would likely be related to political decisions around the extent of ‘user pays’ type charging for a particular Council. It is understood that property owner abuse and damage of on-property equipment is not common, nor a significant issue. Primarily, education is an effective means of avoiding ongoing issues. Education can be assisted by the means to recover costs if particular property owners do not change their behaviours (i.e. carrot and stick anecdote).

A.1.2.2 Electrical Supply & Costs

The industry norm is for the private property owner to pay for the electrical costs of the pump. Pump power is supplied by the house switchboard. Annual power costs are relatively low ($15 to $20 per year) and are generally not an issue with property owners.

The exception to this rule would be certain areas of Parklands, Christchurch. The community was serviced by gravity reticulation pre-earthquake, which was replaced by pressure sewer. A group of property owners saw this as a reduced level of service from Christchurch City Council (CCC) and appealed the project through various Courts. This resulted in CCC placing pressure sewer equipment in road berms and supplying power directly. This case reflects more on the aspects of the earthquake rebuild, community consultation and insurance settlement issues that are unique to this example, and not typical of pressure sewer projects.

Other areas of Christchurch where pressure sewer systems were installed, receive rebates on their rates to cover electricity costs (about $25 per year).

The Himitangi Beach scheme also has power supplied directly by Council, from the public street lighting network. This is due to the scheme adopting the policy of providing a single grinder pump to service two houses instead of one.

A.1.2.3 Network Ownership

In all cases, Council maintains ownership and control of the ‘public’ network. The public network is delineated from private property by the boundary kit. The boundary kit is located on the public road reserve adjacent to the property boundary, similar to a water supply meter and stop-cock.

A.1.2.4 Developers and Design Approval

Established processes for the approval of developer-constructed networks should be adopted. Council planning mechanisms around the sizing of developer-constructed networks and allowance for upstream development should be applied. Control of staging and the coordination of provision of network capacity can then be achieved to ensure efficient and acceptable outcomes for Council.

Design standards specific to pressure sewer design and construction are required to provide a design basis for third parties (developer’s consultants) to carry out pressure sewer sizing and design. The accompanying section Design Approaches' and 'Technical Specifications' accommodate this need.

A.1.2.5 System Flushing

Pressure Sewer systems are not flushed on a regular basis. It is not uncommon to state that 'regular' flushing is required. Primarily, flushing is to address periods of population growth where initial populations are insufficient to achieve flows that can attain self-cleansing velocities. This can lead to accumulation of solids and associated odour issues.

Variable population and flows leading to odour problems is a well-established and well understood aspect of pressure sewer hydraulic design. Solids should be flushed through on a daily basis, and at the very least on a weekly basis to avoid any odour issues. Manual flushing is generally not practical or cost effective for network operators as a means of controlling odour issues in networks.

An informed design process will incorporate other design solutions to address variable flows and odours within a pressure sewer system.

A.1.2.6 Number of Properties per Pump

The industry accepted convention is for a single pump to service a single residential property. This is to ensure that the grinder pump has an acceptable service life, by maintaining low running time. It also allows traceability of abuse, responsibility for alarm monitoring to a single property owner, and simplicity of pump location issues.

The Himatangi Beach pressure sewer scheme uses a single grinder pump installation to service two dwellings. It is understood that this step was taken to ensure the project could proceed within a strictly defined funding envelope. The scheme was 'sanitary wastewater subsidy scheme' (SWSS) funded and was delivered by a design-build contractor. It is understood that Himatangi Beach has a proportion of holiday home properties, meaning a number of properties are not permanently occupied, thus reducing annual pump run times.

A.1.2.7 Demarcation of Private Ownership

Property boundary kits demarcate the public network boundary with on-property equipment. The boundary kit provides a means of isolating a property or pump from the public network.

In the case of the private pump ownership model, the boundary kit demarcates the public and private ownership boundary, and associated liabilities for repair and maintenance. The boundary kit is publicly owned, while the pipe discharging into it is privately owned.

In the case where the on-property equipment is owned by the Council, the demarcation point is taken as the point where the gravity lateral enters the grinder pump tank. The private property owner maintains responsibility for the private lateral from the gully trap to the grinder pump tank.

A.1.2.8 Pump Ups

Some properties within gravity reticulation areas cannot discharge to the reticulation by gravity, due to the local topography, or due to the building platform being below the invert of the gravity line. In these circumstances, the property may install a private pump station to 'pump up' to the existing gravity reticulation. The requirements and specifications of these types of private pump stations differ from pressure sewer systems. A definition of a pressure sewer system should be developed by Council to differentiate from existing private 'pump up' pump stations.

The recommended definition is:

> *Properties that have (or are planned to have) gravity wastewater reticulation at or adjacent to the property boundary, but for what-ever reason cannot discharge to that gravity reticulation by means of a gravity lateral connection and requires a pump to discharge wastewater to the gravity reticulation.*

Alternatively, GIS areas or planning maps can be used to define ‘pressure sewer areas’. Via planning maps, Councils’ policies and specifications for pressure sewer equipment can then be legally applied to defined geographical areas.

A.1.2.9 Spas and Swimming Pools

Spas and swimming pools can have discharge flowrates and volumes that can overwhelm a domestic pressure sewer unit. Flow buffering or flow restrictions are required to be installed if spas or swimming pools are to discharge to a pressure sewer unit. This should be addressed within design standards adopted by Council and require specific design on a case by case basis, to the satisfaction of the relevant Wastewater Infrastructure Manager of that Council.

A.1.3 Adoption Process

There are similarities in the process in which New Zealand authorities have adopted pressure sewer. The work completed for these guidelines has attempted to identify and compile the best practices in terms of the adoption process. The following list is the recommended outline process for the adoption of pressure sewer for use by local authorities in New Zealand:

- Initial investigations and preliminary assessment of pressure sewer systems – usually driven by a need for either alternative reticulation technology or a rethink of planning and provision of infrastructure processes
- Preliminary policy assessment
- Preliminary assessment of technical feasibility and cost benefits
- Develop policy paper
- Determine policy position
- Formerly adopt a Policy Position (i.e. Council ratifies Pressure Sewer Policy)
- Develop robust design requirements and framework (based on these Water NZ Good Practice Guidelines – Design Approaches)
- Establish robust technical specifications for pressure sewer equipment (based on these Water NZ Good Practice Guidelines – Technical Specifications)
- Update existing standards to accommodate pressure sewer (i.e. incorporate Water NZ Good Practice Guideline documents into existing Council Standards & Specification documents)
- Pass any Bylaws that may be required, in accordance with the Council Policy Position adopted
- Roll out pressure sewer implementation on a Council project. An initial pilot-project may be warranted.

A.2 Installation Responsibility Options

Installation responsibilities are dependent on the ownership model, which gives rise to two options for this section.

A.2.1 Option 1 – Private Pump Ownership

Under the private ownership model, the property owner is responsible for selecting and purchasing the grinder pump and associated on-property equipment usually from a list of pre-assessed pumps defined by the system designer and approved by the Council. Under this option, the property owner (or their representative, such as a residential builder or building company) is primarily responsible for the installation.

The public reticulation from the point of supply, including the boundary kit is designed, installed and vested to Council by the developer. There is a requirement, to ensure the effective operation of pressure sewer equipment, that the installation is carried out in accordance with the equipment supplier's requirements. There is also a requirement to ensure the installation is carried out to minimum acceptable standards such as the building code, electrical standards, and standards dictating sanitary drainage work.

In general, the majority of standards compliance requirements are addressed by the building consent process and requirements for Producer Statements. Councils will need to establish standards and guidelines for aspects of the on-property installation that are not covered by existing standards, or will need to make formal reference to particular existing standards as part of Council requirements. Aspects to consider are particular local or bylaw type requirements for the installation of pressure sewer equipment. An example of this is the suitable location of tanks, i.e. minimum access requirements, offsets from boundaries and from structures, so that buried assets do not undermine structures on the property. This is addressed in the Water NZ Good Practice Guideline documents.

In reality, the suppliers (who are in the business of selling pumps) contract various local drain layers to carry out installations on their behalf. Reputable suppliers maintain responsibility for the commissioning of their equipment, and for approval of the installation (for their purposes, i.e. to ensure reliable pump operation post-commissioning). The supplier is typically contractually required to issue a warranty certificate.

Payment is made directly from the property owner to the equipment supplier / installer. This process is independent of the Council. Payment of any Council network connection fees or developer charges is resolved separately between the property owner and Council at the time of live connection to the network.

A.2.2 Option 2 – Council Pump Ownership

Requirements for installation responsibilities under the Council ownership model can vary dependent on the nature of the installation, being greenfield development, or a Council-delivered reticulation of an existing community (septic tank backlog project).

Under the Council-delivered project model, it is assumed that the Council has procured pressure sewer equipment based on a range of technical and track record attributes in addition to commercial terms, and that the type and supplier of pressure sewer equipment is known. Alternatively, under the vested assets model (alternative three below), Council may refer to a list of pre-approved equipment suppliers in the same manner as the private pump ownership scenario.

A.2.2.1 Alternative One – Full Council Installation

This alternative involves Council's O&M contractor, or a specifically appointed contractor, carrying out the full on-property installation. This gives Council full control of all aspects of the installation, including quality, documentation and payment.

This alternative is in general the standard method across New Zealand of installation for retrofit contracts, where existing areas are serviced by pressure sewer, either to replace an existing failing wastewater reticulation, or to provide wastewater reticulation for a community using existing septic tanks. Generally, a construction contract is tendered specific to the project, with a dedicated contractor appointed to deliver the project works.

Where Council has an established and capable 'New Connections' contractors, i.e. an O&M contractor that regularly carries out water supply connections and gravity lateral connections, then this installation alternative can also be applied to greenfield developments and other new builds as appropriate. This option assumes a contractor with suitable resources and skills is available to the Council, such as an existing O&M contractor under an existing contract.

The Council (or the O&M contractor) maintains a contractual relationship with the equipment supplier for the purposes of commissioning equipment. It is assumed that the supplier physically carries out the pump commissioning so that warrantee certificates can be issued on the respective supply contracts.

A.2.2.2 Alternative Two – Partial Council Installation

This alternative is primarily relevant to the greenfield / new build scenario. Under this alternative, Council supply the pressure sewer equipment for the builder or building company to install. The Council maintain responsibility for inspection and approval of the installation, and for the commissioning of the equipment, which should be in conjunction with the equipment supplier for the purposes of warrantee certificates.

Efficiencies are seen under this alternative to avoid multiple trades mobilising to site and the additional project management and overheads of new build connections. Primarily, competent builders and building companies can handle aspects such as the tank installation and plumbing connections while their plumbers / drain layers are on-site carrying out other works. The wiring and electrical work is carried out by the one electrician while the remainder of the house is being wired.

Payment is controlled by the Council in coordination with making the final network connections. This alternative gives the Council flexibility to adjust the connection cost if the builder carries out the primary physical installation, or alternatively if the Council O&M contractor carries out the installation.

A.2.2.3 Alternative Three – Assets Vested to Council

This alternative applies to greenfield developments and new build situations such as infill housing. The developer or building company purchases pressure sewer equipment directly from the supplier, installs the equipment and manages all aspects of consenting through the existing building consent for the property in question. Cost savings are achievable by the building company using trades already on-site to carry out all tasks required. The on-property equipment is then vested to Council, along with other public infrastructure. While the normal processes for vesting of assets to Council for greenfield developments can apply, some minor adjustments to the process are required to align with practical points of house construction and occupation occurring at different times to public infrastructure completion and hand over. This refers to the different timings of signing off and accepting subdivision infrastructure, which enables the construction of residential housing. Installation of on-property assets will occur after installation of public assets in a development. There is then an additional stage when live connections are made and properties are occupied (i.e. commissioning of on-property equipment).

Under this alternative, the developer or building company pays for the on-property equipment, in addition to other developer contribution charges and connection fees. Technical specifications and pre-approval of on-property equipment is required by Council to ensure that Council adopts ownership of suitable and quality equipment. To enable commercial tension and ‘efficiency of pricing’, more than one supplier is generally required to be approved by Council.

A.3 Operation and Maintenance Responsibility Options

The operation and maintenance responsibilities of the on-property equipment are clearly delineated by the ownership model. The advantages, disadvantages and risks of the ownership model are heavily influenced by the O&M responsibilities.

