4SIGHT CONSULTING

LAND. PEOPLE. WATER.

GISBORNE DISTRICT COUNCIL

Gisborne Wastewater Network - Overflow Discharges

Resource Consent Application and Assessment of Effects on the Environment

For Gisborne District Council

Community Lifelines

REPORT INFORMATION AND QUALITY CONTROL

Prepared for:	Wolfgang Kanz 4 Waters Strategy Advisor, Lifelines Gisborne District Council	
Author:	Megan Dever Senior Planning and Policy Consultant	
Author:	Ian Mayhew Principal Planning and Policy Consultant	
Reviewer:	Megan Dever Senior Planning and Policy Consultant	
Approved for Release:	Ian Mayhew Principal Planning and Policy Consultant	

Document Name:	AA2372_GDC Wastewater Overflows_Application and AEE_Final

Version History:	Final	17 June 2020

CONTENTS

Page

List of Tables

List of Figures

List of Appendices

GLOSSARY OF KEY TERMS AND ACRONYMS

Term/Acronym	
ADWF	Average dry weather flow. The average daily flow during a period of dry weather. An ADWF rate of 200 l/person/day is adopted for design purposes. See Figure 1 below.
AEP	Annual Exceedance Probability. The probability of a rainfall event exceeding a given threshold within any one year. For example a 50% AEP rainfall event has a 50% probably of occurring in any given year, while a 10% event has a 10% probability of occurring in any given year. AEP is related to Annual Recurrence Interval (ARI) as follows: ▪ 1% AEP = 1 in 100 year ARI; ▪ 10 % AEP = 1 in 10 year ARI; ▪ 50 % AEP = 1 in 2 year ARI.
AMS	Asset Management Systems
ARI	Annual Recurrence Interval. The average or expected value of the time period (in years) between rainfall events of a given magnitude. For example, a 1 in 10 year ARI events occurs once every 10 years based on a long term average.
DWO	Dry weather overflow. An overflow of wastewater that occurs in dry weather (in the absence of rainfall).
DrainWise	Gisborne District Council's programme for working together with property owners to help fix problems with wastewater and stormwater drains – see https://www.gdc.govt.nz/drainwise/.
Formal overflow points	These are controlled discharge points that are manually opened on instruction from GDC management. They have been valved or plated to prevent an unintended overflow.
Gully traps	A basin that collects wastewater discharge from within the house except for toilets and should a blockage occur will overflow outside not inside the house. Gully traps include a water seal to block odours from the sewer entering the house. Gull traps are required under the Building Act.
Infiltration	Infiltration is groundwater that enters wastewater systems through cracks and/or leaks in the sanitary sewer pipes, manholes and joints. These may be caused by age related deterioration, loose joints, poor design, installation or maintenance errors, damage or root infiltration.
Inflow	Inflow is stormwater that enters into the wastewater system at points of direct connection to the system (roof water downpipes discharging directly into gully traps). This can include stormwater being directed to the wastewater network, deliberate cross connections and flood waters or overland flow entering via gully traps.

Informal overflow points	These are normally access points into the wastewater network such as gully traps or sewer manholes that can be an uncontrolled overflow point if a blockage occurs within the piped network.
LGA	Local Government Act 2002
LTP	Long Term Plan
Manholes	These are access points into the piped network for inspection or cleaning purposes. They are also generally required where there is a change in pipe diameter, direction, multiple pipes coming together or material type. They are mostly spaced 80m apart to accommodate efficient cleaning if required.
NOAEL	No observable adverse effects level
OMMP	Operation Maintenance and Management Plans
PDWF	Peak dry weather flow. The maximum daily flow during peak usage periods (morning or evening). An allowance of 2.5 times the ADWF is used unless actual peak flows can be measured or assessed.
Pumping Station	A wastewater network is designed to be primarily gravity driven – with wastewater flowing from higher to lower elevations. Pumping stations are used to transport wastewater from low areas or where pipe grades are flat. Approximately 30% of Gisborne’s wastewater is pumped due to the flatness of the Gisborne township.
RMA	Resource Management Act 1991
SCADA	Supervisory Control and Data Acquisition
TRMP	Tairāwhiti Resource Management Plan
PWWF	Peak Wet Weather Flow. Comprising 4 to 6 times ADWF this includes an allowance of 1.5 times ADWF for stormwater entering the network through cracked pipes or direct entry of stormwater from illegal connections or over topping of gully traps. Where the flow exceeds the capacity of the pipe network (at least 4 and up to 6 times AWDF) a wastewater overflow may occur.
WWO	Wet weather overflow. A wastewater overflow that occurs during wet weather as a result of excessive stormwater ingress into the wastewater network.

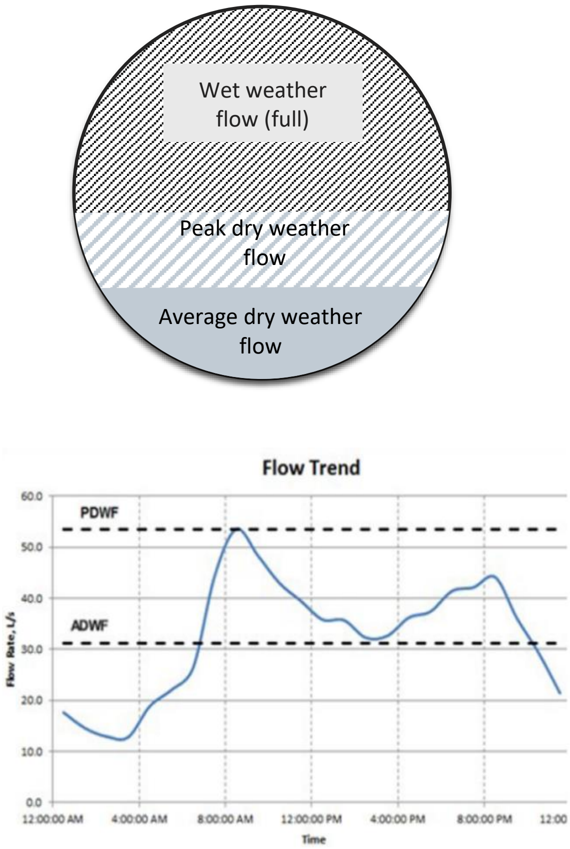


Figure 1: Wastewater System Design Flows

Wastewater Network Design Flows

Average dry weather flow – the average daily flow during a period of dry weather (200 l/person/day

Peak dry weather flow – the maximum daily flow during peak periods (morning or evening) (approximately 2.5 times the ADWF)

Wet weather flow – flow carried during a rainfall event. Where the flow exceeds the capacity of the pipe network (4 to 6 times AWDF) a wastewater overflow may occur

1 APPLICATION – INTRODUCTION AND SCOPE

1.1 Introduction

Gisborne District Council (Council or GDC) owns and operates a wastewater system that services the city of Gisborne, collecting wastewater[1] from houses, businesses and industry and transports this via a series of pipes and pumping stations to a wastewater treatment plant (WWTP) that currently treats the wastewater using a range of screens and a biological trickling filter. The treated discharge from the WWTP is currently directed to a marine outfall, located some 1.8 km offshore in Tūranganui-a-Kiwa (Poverty Bay)[2]. The system is presented in more detail in Section 2. It is important to note that 50% of the reticulated wastewater network is located on private property and is owned by the property owner, and the other 50% is publicly owned and managed by Council. These two components operate as one network, with both public and private responsibilities, which presents specific management challenges.

The Gisborne Wastewater System (GWS) is sized and operated in accordance with current engineering practice, with the main elements of the system being sized to cater for up to four times the average flow of wastewater in dry weather (ADWF) in the main interceptors and up to six times ADWF in upper catchments. Overall, the GWS is assessed as having been designed adequately to convey six times ADWF. This design capacity allows for daily peak usage when demand is the highest and a portion allows for the inevitable ingress of stormwater into the wastewater network during wet weather that occurs in any wastewater network through inflow and infiltration. However, as summarised below and discussed in further detail in the following sections, despite best practice design and operation, wastewater discharges (overflows) can occur from the reticulated network. Overflows from the wastewater system occur in both wet and dry weather.