A.3.1 Option 1 – Private Pump Ownership

Under the private pump ownership model, the private property owner is entirely responsible for the operation and maintenance of on-property equipment. The basic premise of this model is that the pressure sewer pump is treated the same as any other domestic electrical appliance. As such, it is designed to run to failure, and when it ultimately fails, a new one is purchased to replace the previous one. This is the same way any TV, fridge or washing machine would be replaced if they fail in service. In most cases, however, an alarm event for an issue with a pump is something which can be serviced and the owner is not required to purchase a new pump-set.

Preventative maintenance is not expected to be carried out. It is noted that established pressure sewer pump brands do not require preventative maintenance, and are designed to run to fail for residential applications. This is primarily to reduce O&M cost, and because, in domestic applications, market leading brands have demonstrated a track record of acceptable running life to 'first failure', provided good practices specified by Council are followed by property owner (i.e. no flushing of inappropriate items or stormwater discharge into the pump pit).

The ownership model has potential benefits in that it technically absolves Council of any responsibility (and risk) for a large number of mechanical and electrical items (pumps and wiring) in the community. The property owner typically liaises with the original pump supplier in the event of a pump failure.

In the event that the original pump supplier is no longer in business, this may leave the property owner either unable to restore wastewater service in a timely manner (unable to service the pump), or the property owner is faced with increased expenditure in replacing the pump and other items of the installation with another brand, considering the required retrofitting labour.

There are wider risks to the community as a whole under this option. Situations where one brand of pump fails in a widespread manner may cause loss of service issues within a community. The commercial failure of a pump supply company (i.e. bankruptcy or withdrawal from the market) may 'orphan' a number of pumps within a community. In the event of a pump failure, the property owner may be up for additional expense of a new pump from a different supplier, and retrofitting of other components, such as a control panel.

There is also a risk in certain socio-economic areas that property owners will not be able to afford a pump repair or replacement.

There is a possibility that a loss of wastewater service (pump failure) at a property will lead to a public health risk, such as an on-property tank overflowing with wastewater. This could happen due to the property owner not being available or not having the capacity to prevent or react to this situation in a timely manner. In the event that a public health risk does occur, the Council is obligated to address and remedy the situation. In this regard, the Council still carries the risk of any substantial failures of on-property pressure sewer equipment within a community even if the equipment maintenance is the property owner's responsibility.

To address this in part, the former Rodney District Council offered a hardship grant, where the Council would loan property owners money to purchase pressure sewer equipment, and that loan was secured against the property, in a similar way to a rates debt. Upon sale of the property, the Council had a mechanism to ensure repayment of the loan.

Practices for the management of O&M maintenance varies between pump suppliers. It is known that some suppliers maintain a 0800 number and an after-hours response capacity Standard industry / local authority requirements for on-property storage is for a minimum of 24 hrs volume of wastewater. This does afford a degree of flexibility to the response and rectification times for pump faults.

Cost and payment vary and will be dependent on warrantee and commercial terms.

A.3.1.1 Coordination of On-Property and Network Faults

When an unexpected issue occurs in the network, which causes several alarms to trip at properties, the owners will contact their service agent. If the service agent receives a spate of alarms, they then need to make contact with the Council network operator (via the Council's public contact avenues). This could mean a significant time lag between the issue occurring and Council being informed.

A.3.2 Option 2 – Council Pump Ownership

Under the Council pump ownership model, the Council assumes full responsibility for the operation and maintenance of the on-property equipment. The on-property equipment is treated as any other Council infrastructure asset and adopted into various asset management systems. Primary elements to consider are:

- Property owner interaction, methods of contact and fault management.
- Right of Access, specifications and guidelines for the installation, access to and maintenance of on-property equipment.
- Maintenance capabilities, incorporation into existing O&M contracts, and interactions with equipment suppliers and warrantee requirements.

A.3.2.1 Property Owner Interaction

Local authorities in New Zealand generally have well established methods for contact from residents and property owners. These methods are primarily 0800 numbers or email enquiries. This covers a wide range of general Council enquiries. It is assumed Councils have existing contact lines and internal management systems for infrastructure faults such as water supply leaks, burst pipes, blocked or overflowing wastewater pipes, displaced stormwater manhole lids, etc.

In general, the adoption of responsibilities for on-property pressure sewer equipment can be incorporated into existing customer contact and response systems. Resourcing of existing systems should not be significantly impacted but should be considered with respect to the scale and number of pressure sewer installations.

Arrangements for after-hours response should be considered. Councils either maintain an after-hour call centre capability (i.e. to 8 pm) and / or after-hours calls are handled by security firms (as for other Council assets). Generally, the security firms have a response protocol (response and escalation flow chart) and contact details of Council's O&M contractors. Should the need arise, it is assumed the Council O&M contractors have the capability to respond after-hours.

However, systems are generally tailored to enable a physical response the following day, by a combination of the 24 hrs on-property storage volume, and education of property owners. Education of property owners generally involves a 'Property Owner's Manual' for the onsite equipment, a one page FAQ's sheet covering alarm silencing and 'What to do' details, such as minimising water use.

A.3.2.2 Right of Access, Specifications and Guidelines

Specifications and guidelines regarding the placement and location of on-property equipment is largely the same as for the private ownership model (i.e. proximity of tank to boundaries and structures), however ease of access requirements generally need to be strengthened in the Council's favour to ensure sufficient access for O&M contractors.

Right of access to Council-owned equipment is a primary consideration. New Zealand local authorities can incorporate a right of access to the private property within the wastewater service agreement. This type of access clause is well established within the utilities industry such as power companies, for meter reading, meter inspection or meter replacement. To paraphrase, the contract terms read along the lines of:

"By accepting this wastewater service you agree to the terms and conditions of this supply agreement, including the right for the Council to enter your property for the purposes of access and maintaining the wastewater equipment".

Guidelines need to be established and documented regarding time of access (i.e. 8 am to 5 pm Monday to Friday) and notification requirements.

Additionally, Council may utilise provisions within the Local Government Act Section 181 that grant Council power to construct works on or under private land that it considers necessary for wastewater services.

Legal Easements are not normally used for accessing pressure sewer equipment. Legal Easements require a number of steps and tasks which add cost and complexity to ensuring access, but generally do not improve legal access rights over supply agreement terms and conditions or the Local Government Act provisions.

Supply agreements can also be used to allow provision for recovery of costs in certain circumstances, for example, the repeated abuse of equipment, or obstruction of access by constructing sheds or decks over equipment.

It is noted that wastewater supply agreements are the least difficult to establish where water and wastewater services are charged separately to rates, or as separate items with a rates assessment.

Section 181 of the Local Government Act is the preferred mechanism for securing rights of access by New Zealand Councils that have adopted pressure sewer.

A.3.2.3 Maintenance Capabilities

Any existing O&M arrangements for gravity wastewater reticulation should be sufficient for incorporation of a suitable pressure sewer maintenance capability. The primary requirements for maintenance capability is a trained wastewater operator and a suitable vehicle. Grinder pumps can usually be lifted by one person but are considered a heavy lift. Small winch trolleys are available to aid handling and remove manual handling risk, and can be supplied by pump suppliers.

On-site servicing should not occur. On-property equipment should be designed to allow the efficient swap out of pump units, including quick-disconnect discharge lines and power supplies. Level switches and similar appurtenances should all be integral to the pump unit, or designed to be swapped out efficiently. In the event of any pump fault, the whole pump unit should be able to be pulled out and a spare unit installed to restore wastewater service promptly. This also minimises the time wastewater operators are on private property.

O&M contractors should carry a small number of spare pumps to enable prompt swap out of faulty pumps. Faulty pumps can then be returned to the supplier for repair or replacement as appropriate. A number of local authority O&M contractors have established an in-house servicing capability. Pump suppliers can carry out servicing training and provide a test rig local authority O&M contractors.

Contractual arrangements for supplier servicing capabilities are contract specific. A 2-year pump warrantee is the industry standard in New Zealand. Longer warrantees, up to 5 years, are available. Particular terms can be specified at the time of procurement, to Council’s preference.

A.4 Policies Adopted by Local Authorities

This section outlines different pressure sewer policies that have been adopted by local authorities.

A.4.1 Christchurch City Council (CCC)

A.4.1.1 Installation Responsibility

The installation responsibility varies dependent on the type of project. For earthquake rebuild projects and reticulation of existing communities, CCC take full responsibility for, and physically deliver the on-property installation. In the case of rebuild work, this is delivered by short-listed contractors. For reticulation of existing communities, such as the Charteris Bay wastewater scheme (removal of septic tanks), CCC procured dedicated contractors through competitive tender.

For greenfield or new build connections, the building company purchases equipment, carries out the installation and vests the on-property equipment to CCC.

A.4.1.2 O&M Responsibility

CCC own all on-property equipment and maintain O&M responsibility. This is carried out by their O&M contractor, City Care. City Care carry out in-house servicing of most pumps.

A.4.1.3 Procurement & Pump Pre-Approval

CCC have previously carried out competitive tenders for on-property equipment design. CCC currently have two approved pump suppliers.

A.4.1.4 Smart Pressure Sewer

CCC are an early adopter of smart or advanced pressure sewer in New Zealand (i.e. pressure sewer with full telemetry control, hydraulic flow control, peak shifting and remote alarm monitoring). This is being applied primarily in greenfield developments, including 5,000 properties in South East Halswell and 1,400 properties in Upper Styx.

CCC are also using smart pressure sewer for remote alarm monitoring of duplex pump units in earthquake rebuild applications, including commercial applications, and in residential areas were property owners objected to on-property pressure sewer equipment through a district court process.

A.4.1.5 Building Consents and Producer Statements

In the greenfield and new build applications, the building companies are responsible for all aspects of the building consent. Drain-layers are required to supply producer statements – PS3.

Pump suppliers are not required to supply a producer statement for equipment. Pump warrantees are required, which are vested to CCC. It is understood that CCC's procurement and pre-approval process has addressed all aspects that a producer statement would address with regards to the pump and equipment.

A.4.2 Watercare Services Ltd

A.4.2.1 Installation Responsibility

Watercare have adopted the private pump ownership model. As such, all on-site installation responsibilities fall onto the property owner or building company.

Watercare have not recently delivered any retrofit projects (at the time of writing this report) and all new pressure sewer installations are related to greenfield or new build connections.

A.4.2.2 O&M Responsibility

O&M responsibilities are managed privately between the property owner and equipment supplier. Historically, the former Rodney District Council did require that a service agreement exist between the property owner and pump supplier. In the case of pumps designed to run to fail, this service agreement was superfluous.

No formal arrangements exist between Watercare and pump service agents. It is unknown if all of the approved pump suppliers in the area maintain after-hours call capability. Pump faults relating to network issues are communicated to Watercare via the normal public fault contact lines.

A.4.2.3 Procurement & Pump Pre-Approval

Watercare is a council controlled organisation and provide water and wastewater services on behalf of Auckland Council. This means that building consents are lodged with Auckland Council. Any aspects of the consent are then referred to Watercare as appropriate.

Watercare require Compliance Statements for design and construction of pressure sewer installations and equipment to be certified from the supplier. Watercare maintain an ‘accepted materials’ list which includes pumps suitable for use in pressure sewer systems, as well as pumps suitable for other applications.

A.4.3 Rotorua District Council

A.4.3.1 Installation Responsibility

Rotorua District Council have adopted the Council pump ownership model. Rotorua pressure sewer schemes primarily provide reticulation to existing communities serviced by septic tanks. As such, Rotorua District Council take full responsibility for on-property installation. This is delivered by construction contractors procured for each project.

A.4.3.2 O&M Responsibility

Rotorua District Council own all on-property equipment and maintain O&M responsibility. This is carried out by their O&M contractor. Some in-house servicing is undertaken. A small number of spare pumps are maintained, with the equipment supplier undertaking more specialised pump servicing as required.

A.4.3.3 Procurement & Pump Pre-Approval

Rotorua District Council have previously conducted competitive tendering for on-property equipment.

A.5 Summary

The different ownership models for installation and Operation & Maintenance presented in these guidelines should provide the councils interested in developing pressure sewer systems an overview of them as implemented by different Councils in New Zealand. The decision on which ownership model to adopt needs to take into account the particular requirements of each location, whether it's a retrofit or greenfield project, as well as installation and O&M costs. In some projects, there can be enough savings in installation and maintenance costs to provide Council ownership and maintenance of the pumps at an equal or lower cost of a traditional collection system without passing costs and additional responsibilities to property owners.

Draft Public and Private Ownership Policy templates are provided in Appendix B and C, to assist Council.

Part B – Design Approaches

B.2 Design Approaches

B.2.1 General Considerations

Prior to the decision to install a pressure sewer system, the feasibility of servicing the catchment using gravity should be carried out. As gravity is the oldest and most widely used collection system as well where the bulk of experience from Councils or Water Agencies and contractors resides, it is the default choice. Other collection systems are acceptable only when shown that the catchment cannot be best serviced by gravity and the use in particular of a pressure system is proven as the best alternative.

Among the aspects that define the best way to service a catchment come the knowledge and experience of the design engineer, the characteristics of the area to be serviced (extension, number of properties, terrain, existing services, etc.), Council or Water Agency requirements and restrictions and capital, operation and maintenance costs.

The maintenance and ownership model of the property pumps to adopt rests with the Council or Water Agency. As detailed in the Ownership Model & Policy section, there are several ownership models available. The decision to put these responsibilities and costs on the property owners can affect the overall efficiency and operation of the system (e.g. response times to unexpected problems, inflow and infiltration from properties into the network) if the users have not been properly educated in the adequate operation of the pump system.

The NPV for cost comparison of collection systems must consider the expected life of the equipment. This is due to the requirement of pressure systems to replace property pumps as they reach their life expectancy of 15 to 20 years, although some pumps have reportedly been operating for over 30 years. Experience and knowledge of the design engineer is important at this stage, as operation and maintenance costs for alternative collection systems tend to be over-estimated due to the reduced bibliography available in comparison with conventional gravity systems.

The design requirements and methodology chosen can also have a significant impact in project design time and cost, as well as construction cost. More information on these methodologies is detailed in the following sections.

B.2.2 References

The Pressure Sewerage Code of Australia is the main standard used in New Zealand and Australia, but it does tend to lack specificity and is now over 10 years old with no update. As such, the majority of Councils or Water Agencies have adopted local amendments (regional variations) to address various aspects and region-specific requirements.

Links to the sources of reference documents is included in Appendix A

B.2.3 Key Design Aspects

There are various requirements for the correct design of a pressure sewer system, which include velocities, retention times, system layout, service clearances, pipe cover, flushing schemes, property connections, etc. This section presents a summary of the key aspects for design of the system.

B.2.3.1 Design Criteria

Design of the pressure sewer system is to allow for individual pumps and collection tanks to be located within each property and should be designed to the following criteria:

- Design flow based on Average Day Flow (ADF)
- Maximum total dynamic head (TDH) of 55 metres
- Pressure sewer pipeline material to be polyethylene pipe
- Solids self-cleansing velocities to be achieved daily
- Minimise pipe length and diameter, as much as practical, to reduce retention times
- Velocities to be maximised within the design constraints specified in this section
- Discharge manhole to be the highest elevation in the system such that the pressure sewer pressure pipelines remain full at all times
- Design should be carried out for each stage of the project, not just ultimate development

Pipe diameters of DN 50, 63, 75, 90, 110 and greater may be specified within the pressure sewer network, based on PE 100 PN 16.

The minimum on-property pipe size is DN 40. The minimum pressure sewer main (off-property) size is DN 50.

As with any design, care needs to be taken when working at the extremes of normal system operation. For example, the standard semi-positive and turbine pump technologies have a near vertical pump curve, which is why standard output flow can typically be adopted. However, when designing a system that will primarily operate at one end of the pressure range, the pump curve should be checked to see what the actual pump output is likely to be.

B.2.3.2 Velocity

Low velocities in the pressure main can occur if the catchment will is to be developed in stages, as is typical in New Zealand.

The maximum velocity should ideally be below 2.5 m/s to reduce frictional losses and water hammer effects. The maximum should not be greater than 3.5 m/s in any circumstances.

The minimum velocity to achieve self-cleansing at peak daily flow is typically stated to be 0.6 m/s, with 0.9 m/s preferred for public reticulation. This should only be relaxed for situations were a limited number of properties are connected at the extent of a system via a 50 mm pipe, or where a sufficient Shear Force (greater than 1.6 Pascals) can be demonstrated.

Where the minimum velocity is not achieved, an appropriate mitigation measure is to be identified to manage sedimentation. Examples of these measures are:

Flushing

Force flushing of the network for temporary mitigation during early stages or prior to compliant development, although considered a fall-back option.

Duplicate pipelines

Duplicate pipelines with one pipe initially isolated to reduce detention times and increase velocities during buildout phase. The use of a dynamic hydraulic model, verified on a routine basis from data collected from a flow meter and pressure sensor, will allow system performance to be understood and the duplicate line to be commissioned at the appropriate time.

Pre-programmed pumping times

Pre-programmed pumps during the first stages of the development to activate at set times and provide daily self-cleansing flows in the network.

Note: this requires a programmable control panel. This includes the facility to operate pumps such that a given volume is retained in the pump chamber until a given time, with pumps then being set to operate simultaneously, and for the pump to operate if the level exceeds the pre-determined level, reducing the level to the pre-determined level, to maintain an emergency storage volume.

B.2.3.3 Retention Times

The system should be designed so that average retention times are ideally below four (4) hours at **any stage of the development**, but certainly be less than eight (8) hours.

Where average retention times are predicted to exceed four (4) hours, specific measures should be identified as to how odour and septicity issues are to be managed for protection of the downstream infrastructure.

Examples of such mitigating measures are:

Duplicate pipelines

Duplicate pipelines with one pipe initially isolated to reduce detention times and increase velocities during buildout phase. The use of a dynamic hydraulic model, verified on a routine basis from data collected from a flow meter and pressure sensor, will allow system performance to be understood and the duplicate line to be commissioned at the appropriate time.

Development controls

Phased development of the whole site to ensure maximum retention times are not exceeded during buildout.

Upgrade of downstream infrastructure

Upgrade of all affected downstream infrastructure to mitigate impact associated with odour and septicity. This potentially includes receiving manholes to be constructed in GRP, Polyethylene or HDPE lined concrete to resist chemical corrosion.

Chemical dosing

Use of chemical dosing where retention times exceed eight (8) hours for protection of downstream infrastructure.

Where chemical dosing is identified as being required, the option should be fully detailed and costed within the design report.

Forced ventilation

Forced ventilation should be provided at the receiving manhole with an airflow rate equal to, or greater than, the maximum wastewater flow rate into the manhole. Air should be discharged via a suitably designed and approved odour filter.

B.2.3.4 System Layout

The network must have a tree like (or dendritic) structure, avoid loops and prevent backflow with non-return valves at key junctions. The layout should minimise length of pipes and consider the topography constraints of the catchment. For details on vertical alignment, see section B.2.3.5.

Network mains should be located in public road reserve, with the exclusion of road crossings. The preference is to have a single main within a street, rather than one for each side. To minimise the number of service crossings, boundary kits may be paired and serviced with a single DN 50 service crossing. Single boundary kits service connections should be DN 40.

On significant roads or where multiple services are required to be crossed, pressure sewer rider mains may be used in order to reduce the number of service connection crossings. Hydraulic calculations should be completed to confirm that the hydraulic design criteria are still met for rider mains.

Isolation valves should be located on both upstream legs of each three way branch tee. Isolation valves should be located such that no more than 50 properties are isolated with a valve or set of valves.

Maximum extension of the pressure sewer network is not specified. However, the designer should demonstrate that minimum velocities and maximum retention times are achieved with pressures not exceeding 55 metres. This applies to all stages of the development.

B.2.3.5 Vertical Alignment

The discharge location into the gravity reticulation should be the highest point in the pressure sewer system such that all pipes remain full at all time, including when no pumps are operating.

Vertical alignment must consider requirements for air entrainment and air and scour valve locations.

Air entrained in the pressure sewer systems presents a risk of reduced system efficiency due to increased head losses. The vertical alignment should be designed to control air entrainment and removal along the pressure sewer profile. The networks should be designed to avoid the need for air release valves if practical. Falling pipe sections (where the pipe empties out if no pumps are operating) are to be avoided as much as practicable.

Where air release valves are to be used, odour control such as activated carbon or soil filters should be considered, especially where the air valve is close (within 50m) of a property.

The option to construct a “barometric loop” to ensure that the discharge point is the highest point in the network should be considered where the invert level of the discharge manhole is not the highest point in the network.

The recommendation is to avoid the requirement of air release/vacuum break valves for simplicity reasons and to reduce the requirement for odour control in the network.

It is noted that air release valves require a minimum pressure within the pipeline to remain closed and sealed. The required pressure can vary from 0.5 to 5 metres, dependant on the make or manufacturer of the unit. The designer should check that a suitable air valve has been specified where one is required

B.2.3.6 On-property Equipment and Connections

It is recommended that each dwellings is to be serviced by an individual pump. No pumps should be shared by multiple properties or housing units. Pumps and tanks should be located in private property and fitted with a control panel with an alarm system configured based on the pressure system design.

Tanks should provide a minimum of 24 hours storage capacity in the event extended power outages or system down-time.

Boundary kits should be located on the public side adjacent to the property, within the road berm. Where multiple connections (up to 6) originate on a single property (e.g. subdivision) a bulk boundary kit should be used and installed.

Ideally property boundary kit, (including the check valve, flushing/inspection tee, ball isolating valve and enclosure), should be supplied by the same manufacturer as the pump unit system, however, it is noted that this is not always feasible, with boundary kits being installed separate to household pump units.

B.2.3.7 Monitoring and Control

Flow Meter

A flow meter, and associated data logger, is recommended and should be located at or near the discharge of a pressure sewer system into a gravity network, downstream of the final connection. Vertical alignment must ensure that the flow meter, and associated upstream and downstream pipework, remains surcharged at all times and that any air within the pipeline is expelled prior to passing through the meter. A minimum of ten and five diameters of straight pipe should be provided upstream and downstream of the meter respectively.

Pressure Transducer

A pressure transducer and associated data logger is also recommended and should be located at or near the most disadvantaged pump in terms of total dynamic head in the pressure sewer system.

Pressure transducers can be located at flush points and can be relocated as a network expands.

A minimum of one pressure transducer is recommended for every 100 properties.

Household Units

Primarily two Household Control Unit options are available: a basic unit or a Smart Panel. The basic unit operates the pump on level control and provides a local alarm if a fault in noted or the pump cannot keep up with the inflow. A Smart Panel allow data to be collected and stored, the pump to be programmed to operate at particular times and potentially operated remotely.

It is recommended that household pump control units (Smart Panels) are specified that include the facility to record and store data including: real time clock (date and time) and pump status (on and off), or the ability to upgrade to the above without the need to replace the complete unit.

The network flow meter allows average household flows to be determined to confirm, or otherwise, whether there is any significant inflow or infiltration. If flows are significantly higher than anticipated and/or there is a noted response to rain events, individual pump units can be interrogated to determine which unit is pumping significantly more than anticipated, if the control panel saves the required data, and the issue pinpointed. High inflow or infiltration can also be identified by a basic unit alarming on a regular basis where the pump is unable to keep up with inflows and the level in the chamber rises above the alarm level.

Additionally, depending on the complexity of the development (multiple stages, low flow velocities, high retention times), the design may warrant the installation of remote monitoring and/or control capabilities of on property pumps to allow full control of the systems operation.

This currently includes systems such as the Iota OneBox® system or the Aquatec OmniSmart controller.

These instruments allow for online network monitoring and problem troubleshooting such as leaks, blockages, infiltration and inflow in the network as well as provide inputs for modelling future system expansions and pump replacements.

B.2.3.8 Connection to Rising Main

A pressure sewer network should not be connected to wastewater pump station rising main unless instructed / agreed by Council and that the Wastewater Pump Station and rising main have been explicitly designed to allow the pressure sewer network to connect to the rising main. In all cases this option should be modelled using a dynamic model, including the main wastewater pump station and rising main.

B.2.4 Design Methodologies

As outlined within WSA-07, the design flow rate can be estimated using one of three methods, being:

- Probability Method
- Rational Method
- Dynamic Modelling

A number of factors should be considered when selecting the appropriate design methodology. This includes variables, such as topography and the property mix, as well as the proposed transitions from initial, intermediate and ultimate development conditions.

However, it is also recommended that a dynamic model be required as part of the Operation and Maintenance Manual, linked to flow and pressure data collected during operation, to allow operators to confirm that the system is operating as designed and allow issues to be identified and resolved.

Average daily flow (ADF) should be based on the Council or Water Agency design criteria. The designer should confirm the design methodology and the basis for establishing the ADF. Peak flows should be based on average dry weather flow (ADWF) with an added capacity safety factor of 1.2 per dwelling unit.

Flow estimation is based on the accumulated number of individual pump units discharging to a particular segment of the trunk main. The peak flow within a particular segment of the main is dependent on the accumulated number of pumps connected to that segment. Due to the nature of pressure sewer systems, the total peak flow at a pipe segment is not the sum of peak flows from the upstream segments.

It should also be noted that for a system of more than ten dwellings that will not be fully developed at one time (all properties completed and occupied within 6 months) a dynamic pressure sewer hydraulic model is recommended.

For each design section, the minimum build-out point must be established. This represents the minimum number of connected properties required to achieve self-cleansing velocity and maximum retention times.

B.2.4.1 Criteria for Design Methodologies

Both the Probability and Rational design methods can be considered ‘simple’ or spreadsheet-based design methods.

The use of the Probability and Rational design methods is limited to very simple catchments. This is defined as:

- Residential only, assuming single house lots with one pump per dwelling.
- With consistent loading rates and diurnal patterns across the catchment.
- Catchments with pumps giving consistent head – flow curves of a near vertical nature.

These methods are also considered beneficial for use during the concept design phase to develop provisional layouts and cost estimates.

For detailed design of all but the most simple networks, dynamic hydraulic modelling is recommended.

The Probability and Rational design methods can offer a quick analysis, but cannot account for different diurnal patterns or varied pump performance. Therefore, for other than the simplest catchments with all pumps being provided by the one supplier and of the same make / model, dynamic modelling should be used.

Dynamic modelling can provide a more optimised design by improving pipe size, allow system to use a mixture of centrifugal and progressive cavity pumps and allows the modelling of a smart system. Dynamic models can also be used to allow analysis of the performance of systems, once constructed and in operation. It is recommended that dynamic modelling is required for all but very minor pressure sewer networks.

Under all design methods, sensitivity analysis should be undertaken, as defined in Section B.2.6.

The following sections provide additional details on these methodologies.

B.2.4.2 Probability Method (number of pumps operating)

The Probability Method is an empirical relationship between the number of accumulated pumps in a segment of pipe, and the statistical number of pumps expected to run simultaneously to give the maximum flow. The estimated pump flow rate is multiplied by the expected number of simultaneous pump operations to give the expected peak flow rate. Refer to Table 2 - Maximum Simultaneous Pump Operations for the Probability Table.

The designer is responsible for estimating the pump flow rate based on knowledge of pump models to be installed in the catchment, system parameters such as total dynamic head, and in conjunction with sensitivity analysis as outlined in Section B.2.6.

Table 2 - Maximum Simultaneous Pump Operations

Number of Pump Units Connected	Maximum Daily Number of Pump Units Operating Simultaneously
1	1
2-3	2
4-9	3
10-18	4
19-30	5
31-50	6
51-80	7
81-113	8
114-146	9
147-179	10
180-212	11
213-245	12
246-278	13
279-311	14
312-344	15
345-377	16
378-410	17
411-443	18
444-476	19
477-509	20

(Adapted from E-One Low Pressure Sewer Systems Using Environment One Grinder Pumps LM000353 Rev A)

It has been suggested by various parties that this method is very conservative resulting in pipes being oversized, leading to increased retention times (resulting in odour and septicity issues) and low velocities. It is however, considered a useful tool for initial / concept designs.

A varying topography and multiple network layout changes may require multiple iteration of pipe sizes until an adequate system performance can be achieved.

As stated in the previous section, this method assumes that all pumps produce an equal and constant flow (progressive cavity pumps) and does not cater for non-residential flows, multiple properties connected to a single pump, or alternative pressure sewer pump technologies.

B.2.4.3 Rational Method (flow rates)

The Rational Method is based on a linear equation to estimate the peak flow rate based on the number of accumulated pumps:

$$y = ax + b$$

Where:

y = total flow (L/s)

a, b = proprietary coefficients

x = number of accumulated pumps

Table 3 - Rational Method – Design Coefficients

Rational Method Coefficients for PS modelling *y* (L/s) = *ax* + *b*				
	High Flow (975 L/property/day and 0.7 L/s)		Low Flow (540 l/property/day and 0.4 L/s)	
No. Of Houses (*x*)	*a*	*b*	*a*	*b*
0 - 50	0.0510	1.0534	0.0348	0.9485
50 - 100	0.0363	1.7716	0.0184	1.7333
100 - 150	0.0271	2.6781	0.0124	2.3068
150 - 200	0.0219	3.4462	0.0130	2.1902
200 - 250	0.0191	4.0051	0.0164	1.5103
250 - 300	0.017	4.5335	0.0186	0.9910

Source: GHD Ltd: Proprietary Rational Method Coefficient developed from Dynamic Modelling (based on e-one pump)

The coefficients for the Rational Method are specific to pump flow rate characteristics and loading rates. Generally, coefficients relevant to particular pumps can be supplied by those pump suppliers.

The above table is based on a pump that operates at 0.4 L/s at 55 m head and 0.7 L/s at 10 m head.

Being a “linear” equation, predicted flowrates cannot be extrapolated across a wide number of properties. The designer must state the number of properties (range of total number of dwellings) for which the site-specific rational equation is accurate. Care must be used to ensure that an accurate range of total properties is used and not exceeded. As with the Probability Method, this method does not cater for non-residential flows and considers consistent loading rates and diurnal patterns across the catchment.

Non-linear or polynomial relationships for the Rational Method can be developed for specific applications. Non-linear equations have a wider range of applications than linear equations. Such equations are proprietary in nature and can be developed by dynamic modelling for specific applications, such as assessing loading rates that are both higher and lower than those prescribed by the Council or Water Agency design standards, for the purposes of sensitivity analysis. Polynomial equations also allow for improved accuracy, population changes and consideration for centrifugal pumps.

B.2.4.4 Dynamic Hydraulic Modelling

Dynamic modelling of pressure sewer networks is recommended for all cases as it provides a high level of accuracy; and is a tool for council or the operator to use on completion of the works.

Dynamic modelling involves using a computer hydraulic model to calculate flows and undertake simulations. A model must be built to represent the proposed pressure sewer system including all individual pumping units, and specific connections including property-specific loading rates and diurnal patterns. The computer model can be used to simulate steady-state (static) conditions and extended-period (dynamic) scenarios like system recovery after a prolonged power outage. It is strongly recommended to use software specific for wastewater modelling (e.g. InfoWorks ICM with forced main model or equivalent).

The use of this design tool implies increased design costs and time in comparison with the others methods, due to factors like the requirement of experienced modellers, model set-up time and multiple reviews of the model. However, despite this, a computational model offers improved optimization, (therefore being a requirement for smart systems) and assessment of the network operation and simplifies the analysis of multiple scenarios for the system, which translates to reduced capital costs, particularly in larger catchments, which can outweigh the additional design costs as well as significantly reduce risks during the operation of the system.

Additionally, once the pressure sewer system is operating, the information gathered can be used to calibrate the model and provide network optimization and be used as a basis for any future expansion or planned changes to the network, including pump requirements for new installation or pump replacements.

The model should be based on:

- A minimum of 120 hours model time (to achieve stability).
- Initial pump chamber storage percentage full to be randomly assigned to each pump station storage chamber on start-up (i.e. =RAND() function in Excel).
- Standard diurnal flow pattern adopted for residential properties.
- Specific diurnal flow patterns determined for industrial or commercial.

B.2.5 Model Objectives

The objective of the hydraulic assessment is to ensure that the proposed pressure sewer network will:

- Achieve minimum self-cleansing velocities.
- Operate within acceptable pump heads.
- Recovery within an acceptable period of time after an abnormal operation, such as a power failure or network shutdown.
- Operate within a range of conditions, such as higher or lower than expected inflows.

- Evaluate network performance within a range of pipe conditions, with a higher and lower pipe roughness.
- Discharge wastewater from the network within an acceptable period of time (wastewater detention time) to avoid septicity and corrosion.
- Achieve sufficient air movement to avoid the need for air valves.

To access whether the network meets these objectives, various model scenarios are created.

B.2.6 Model Scenarios

The following scenarios should be modelled as part of the pressure sewer assessment:

B.2.6.1 Normal Operating Scenarios

Dry Weather

The model scenario is used as the basis for confirmation of the network's pipe sizes and pipe network layouts.

The results from this scenario run are used for:

- Calculating system wastewater detention times.
- Reviewing pipe velocities and ability to achieve minimum velocities/durations.
- Reviewing maximum head at individual pump units and assessing if they remain within target limits (less than 55m).
- Calculating the dry weather design flow from the system (expected to occur once or twice per day.)

Wet Weather

The model scenario is used to verify satisfactory performance assuming a representative volume of inflow and infiltration (I/I) into the system as a result of rainfall events.

Satisfactory performance is considered to be demonstrated if there is no usage of the tank emergency storage volumes during a wet weather event.

The results from this scenario run are used for:

- Confirming the system is able to accommodate wet weather inflows without any alarms being triggered or surcharging.
- Calculating the wet weather design flow from the system.

B.2.6.2 Abnormal Operating Scenarios

Failure recovery scenarios are modelled to understand the system's likely to recovery response to a system-wide failure that would prevent individual pump units from operating for a period of time. The cause of system wide failure would most likely be due to a network wide power failure. Another reason could be an intentional shut-down of the system to allow maintenance activities to be undertaken on the downstream network.

The system recovery period is modelled assuming standard dry weather inflow is received by each pump unit over the recovery period.

The results from this scenario run are used for:

- Calculating the failure recovery design flow from the system.
- System recovery after power failure is acceptable. System recovery to normal operating patterns should ideally be achieve within 8 hours.

The model simulation is started assuming 24-hours of standard inflow into each pump unit above a randomised pre-failure tank level.

A power failure or network shutdown is assumed to start at 5am and last for 24 hours.

Requirements for onsite emergency storage is based on 24 hours of storage at the average dry-weather flow.

B.2.6.3 Sensitivity Scenarios

Sensitivity investigations are to consider increases and decreases in dry weather flow loading rates. This testing is intended to capture variation in system loading that could be expected throughout the year because of factors such as changes in population densities within the catchment (e.g. due to holiday periods), or changes in water usage. It is also intended to capture uncertainty in the modelled sewer loads recognising the dry-weather inflows adopted may be different to the loads the system actually experiences once constructed.

Higher Tank Inflows

Baseline loading to be applied for all residential connections – a factor of 1.3 times Average Dry Weather Flow over the 24hrs diurnal inflow pattern.

The results from this scenario run are used for:

- Confirming the robustness of the system for pumps operating within the maximum pump head requirements.

Lower Tank Inflows

Baseline loading to be applied for all residential connections – a factor of 0.7 over the 24hrs diurnal dry weather inflow pattern.

The results from this scenario run are used for:

- Confirming the robustness of the system for achieving minimum velocity conditions and sensitivity of system detention times.

Alternate Roughness (k = 0.15mm)

An alternative pipe roughness for all pressure sewer pipes to assess the potential impact of smoother pipes.

The results from this scenario run are used:

- To investigate the impact of a lower pipe roughness on pipe head loss and pump head and system performance.

Alternate Roughness (k = 1.5mm)

An alternative pipe roughness for all pressure sewer pipes to assess the potential impact of sedimentation and/or bio-film formation within the pipes.

The results from this scenario run are used:

- To investigate the impact of a higher pipe roughness on pipe head loss and pump head and system performance.

B.2.6.4 Design Scenarios

For larger developments, were construction is to be carried out in different stages, the system will initially operate with a partial number of dwellings connected. The design of the pressure sewer should not only focus on the ultimate development, but should consider these different stages when designing to achieve self-cleansing velocities, adequate pump selection and pipe sizing.

The following design scenarios should be modelled and the results provided in the design report

Scenario 1 - 10% of development buildout.

Scenario 2 – 50% of development buildout.

Scenario 3 – Ultimate development.

The compliant development (the number of properties required to achieve minimum velocities and a maximum average retention time of 8 hours at the discharge point) should be indicated in the design report.

B.2.7 Air Movement Assessment

Within pressure sewer networks, combination air-release/vacuum break valves are required at significant high points to purge air daily from the network. Air valves may also be required on downward sloping pipe where a sufficient velocity and duration of flow is not achieved to move the air to the next air valve or to the downstream upward sloping pipe section.

The potential of gas collection is estimated for a network using the Walski et al equation, by calculating a minimum pipe velocity for air movement.

Gas movement does not need to be assessed for pipes running uphill with respect to the direction of flow, as air will naturally move to the higher end of the pipe.

Two key aspects to consider in applying the Walski et al equation, are the duration and reliability of achieving the minimum pipe flow velocity to move gases along the pipe. For a gas pocket to be successfully transported downstream to the next air valve or system outlet, there needs to be continuous duration of flow above the minimum velocity long enough for the air pocket to move beyond any intermediate low points in the pipe.

The flowrate and duration required to move gas pockets through the system must be assessed to occur at least once a day, using system inflows expected during normal dry weather operating conditions.

If a sufficient duration to move the gas along a downward sloping pipe gradient to either an air valve or an upward sloping pipe cannot be reliability achieved on a daily basis, then an air valve is required.

The minimum velocity and required travel time for air movement for the identified downward sloping pipes should be calculated and compared to the duration of flow per day required to achieve sufficient air movement.

B.2.8 Design Report

A design report should be submitted by the designer which demonstrates that the above requirements have been undertaken and the results provided.

B.2.9 Retrofit Projects

When pressure or vacuum systems are installed either as a retrofit project (replacement of septic tanks) or more significantly following significant natural events (i.e. earthquakes) occurring it is important to pre-flush the gravity laterals to the pressure sewer tank and catch any debris that has entered the laterals or the debris (gravel in particular) will damage the new pump. This can be achieved by utilizing an “onion bag” or muslin bag on a wire.

Further, at the commissioning stage, there should be a check to ensure that there is no infiltration into the tank from laterals.

Part C – Technical Specifications

C.3 Technical Specifications

The technical specification (Specification) covers the supply and installation of pressure sewer products, materials and equipment located on and off private property.

C.3.1 Pumping Units

It is recommended that the Council provides a list of approved pumps for use in the pressure network. The list must consider the following selection criteria as a minimum.

C.3.1.1 Pumps / Pump Chamber

The grinder pump core unit and appurtenances form an integral system, and as such should all be supplied by the manufacturer/supplier. The supplier should be responsible for the satisfactory operation of the entire pump unit system.

The equipment should be a product of a company experienced in the design and manufacture of pressure sewer system grinder pumps. The company should be required to submit detailed installation and user instructions for its product, submit evidence of an established service program including complete parts and service manuals, and be responsible for maintaining a continuing inventory of grinder pump replacement parts.

All components and materials should be in accordance with these guidelines.

The pump supplier should be required to demonstrate a minimum significant performance period (i.e. track record of performance as a pressure sewer pumping unit). Ten years would be considered as meeting this significant period requirement. The manufacturer should provide a list of contactable references from the previous grinder pump installations. An installation is defined as a minimum of 25 pumps discharging into a common pressure main, which forms a pressure sewer system.

The supplier should provide evidence that the equipment supplied would not become redundant and remain serviceable at least 15 years after installation.

C.3.1.2 Collector Tank / Chamber

The pump chamber should include:

- A sealed lid preventing the ingress of surface water where it is identified that the chamber may be at risk of inundation, with venting via a separate high level vent; or
- A self-venting type lid if inundation is not a risk, with venting through the polyethylene cover ; or
- A trafficable cover, where the chamber is subject to traffic loads, with suitably rated gastight covers and venting via a separate vent; and
- Cleaning access
- Being sealed against groundwater

The collection tank should be rotationally or injection-moulded, round in shape, polyethylene or Council approved alternative.

The use of concrete chamber is not recommended, due to the risk of corrosion from retained sewage and limited ability to sufficiently slope the base for solids movement.

The chamber should be of dimensions that provide for ease of installation and minimising cartage costs.

The chamber should be designed assuming the ground water level is at ground surface. Provision of ribs or flanges should be made for anchoring the tank with anti-buoyancy mass concrete ballast.

The chamber should be supplied with a sloping internal base towards the pump position, or otherwise designed to mobilise and entrain solids through the pump during pump operation.

The chamber should provide a minimum storage (emergency storage) capacity of a minimum of 24 hours Average Day Flow storage between the pump start level and the system overflow level.

The chamber should have all necessary penetrations moulded in and factory sealed.

Chambers should be supplied with a waterproof polyethylene cover. The cover should be securely fitted and bolted down or otherwise lockable with a padlock to prevent access from children and minors. It is recommended that lids should have the provision for the fitment of a seal if required in the future.

The chamber should have design and manufacturing certification to AS/NZS 1546.1 2008 for use in the sewer application, including the lid, access cover and riser if applicable.

The supplier should state the design and recommend maximum vertical and horizontal loading rates on the chamber.

The chamber should include inlet fittings that comply with standard drainage fittings that are readily available in New Zealand.

Figure 8 - Typical Pump Chambers

C.3.1.3 Chamber Storage Volume

The chamber should provide a minimum total wet-well storage volume equal to 24 hours Average Day Flow (ADF) from the source, as determined using the Council's design criteria. The total storage volume represents the wastewater stored between the pump start level and the overflow level. This volume excludes the volume taken up by the pump, pipework and its mountings.

Note: where pumps are to be programmed to store a specific volume and pump at a given time, the stored volume should be in addition to the required storage volume equivalent to 24 hours storage.

C.3.1.4 Odour Control

Appropriate venting should be provided so that any odour issues are minimised as part of chamber design. The chamber should be vented above the system overflow level via an insect proof vent.

The chamber lid level should be installed clear of local potential surface water ponding and local low lying areas which tend to flood during inclement weather. If such an installation cannot be avoided, or if the property is located in a flood susceptible area as defined by flood hazard maps, the supplied chamber vent should be sealed and a new vent point positioned near the top of the chamber sidewall with a vent pipe routed to the building wall and up to a vent point above the existing roofline, in accordance with AS/NZS 3500. Council approval is required for any other venting position.

C.3.1.5 Pump & Motor

The pump should be an integrally designed submersible type with vertical rotor, motor driven and with a grinder mechanism. The following should be provided for each pump installation:

- A grinder pump, either free standing or mounted on a purpose-made base and / or be guiderail mounted with rails. These shall be 316 stainless steel.
- Electrical quick disconnect rated to IP68 (to not be affected by condensation build-up within the chamber).
- Pump should be supplied with a suitable harness, chain or rope fixed to the pump and secured at the access opening, and
- Discharge assembly and shut-off valve, anti-siphon valve and check valve assembly, electrical alarm assembly, and all necessary internal wiring and controls.

The alternative of a wet well / dry well installation with a progressive cavity pump / macerator specifically designed for a pressure sewer application can be adopted in place of a submersible pump type system, if approved by Council.

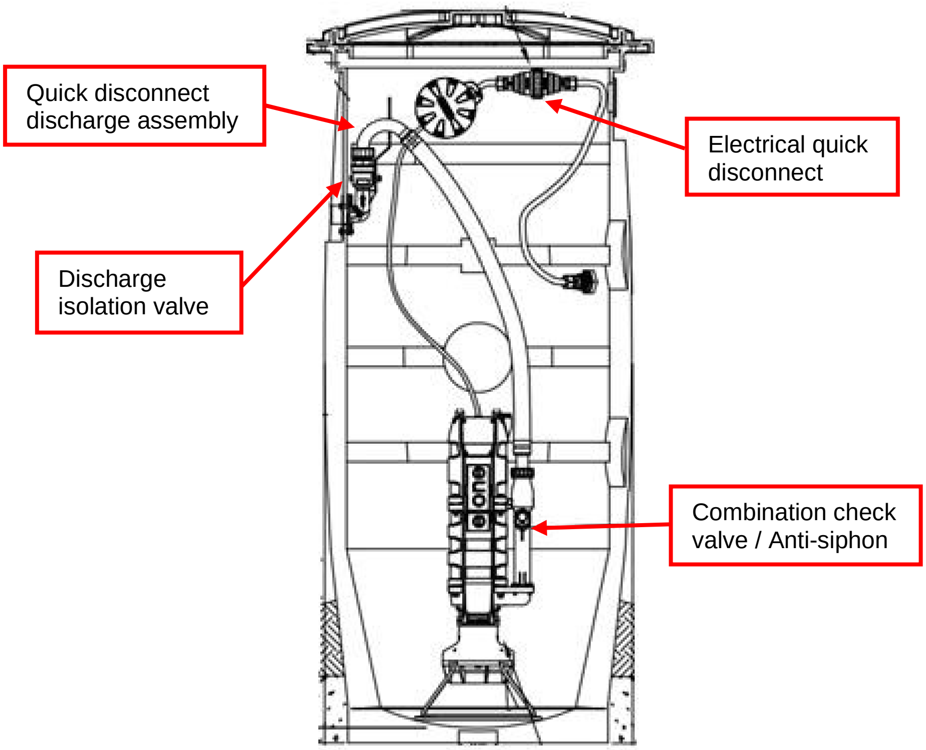

Figure 9 - Example Simplex Pump Unit with Required Valves & Appurtenances

The motor ingress protection should be rated to IP68 or NEMA 6P submergence.

The pump should have a predictable and constant flow rate across the required pressure head range, and should comply with the following head and flow capabilities:

- A maximum flow rate of less than 1.25 l/s at zero head
- A minimum flow rate of greater than 0.4 l/s at 55 m head
- Rated for continuous operation at 55 m head, and
- An ability to operate intermittently at between 55 m and 80 m head.

"Intermittent" running is expected to be on rare or unplanned occasions (e.g. after prolonged power outages). The maximum designed continuous operating head for any pump in a system should be 55 m pressure head.

The pump unit should carry NSF/ANSI 46 certification or 3rd party certification from a reputable organisation. All model variations in the pump range should also carry NSF/ANSI 46 certification, which demonstrate the pump's ability to handle potential in-service conditions.

The pump motor should meet the following minimum requirements:

- Minimum 0.75 KW; and
- 240V 50 hertz, single phase.

The pumping units are intended to be incorporated into the residential power board. Therefore they must therefore be capable of being operated on single-phase power supply typical of a residential household, without the need to augment a standard residential power supply. Required power supply circuit should be 20 amps or less.

Pumps should have a minimum design life of 25 years and include no materials that degrade significantly while the product is on the shelf.

Pump should be of weight that can be man handled safely by a single person. Alternatively, equipment should be made available to facilitate the safe manual handling of pumps. The installation and removal of the pump should be possible without confined space entry requirements.

C.3.1.6 Pump Operating Levels

The pumping unit should be started and stopped by a pressure switch, pressure transducer, float switches, or other reliable types available on the market.

The pump should be supplied with an over-pressure capability (pressure switch or electronic over pressure protection) with an automatic reset mechanism. The system should inhibit the start of the pumping during an over-pressure event. The reset mechanism should also be capable of restarting the pump unit after a power failure.

The Pump Stop control point (e.g. off switch) should be set as low as possible to minimise the volume of the sewage stored in the tank after each cycle, whilst protecting the pump from running dry / cavitation.

C.3.2 Electrical & Controls

C.3.2.1 Pump Controls

Pump controls located within the control cabinet should include the following controls, as a minimum:

- Pump/panel Circuit Breaker.
- A switch with On/Off/Auto positions.
- Alarm and Control Components.
- Battery backup for alarms.

Installation must be in accordance with all applicable codes, regulations and manufacture’s requirements.

C.3.2.2 Pump and System Protection

Pump units should have the following pump protections:

- Pump run dry protection – (pump running continuously)
- High pressure – (Pump operating at abnormally high wattage level)
- Thermal overload
- High voltage
- Low voltage (brown out)

C.3.2.3 Control Panel / Alarms

The pump unit must be fitted with an alarm system activated by a high-level alarm switch in the pump unit. It should consist of a visual and audible alarm. If monitored remotely via a smart system, it is normal to set a delay on the activation of the local alarm. The following features should be provided:

- Visual alarm, such as a flashing light that must be located so that it is visible to the property owner
- The audible alarm with a resident mute switch to silence the audible component of the alarm. The audible alarm should be externally mounted on the bottom of the enclosure
- Individually fused circuits for alarm and pump
- Pump/panel circuit breaker
- Status LED's: power, pump running, alarm(s)
- Ability to operate as Manual; set to Auto; and to isolate
- Terminal strip and ground lug for incoming connections
- Pump fault diagnostic ability without need for opening chamber
- Hours run meter and pump start counter
- The pump control panel enclosure should be manufactured of stainless steel powder coated construction or other durable approved UV resistant material and be weatherproof to IP65 or better. The enclosure should be painted a neutral colour, and
    - The enclosure should include a hinged lockable cover to prevent unauthorised entry.
    - Connected to a circuit separate from the pump circuit.
    - Connected to a battery back-up to provide backup for alarm in case of mains power outages.

Provision to delay activation of audible high level alarm for specific time periods, i.e. 10 pm to 6 am, is desirable, but not typically available with basic units.

Figure 10 - Control Panel and Alarm

If there is a requirement for data collection and programming (i.e. for flushing during early build out stages), the control unit should be a Smart Panel

C.3.2.4 Smart Panel

Where specified within the design and accepted by Council a smart controller (e.g. IOTA OneBox, Aquatec OmniSmart 6000 controller or similar approved), is to be installed rather than a standard control panel as previously detailed.

A Smart Panel should have:

- Real time clock (date and time)
- Programmable (variable stored volume and operating times), with pressure transducer
- Data storage (minimum 2000 data point) including pump status and alarms
  - Ability to readily convert to remote communication system at later date (i.e. Telemetry /SCADA RS485 and RS232 MODBUS or 3G/4G Cellular and DNP3
    Expansion port to allow for upgrades of communication types in future, without requiring changes to the main componentry.

The telemetry system enables the Council to programme and/or remotely monitor and control the on-property pumping station.

The smart panel can be included in the pump's control panel or be a separate unit as per existing alternatives.

The standard features of the smart control panel incorporate:

- Electricity supply via an independent circuit from the house switch board.
- A 20amp 'D' Curve circuit breaker is to be used for a Simplex (one pump) system.
- A lockable isolation switch is to be installed near the panel.
- 240V +/- 10% to be provided to the Alarm Panel (216V to 264V).

C.3.2.5 Generator Connection

It should be feasible to connect a generator to the pump unit, by either:

- Electrical quick disconnect within the pump chamber that a generator can easily be connected to; or
- The control panel should be fitted with a suitable emergency generator connection

C.3.2.6 Controller / Panel Mounting

The controller should be mounted on the side of the house at an appropriate height to enable access. The installation should meet the following requirements:

- Accessible for maintenance.
- Within eye sight of the pump chamber (i.e. not behind a wall)
- Minimum of 500mm to the base of the Alarm Panel from ground level.
- Maximum of 1800mm to the top of the Alarm Panel from ground level.
- Ideally within 10m of the pump (which is the standard cable length).

The controller should **NOT** to be mounted on fences or temporary structures.

C.3.3 Pipelines

C.3.3.1 Pipe Material

Pressure sewer pipe material should be PE100, PN16 (SDR11) and coloured black with a cream strip.

Pipeline supply, transport, storage, installation, and acceptance should all be in accordance with Council's construction standards.

C.3.3.2 Pipe Sizing

Pipe diameters of DN 50, 63, 75, 90, 110 and greater may be specified within the pressure sewer networks, based on PE 100 PN 16.

The minimum on-property pipe size should be DN 40. The minimum pressure sewer main (off-property) size should be DN 50.

C.3.4 Valves and Fittings

All valves and fittings should be pressure rated at least PN16 and be suitable for wastewater applications.

Pipeline bends, fittings, and tees should be ductile-iron or PE in accordance with the Council's Material Specifications.

It is recommended that PE pipes are butt welded where feasible and electrofusion coupler, tees, bends and saddles etc. are used to connect pipes. Compression couplers can be used, but are not recommended for buried connections. Flanged joints, suitably protected with denso or similar wrapping are also acceptable, subject to standard Council Specifications.

Isolating valves should be cast or ductile iron sluice valves, resilient-seated solid wedge type, anti-clockwise closing and should have thermal-bonded polymeric coating inside and out. To differentiate wastewater valves from water valves, the valve spindle cap of triangular pattern should be used, and the valve box lid should be painted red.

C.3.4.1 Air Valves

Air valves should be determined by design requirements. Air valves must be specified for use in wastewater applications and should be double acting. **Consideration should be given to the head required to close an air valve for specific applications of air valves within the pressure sewer network. Air valves may weep wastewater if insufficient head is applied to the valve.**

Water supply air valves are not acceptable as they rapidly block when passing sewage.

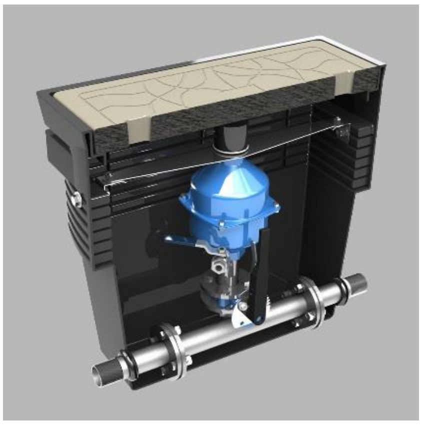

Figure 11 - Typical Air Valve Arrangement

C.3.4.2 Isolation Valves

Isolation valves should be located on both upstream legs of each three way branch tee. Isolation valves should be located such that no more than 50 properties are isolated with a valve or set of valves.

C.3.4.3 Flushing Pits

Flushing pits are required where specified on the construction drawings, typically at upstream ends of pipelines. The flushing pit should consist of:

- DN50, Type 316 stainless steel manifold DN50,
- Type 316 stainless steel ball valve
- DN50 PE male camlock fitting (stainless steel camlocks should not be used)
- For trafficable locations a precast concrete chamber with frame and lid should be used
- For non-trafficable location a PE pit with red cover marked ‘pressure sewer’ is sufficient.

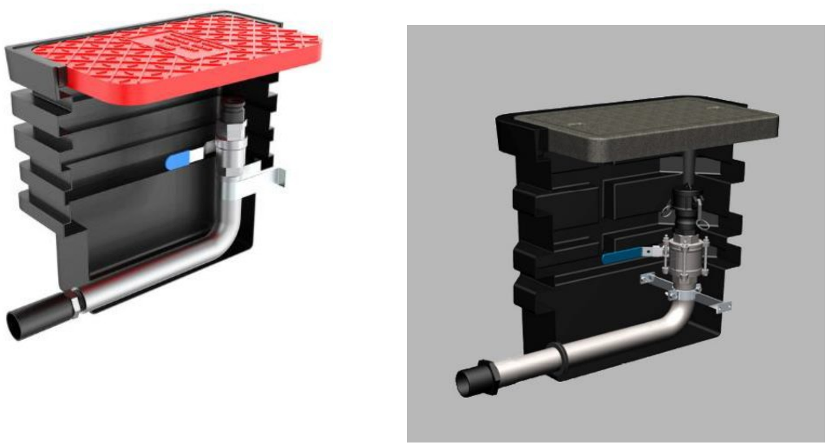

Figure 12 - Typical Flush Points

C.3.4.4 Boundary Kits

The Boundary kit should comprise the following:

- Isolation Valve (Full bore or gate) - bronze (max zinc component 7%) or grade 316 Stainless Steel and pressure rated PN16.
- Non-Return Valve with top access - bronze (max zinc component 7%) or grade 316 Stainless Steel and pressure rated PN16. The non-return valve should be a swing check valve.
- Flushing Tee - bronze (max zinc component 7%) or grade 316 Stainless Steel and pressure rated PN16.
- All incidental fittings to be bronze (max zinc component 7%) or grade 316 Stainless Steel and pressure rated PN16.

The above should be of integral one piece construction, and included inside a polymer or approved alternative valve box, with cover and base with “pressure sewer” lid markings. The unit needs to be capable of withstanding occasional foot traffic (locations in trafficked areas require a higher-strength box/lid combination).

Figure 13 - Typical Boundary Kits

Boundary kits are to be sized to match the pump installation, i.e. 40mm DN for Simplex. 50mm DN for Duplex etc.

C.3.4.5 Flow Meters

A flow meter and data loggers should be installed at, or close to, the gravity discharge manhole. The flow meter should be specifically designed for wastewater applications. The flow meter and data logger may be mains or battery / solar powered and should be linked to a website via an Internet of Things (IoT) device to allow flows to be monitored remotely, without the need to visit site to download the data.

Monitoring frequency should be at a maximum of every minute, but ideally ever 10 seconds.

C.3.4.6 Pressure Loggers

Pressure transducers and data loggers should be provided, as detailed in the Design Approaches, to allow pressures within the pressure sewer network to be monitored. These pressure sensors should ideally be linked to a website via an IoT device to allow pressures to be monitored remotely, without the need to visit site to download the data.

The pressure transducer should be specifically designed for wastewater applications and may be mains or battery / solar powered.

Monitoring frequency should be at a maximum of every minute, but ideally every 10 seconds.

Part D – Operation and Maintenance

D.4 Operation and Maintenance

The nature of pressure sewer systems, based on different principles and equipment from conventional collection systems, requires a different approach to operation and maintenance (O&M) aspects of the network and its elements. The issues and benefits listed below are mainly related to the operating stage of the project and not necessarily focused on design decisions.

D.4.1 Operation & Maintenance

- Operation & Maintenance costs can be higher compared to a simple gravity system (without "lift" or local stations), but may be cheaper for a smaller number of pressure sewer pumps if a network pump station would otherwise be required.
- Odour generation and control: As with other systems, detention times need to be considered. If air valves are installed, odour control measures are recommended and routine maintenance programmed.
- Accumulation of grease and oil in network can occur if scouring velocity is not achieved for initial stages of the project or if pipe are oversized to allow for future expansion.
- Pressure sewer system can be considered a "black box" system with no visibility as to the performance of the system. It is therefore recommended that all systems, perhaps with the exemption of very small systems, to include a flow meter on the outlet and a pressure sensor within the network, linked to the web via an Internet of Things (IoT) device to allow the performance of the system to be reviewed or monitored. Data from these devices can also be used to verify the dynamic hydraulic model to confirm system performance, and will assist identification of issues such as sedimentation / fats and grease build-up within the system.
- Occurrence of on-lot alarms or power outages implies residents have to reduce water usage until issue is resolved (limited storage in pump unit).
- False alarms caused by partial blockages, brown out protection, thermal overloads or pump time delay during recovery period after prolonged power outage can overwhelm the call centre.
- System requires electric power at each property, making it difficult to use generators during extended power outages, with emergency storage provided with the pump chamber (Note: water demand, and therefore wastewater production, is significantly reduced during power outages as washing machines and dishwashers are unable to operate and, typically, hot water is not available for showers or baths)
- Possibility of homeowner deactivating and ignoring audible alarms (especially if pumps are not centrally monitored).
- Pump replacement for low-income residents is a high and sudden expense that may not be met quickly enough, considering limited storage capacity.
- If Council or Water Agency is in charge of pump unit maintenance, general easement agreements should not be needed to permit access to equipment, however, it may be considered beneficial to cover within a householder agreement or local By-law.
- Requires Council maintenance team or contractors (if maintenance not managed directly by Council) to be trained and suitably experience with operating and maintaining pressure sewer systems.

- Health and safety risk if homeowner decides to do own maintenance/repairs or use unapproved contractor (exposure to gases, electrocution, etc.) as well as possibility of damage to pump unit)
- Cost of pump replacement can be important expense for homeowner.

D.4.2 Operation & Maintenance Benefits

- Pumps do not require periodical maintenance. Maintenance is performed only when issues or alarms are noticed, as they are easy to disassemble or replace, reducing downtime of the service for the client.
- Maintenance calls are typically rare and easily solved, not requiring a large amount of personnel. The mean time between service calls per pump obtained in a group of pressure sewer systems averaged 7.2 years[1].
- Reduced or no inflow and infiltration implies reduced pump usage, extending expected pump life and reducing electricity costs. This can also be a benefit to the wider system, including at the treatment plant, with reduced flows in comparison to a gravity network area.
- On-property alarm immediately notifies of issues in the pump unit.
- Smart system pump systems allow a high degree of control for efficient use of the network.
- Network self-regulates after prolonged power outages. Pumps closer to the downstream discharge operate first as the others reach shut off pressure point immediately. Once pressure in the force main is reduced, pumps upstream start operating until system goes back to normal (45 minutes in some situations).
- Pressure main repair is faster and less costly than with gravity sewers due to shallower depths and smaller size pipes.
- SCADA data and pump unit inspection allows identification of those properties where additional flows or unauthorised elements are being discharged into the system.
- If system reliability is high, SCADA system can be removed (partially) to reduce operation costs.
- Low power consumption of equipment for homeowners.

D.4.3 Measures for Mitigation of issues

As with new systems that are not generally understood, education of all involved parties is important with the successful introduction and use of pressure sewers. It is recommended that the following be considered:

- Adequate manuals and education programme on property owners duties and responsibilities (more details in Section D.4.6). This reduces false alarms and maintenance calls due to negligent use.
- Training of call centre staff to identify possible false alarms, reducing the need to send a maintenance team when not needed.

[1] Introduction to Pressure Sewers. R. Farrell and S. Kreitzmann. Environment One Corp. 1999

- Use of a smart system for the network can imply quicker detection and response for on- and off-lot issues, partially reducing reliability on the homeowner to notify issues.
- Repeated maintenance calls due to pump unit negligent use or deliberate damage could be charged to homeowners. Since pump units are individual, it is easy to identify inappropriate use.
- Periodic inspection of pump units to ensure no inflow and infiltration is occurring. The use of smart systems to collect and monitor data allows remote identification of these.
- Having the Council or Water Agency in charge of Operation & Maintenance can reduce maintenance and replacement costs and provide a better monitoring of those expenses. Pump/system supplier should be required to provide an operation and maintenance manual to the Council (or Water Agency) and training if required by the latter.
- Use of smart system to achieve flushing velocities (by running pumps simultaneously) and reduce maximum flows (timing pump operations to even out flows during the day).
- Equipment purchase from reliable and proven manufacturers, with good warranty and maintenance cost breakdown information. Reducing service calls and maintenance to pump units can outweigh increased purchase cost.
- Proactive maintenance helps reduce reactive maintenance. Sharpen of grinder blades, liquid level sensors check and pump inspections.

D.4.4 Monitoring Options

As detailed in the Design Approaches section, system monitoring is recommended for network troubleshooting and optimization. The minimum monitoring instruments recommended to be installed are a flowmeter (and data logger), immediately before the pressure sewer discharge location, and a pressure transducer with data logger at a strategic location(s) in the network (usually at flushing points near the most disadvantaged pumps in terms of Total Dynamic Head).

Additionally on-property data loggers capture assists with system optimisation, faster troubleshooting and pump control.

Current equipment and solutions providers offer several monitoring options allowing for the following scenarios:

1. Minimum: Flowmeter at discharge + Pressure transducers (physical or remote data collection)
2. Minimum + On-property monitoring - Download (physical)
3. Minimum + On-property monitoring - Connected (remote)
4. Minimum + On-property monitoring and control - Connected (remote)

All the options specified above allow identification of issues in the network’s operation, with each one in sequential order providing quicker and more detailed issue identification, location and response time.

Scenario 1: Flowmeter at discharge provides data that can be utilised to determine average household flows, and allow comparison of dry and wet day flows (inflow) and summer and winter flows (infiltration due to higher ground water table). If higher than anticipated flows are noted, these can be further investigated.

Pressure transducers allow the system performance to be compared to the design pressures, allowing identification of sedimentation or fat / grease build up etc.

Scenario 2: On-property monitoring allows precise identification on which pump is running longer due to inflow into the pump chamber or not able to run due to pipe blockages. Additionally, the information provided (time stamps, motor state, fluid level) allows to update and optimise the network model and in the middle term adjust pump configuration in the network.

Scenario 3: Remote instant access to pump data provides the fastest response time for problem identification as well as instantly assessing network behaviour, being an improvement of Scenario 2.

Scenario 4: The addition of on-property remote control, in addition to the previous scenarios benefits, allows for optimised design of the wider sewer network due to the ability of easily eliminate peak flows and therefore reducing pipe sizes. This feature also provides benefits during the operational stage, as in the case where a large and unexpected inflow occurs, the central system can quickly reprogram the pumps in the vicinity to convey the increased flow, without requiring to dispatch a team immediately.

D.4.5 Connections or repair of pipework

Care must be taken when connecting to an in-situ / operating pressure sewer line, with particular regard to health and safety.

- A Job Safety and Environmental Assessment, or equivalent to Council requirements, must be completed prior to work commencing
- Staff must be suitably qualified and meet Health and Safety requirements (i.e. appropriate inoculations)
- The section to be connected to must be isolated (i.e. all valves closed) from operating pumps, including line valves and any individual household isolation valves located within the boundary kit. (Note: if pumps attempt to operate they will shut down on over pressure)
- If feasible, the line can be flushed with clean water
- Connections can be made by:
    - Cutting and insertion of electrofusion coupler(s) or electrofusion tee
    - Electrofusion branching saddle

Figure 14 - Electrofusion Branching Saddle

D.4.6 Home Owner's Manual

The Council should require the pump supplier to provide a full "Home Owner's Manual" to the property owner, which provides an overview of how the system operates, its elements and more importantly sets out in detail the operation, maintenance and repair requirements. As a minimum, the following topics shall be included:

- Information on system operation and benefits
- Numbers and/or web site details for further enquiries.
- Emergency phone number of service agent.
- What to do if the alarm sounds or flashes.
- What to do in the case of a power failure.
- Routine inspection requirements and checklists.
- Operation and maintenance responsibilities, including tank maintenance, odour control devices, etc. (e.g. what to do before leaving for any extended period). According to ownership and maintenance scheme adopted by the Council. This includes expected costs to homeowner, if any.
- List of items not to be flushed down the drain, including:
  - Glass
  - Metal
  - Gravel or sand, including stone from fish tanks
  - Seafood shells
  - Socks, rags, clothes
  - Plastics
  - Wet wipes, nappies, sanitary napkins, tampons
  - Flammable materials
  - Lubricating oil and grease
  - Stormwater
  - Strong chemicals, petrol, diesel, etc.

Appendices

Appendix A – Technical References

All links are correct as of 3 February 2020.

Standards

- WSAA WSA-07 Pressure Sewerage Code of Australia

  https://www.wsaa.asn.au/shop/product/27061

- British Standards BS/EN 1671:1997

  https://shop.bsigroup.com/ProductDetail/?pid=000000000001189595

- National Sanitation Foundation NSF/ANSI 46 'Evaluation of Components and Devices Used in Wastewater Treatment Systems

  http://www.nsf.org/services/by-industry/water-wastewater/onsite-wastewater/wastewater- treatment-system-components

Utility Standards – Pressure Sewer Systems

Australia

- Hunter Water – Pressure Sewer Systems

  https://www.hunterwater.com.au/Building-and-Development/Drawings-Plans-Specifications/Pressure-Sewer-Systems.aspx

  - Guide for Home Owners and Builders
  - Supplement to WSA 07
  - Pressure Sewer Standard Drawings
  - Planning and Design Guideline
  - Hydraulic Design Guidelines

- South East Queensland (SEQ) Pressure Sewerage Code (Australia) Amendment to WSA-07

  http://www.seqcode.com.au/storage/seq-pessure-sewerage-code/SEQ%20Amendment%20to%20Pressure%20Sewer%20Code.pdf

- Melbourne Retail Water Agencies (MRWA) (Australia) Amendment to WSA-07

  http://www.mrwa.com.au/Documents/Standards/MRWA%20WSA07%20Pressure%20Sewer%20Supplement.pdf

- Melbourne Metropolitan Board of Works 'Hydrogen Sulphide Control Manual' (Australia)

  https://www.wsaa.asn.au/shop/product/5701

- South East Water Sewer Servicing Guide (Australia)

  https://southeastwater.com.au/SiteCollectionDocuments/BuildingAndDevelopment/Plumbers/SewerServicingGuide.pdf

- Yarra Valley Water Sewerage Design Principles (Australia)

  https://media.yvw.com.au/inline-files/Sewer%20Design%20Principles_Jan2019.pdf

- Goulburn Valley Water Guidelines for Pressure Sewer and Owner's Manual (Australia)

  https://www.gvwater.vic.gov.au/development/developers/land-development-framework/pressure-sewer

- Western Water Home Owner's Manual (Australia)

  http://www.westernwater.com.au/files/assets/public/documents/reference-documents/pressure-sewer-system-manual.pdf

New Zealand

- Watercare 'Water and Wastewater Code of Practice for Land Development and Subdivision'

  https://www.watercare.co.nz/CMSPages/GetAzureFile.aspx?path=~%5Cwatercarepublicweb%5Cmedia%5Cwatercare-media-library%5Cwastewater-network-standards%5Ccop_wastewater_only.pdf&hash=befb480fa0481b879968af82d2d6f3d9abcc4b0ff47176dee3675190983eaafc

  Watercare Material Supply Standard

- https://www.watercare.co.nz/Water-and-wastewater/Building-and-developing/Engineering-standards-framework/Material-supply

- Christchurch City Council 'Infrastructure Design Standards'

  https://www.ccc.govt.nz/assets/Documents/Consents-and-Licences/construction-requirements/IDS/Infrastructure-Design-Standard-2019/Part-6-Wastewater-Drainage-PDF-2.4-MB.pdf

- Rotorua Lakes Council 'Wastewater Treatment and Disposal Policy'

  https://www.rotorualakescouncil.nz/our-council/PoliciesandBylaws/Policies/Documents/EngineeringInfrastructure%20Policies/Wastewater%20Treatment%20and%20Disposal%20Policy.pdf

- The Whangarei District Council 'Pressure Sewer Policy'

  http://www.wdc.govt.nz/WaterandWaste/Wastewater/Documents/Pressure-sewer-policy.pdf

- Waimakariri District Council 'Wastewater Pressure Policy'

  https://www.waimakariri.govt.nz/__data/assets/pdf_file/0027/28476/S-CP-5001-Wastewater-Policy.pdf

- Palmerston North

  'Pressure Sewer System Policy' https://www.pncc.govt.nz/media/3131337/pressure-sewer-systems-policy-2018.pdf

  'Pressure Sewer Design Standards'

  https://www.pncc.govt.nz/media/3131636/pressure-sewer-design-standards-march-2019.pdf

- Western Bay of Plenty - Te Puna Wastewater
  https://www.westernbay.govt.nz/repository/libraries/id:25p4fe6mo17q9stw0v5w/hierarchy/council/projects/documents/TPWW%20report.pdf

Pressure sewer equipment and design manuals from the following suppliers

- Aquatec

  https://www.aquatecenviro.com.au/knowledge-centre/brochures/pressure-sewer
- E-one / Ecoflow

  https://www.ecoflow.co.nz/technical-info
- Flygt

  https://www.xylem.com/en-nz/products-services/pumps--packaged-pump-systems/packaged-solutions/wastewater--sewage-packaged-pump-stations/view-all-categories-share-flygt-pressure-sewage-systems/

- Aquate

  https://www.aquate.co.nz/?page_id=135
- Mono

  http://www.monopumps.com.au/en-NZ/pressure-sewer-systems-0
- Sabre

  https://fastflo.co.nz/product/sabre-hgp2-series/

Other references and documents

- EPA Wastewater Technology Fact Sheet, Pressure Sewer, 2002

  https://www.epa.gov/sites/production/files/2015-06/documents/presewer.pdf
- Dynamic Modelling of Pressure Sewerage Systems. G Hutchison

  https://www.waternz.org.nz/Attachment?Action=Download&Attachment_id=598
- Design Flows for Pressure Sewers. R. Blazejewski, R Matz. 2012
- WERF, Performance & Cost of Decentralized Unit Processes, 2010

  http://www.ndwrcdp.org/documents/DEC2R08/DEC2R08web.pdf
- Wastewater Collection Systems Comparison. W. Hensley, Orenco Systems, 2012

  https://steve-barry.squarespace.com/s/Tech-Paper-Comparison-of-Collection-Systems.pdf
- Operation and Maintenance of Pressure Sewer Systems. G Grogan. 2007

  http://www.wioa.org.au/conference_papers/07_vic/documents/GaryGrogan.pdf

Appendix B – 'Public' Ownership Policy Template

[ENTER LOCAL AUTHORITY NAME]

Pressure Sewer Policy

“Public Ownership”

Table of contents

1. Introduction

The document sets [Enter Local Authority Name]'s Policy for Pressure Sewer Systems. This Policy covers the use of pressure sewer systems as a wastewater reticulation, the ownership of on-property equipment, responsibilities for installation and for operation and maintenance.

2. Definitions

For the purpose of this Policy, a Pressure Sewer System is defined as:

A wastewater reticulation system that includes individual pumps and associated collection tanks that are located on private property at every residence or connection in the pressure sewer network, that discharge wastewater which is conveyed by the individual pumps, including grinding any solids present, by small bore (50 mm OD or greater) polyethylene pipe to a common discharge point.

The term "Pressure Sewer System" collectively refers to the on-property equipment and the conveyance pipework network located in public road reserves.

"On-property Equipment" collectively refers to a grinder pump, collection tank, electrical & control system and individual discharge pipe up to the boundary kit.

"Public Pressure Sewer Network" refers to the conveyance pipework network located in public road reserves including all appurtenances, from (and including) the boundary kit to the common discharge point.

Single-property pumped systems and "pump ups" are not pressure sewer systems for the purposes of this Policy and are therefore excluded from this Policy.

"Pump ups" are defined as properties that have (or are planned to have) gravity wastewater reticulation at or adjacent to the property boundary, but for what-ever reason cannot discharge to that gravity reticulation by means of a gravity lateral connection and requires a pump to discharge wastewater to the gravity reticulation.

3. Policy

3.1 Use of Pressure Sewer

The use of pressure sewer systems is limited to geographical areas defined as 'Pressure Sewer Areas' by the [Enter Local Authority Name] Water Infrastructure Manager, or approved representative. Refer to [Enter Local Authority Name] Planning Maps for a Pressure Sewer Area overlay.

Areas will only be defined as a Pressure Sewer Area where there is a demonstrable benefit to Council of using pressure sewer in lieu of gravity reticulation, including financial, technical (i.e. hydraulic), environmental and safety related attributes. Any assessment of the benefits of pressure sewer shall incorporate a whole of life assessment of costs and benefits.

Where private property owners (or Developers) wish to have an area zoned for pressure sewer use, suitably detailed technical submissions shall be made in writing to the Council Water Infrastructure Manager.

3.2 Ownership

[Enter Local Authority Name] shall own all pressure sewer on-property equipment, and all public pressure sewer network assets.

Delineation of private and Council responsibility shall be at the point where the gravity wastewater lateral enters the pressure sewer collection tank. The private property owner is responsible for the gravity lateral and all aspects upstream. For electrical supply, the Council is responsible for the electrical and control system from and including the control panel including the pump. The private property owner is responsible for the power supply up to the point of entry to the control panel. The property owner is responsible for the cost of the power supply and for maintaining the power supply in accordance with electrical standards applicable to the type of dwelling (i.e. a residential dwelling).

3.3 Installation Responsibility

The installation of on-property pressure sewer equipment shall be the responsibility of the private property owner, including where applicable, the property developer, builders or other entities deemed to be the private property owner's agent.

On-property pressure sewer equipment shall be vested to [Enter Local Authority Name].

[*Note – make reference to existing standards / requirements for vesting assets to Council*]

Only pressure sewer on-property equipment pre-approved by the Council shall be installed and vested to Council, subject to satisfactory installation testing requirements.

Pressure sewer on-property installations shall comply with:

- Local Authority Technical Specifications
- The requirements of the NZ Building Code Clause B1
- Any site-specific Building Consent Conditions, as applicable.

3.4 Operational & Maintenance Responsibility

[Enter Local Authority Name] shall be responsible for the operation and maintenance of on-property pressure sewer equipment.

The private property owner shall be responsible for:

- The cost and supply of power to the pressure sewer equipment;
- Maintaining adequate access to the pressure sewer equipment, as defined by the [Enter Local Authority Name] Specifications;
- Complying with [Enter Local Authority Name] 's Trade Waste Bylaw, and;
- The pressure sewer equipment supplier's guidelines for use of the pressure sewer equipment, with specific regard to not putting prohibited items (including wet wipes and sanitaryproducts) into the pressure sewer equipment, toilets, or down the sewer drain.

3.5 Private Pump Stations & Pump Ups

Private pump stations and pump ups, as defined in section 2 above, shall be treated as private and are not considered pressure sewers for the purposes of this Policy.

3.6 Swimming Pools & Other High Flow Connections

Swimming pool and spa pool installations can produce high flows during filter backwash and cleaning cycles. The private property owner shall be responsible for designing, installing and maintaining a suitable means of ensuring that high flows do not inundate or otherwise adversely impact on pressure sewer on-property equipment. Generally, it is expected that high flows will be attenuated in a buffer tank. Details of the method of attenuating high flows shall be submitted in writing to the Water Infrastructure Manager, or approved representative. Approval from the Water Infrastructure Manager, or approved representative, shall be obtained.

3.7 Number of Connections to Pressure Sewer Equipment

The number of connections of single residential lots to on-property pressure sewer equipment is limited to one.

For multi-unit title residential dwellings, commercial, industrial and other non-residential connections, the requirements for the on-property equipment will be determined on a case by case basis, by the Water Infrastructure Manager, or approved representative.

The general principles for determining the requirements of non-standard, non-residential connections will be to use duplex or quad (2 or 4 pump) installations and to size the required operational and emergency storage volumes of the collection tank as appropriate to the specifics of the site.

The private property owner shall be responsible for determining the requirements of non-standard, non-residential connections, to the satisfaction of the Water Infrastructure Manager, or approved representative.

3.8 Legal Access

[Enter Local Authority Name] may use provisions within the Local Government Act section 181 that grant [Enter Local Authority Name] the power to construct works on or under private land or under a building on private land that it considers necessary for wastewater reticulation.

Generally, easements will not be required over any part of the on-property pressure sewer equipment.

[Enter Local Authority Name] reserves the right to require the creation of an easement on a particular private property, to ensure the safe ongoing operation of the wastewater system, minimisation of any health concerns or the protection of [Enter Local Authority Name]'s assets at the cost of the private property owner.

3.9 Modifications to Properties

Changes to wastewater flowfrom a property, for example due to changes in land use or building extensions, may require review and upgrade of the pressure sewer pumping unit and associated equipment. Also, this may require review of the wastewater development contribution.

Building over discharge lines located on private property shall comply with the [Enter Local Authority Name]'s "Building over public sewers policy" (including any subsequent amendments to that policy).

3.10 Supporting Documentation

- Local Authority Design Standards

- Local Authority Standard Specifications
- Local Authority Standard Construction Drawings
- Local Authority Wastewater Bylaw
- Local Authority Trade Waste Bylaw
- Local Government Act
- Public Works Act
- NZ Building Act and Building Code
- Local Authority Building Consent application

Appendix C – 'Private' Ownership Policy Template

[ENTER LOCAL AUTHORITY NAME]

Pressure Sewer Policy

"Private Ownership"

Table of contents

1. Introduction

The document sets [Enter Local Authority Name]'s Policy for Pressure Sewer Systems. This Policy covers the use of pressure sewer systems as a wastewater reticulation, the ownership of on-property equipment, responsibilities for installation and for operation and maintenance.

2. Definitions

For the purpose of this Policy, a Pressure Sewer System is defined as:

A wastewater reticulation system that includes individual pumps and associated collection tanks that are located on private property at every residence or connection in the pressure sewer network, that discharge wastewater which is conveyed by the individual pumps, including grinding any solids present, by small bore (50 mm OD or greater from the boundary kit) polyethylene pipe to a common discharge point.

The term "Pressure Sewer System" collectively refers to the on-property equipment and the conveyance pipework network located in public road reserves.

"On-property Equipment" collectively refers to a grinder pump, collection tank, electrical & control system and individual discharge pipe up to the boundary kit.

"Public Pressure Sewer Network" refers to the conveyance pipework network located in public road reserves including all appurtenances, from (and including) the boundary kit to the common discharge point.

Single-property pumped systems and "pump ups" are not pressure sewer systems for the purposes of this Policy and are therefore excluded from this Policy.

"Pump ups" are defined as properties that have (or are planned to have) gravity wastewater reticulation at or adjacent to the property boundary, but for what-ever reason cannot discharge to that gravity reticulation by means of a gravity lateral connection and requires a pump to discharge wastewater to the gravity reticulation.

3. Policy

3.1 Use of Pressure Sewer

The use of pressure sewer systems is limited to geographical areas defined as 'Pressure Sewer Areas' by the [Enter Local Authority Name] Water Infrastructure Manager, or approved representative. Refer to [Enter Local Authority Name] Planning Maps for a Pressure Sewer Area overlay.

Areas will only be defined as a Pressure Sewer Area where there is a demonstrable benefit to Council of using pressure sewer in lieu of gravity reticulation, including financial, technical (i.e. hydraulic), environmental and safety related attributes. Any assessment of the benefits of pressure sewer shall incorporate a whole of life assessment of costs and benefits.

Where private property owners (or Developers) wish to have an area zoned for pressure sewer use, suitably detailed technical submissions shall be made in writing to the Council Water Infrastructure Manager.

3.2 Ownership

The private property owner shall own all pressure sewer on-property equipment, and [Enter Local Authority Name] shall own all public pressure sewer network assets.

Delineation of private and Council responsibility shall be at the boundary kit located on public road reserve immediately adjacent to the property boundary.

3.3 Installation Responsibility

The installation of on-property pressure sewer equipment shall be the responsibility of the private property owner, including where applicable, the property developer, builders or other entities deemed to be the private property owner's agent.

Only pressure sewer on-property equipment pre-approved by the Council shall be installed and discharge wastewater to Council-owned pressure sewer systems.

Pressure sewer on-property installations shall comply with:

- Local Authority Technical Specifications
- The requirements of the NZ Building Code Clause B1
- Any site-specific Building Consent Conditions, as applicable.

3.4 Operational & Maintenance Responsibility

The private property owner shall be responsible for the operation and maintenance of on-property pressure sewer equipment, including:

- The cost and supply of power to the pressure sewer equipment;
- Maintaining adequate access to the pressure sewer equipment for maintenance as required;
- Complying with [Enter Local Authority Name] 's Trade Waste Bylaw, and;
- The pressure sewer equipment supplier's guidelines for use of the pressure sewer equipment, with specific regard to not putting prohibited items (including wet wipes and sanitaryproducts) into the pressure sewer equipment, toilets, or down the sewer drain.

3.5 Private Pump Stations & Pump Ups

Private pump stations and pump ups, as defined in section 2 above, shall be treated as private and are not considered pressure sewers for the purposes of this Policy.

3.6 Swimming Pools & Other High Flow Connections

Swimming pool and spa pool installations can produce high flows during filter backwash and cleaning cycles. The private property owner shall be responsible for designing, installing and maintaining a suitable means of ensuring that high flows do not inundate or otherwise adversely impact on pressure sewer on-property equipment. Generally, it is expected that high flows will be attenuated in a buffer tank. Details of the method of attenuating high flows shall be submitted in writing to the Water Infrastructure Manager, or approved representative. Approval from the Water Infrastructure Manager, or approved representative, shall be obtained.

3.7 Number of Connections to Pressure Sewer Equipment

The number of connections of single residential lots to on-property pressure sewer equipment is limited to one.

For multi-unit title residential dwellings, commercial, industrial and other non-residential connections, the requirements for the on-property equipment will be determined on a case by case basis, by the Water Infrastructure Manager, or approved representative.

The general principles for determining the requirements of non-standard, non-residential connections will be to use duplex or quad (2 or 4 pump) installations and to size the required operational and emergency storage volumes of the collection tank as appropriate to the specifics of the site.

The private property owner shall be responsible for determining the requirements of non-standard, non-residential connections, to the satisfaction of the Water Infrastructure Manager, or approved representative.

3.8 Modifications to Properties

Changes to wastewater flowfrom a property, for example due to changes in land use or building extensions, may require review and upgrade of the pressure sewer pumping unit and associated equipment. Also, this may require review of the wastewater development contribution.

3.9 Supporting Documentation

- Local Authority Design Standards
- Local Authority Standard Specifications
- Local Authority Standard Construction Drawings
- Local Authority Wastewater Bylaw
- Local Authority Trade Waste Bylaw
- Local Government Act
- Public Works Act
- NZ Building Act and Building Code
- Local Authority Building Consent application

Appendix D – System Selection Tool

Appendix D– System Selection Tool

		Pressure Sewer Preferred
	Gravity is the default option and is to be adopted except where Pressure Sewer is shown to be advantageous to Council:	
	Answer Yes, where applicable	
1	General Conditions:	
a	Very flat ground, requiring deep sewers and/or numerous network pump stations (i.e. more than 1 network pump station / 100 properties)	
b	Undulating, requiring deep sewers and/or numerous network pump stations (i.e. more than 1 network pump station / 100 properties)	
c	Very soft ground	
d	Rocky ground, making excavation expensive	
e	High Groundwater table (risk if infiltration)	
f	Environmentally sensitive areas	
g	Is it a Retrofit Project	
	Count 1 (Yes)	
2	Is the 25 year NPV assessment for Pressure Sewer less than for the Gravity Option	
	Count 2 (Yes)	

If Count 1 x Count 2 >0, consider Pressure Sewer System

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NEW ZEALAND

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