1.2 Wet Weather Overflows

Wet weather overflows (WWOs) occur as a result of excessive rainwater/ stormwater entering the wastewater network through inflow and infiltration. As indicated previously, a wastewater network is designed and sized to accommodate some stormwater as over time, stormwater ingress is inevitable. Where the combined volume of stormwater and the wastewater flow carried in the network exceeds the capacity of the system, a combination of stormwater and wastewater will be discharged – either through formal (designed) overflow points or otherwise via informal overflow points such as manholes and private gully traps at low points in the system.

---

[1] Under the TRMP wastewater is defined as:

In relation to C6.2.17 – C6.2.20 means wastewater originating from household or personal activities – including toilets, urinals, kitchens, bathrooms (including shower, washbasin, bath, spa bath (but not spa)) and laundries. It includes wastewater flows generated from facilities serving employees, residents, students or guests within institutional, commercial and industrial establishments. It excludes commercial and industrial wastes, large-scale laundry activities and any stormwater flows.

[2] The WWTP and outfall operate pursuant to existing consents which do not form part of this application.

The causes of WWOs are discussed in more detail in Section 2. However, Gisborne's urban area is typically flat and low lying and in some areas there is insufficient topographic height to effectively drain stormwater, especially from private property. Investigations have shown considerable variation in the performance of the stormwater system for various reasons, and as a result extensive stormwater flooding can occur. The performance is affected by capacity constraints within the public stormwater network, topographical challenges, and inadequate private property drainage. In respect of the latter, in some instances stormwater from roofs has been intentionally directed into the wastewater network by the homeowners.

The consequence of this flooding is that rainwater enters the wastewater network when gully traps are overtopped or water flows through broken gully traps as a result of the overland flow or localised flooding. Infiltration of groundwater into the wastewater network, typically through cracked pipes/joints, can also occur, As is discussed in the application, these causes primarily occur on private property and are being progressively reduced through a range of actions by council (or landowners as directed by Council).

Rainwater and surface water runoff are highly unlikely to enter the public wastewater network as direct inflow as the public wastewater network is disconnected from surface waters, with the exception of manhole covers (which are sealed). The underground public wastewater network will be subject to infiltration, however, public wastewater assets are generally subject to more frequent inspection, repair and upgrading than those in private ownership.

1.3 Dry Weather Overflows

Dry weather overflows (DWOs) occur as a result of unexpected problems in the wastewater network resulting in wastewater being discharged from manholes or gully traps and, in extreme cases, pump stations. In Gisborne DWOs generally occur where there is a blockage in the network, mostly associated with a third party putting a foreign object in the wastewater system or fat build-up, and also occur in rare instances as a result of an extended power failure to a pumping station or a break in the network.

The range of actions undertaken by the Applicant, particularly around public education campaigns to address third party behaviour which can impact on the network, is discussed in more detail in Section 3.

1.4 Overflow Reduction and Mitigation

The risk of overflows is mitigated through a range of methods including:

- Network design and upgrading to ensure sufficient conveyance capacity within the wastewater and stormwater network;
- Stormwater Network extensions into areas with poor drainage;
- Stormwater and Wastewater Network renewals;
- Operational activities to reduce the occurrence of overflows, including;
  - Surveillance of the wastewater network, including key manholes;
  - Surveillance of the stormwater network, including open drains;
  - Jet cleaning of sewer pipes (proactive maintenance);
  - Collecting and removing solids in pump stations;

  - Prompt response to blockages;
  - Heavy rainfall monitoring and warnings;
  - Pre wet weather cleaning and inspections of key wastewater and stormwater infrastructure;
  - Access to suction trucks to remove excess wastewater before overflow;
  - CCTV to identify reason for fault and reduce risk of a repeat fault;
- Pump stations have multiple levels of redundancy, including;
  - Standby pump;
  - Ability to increase flow by running both pumps if inflow is above design flows or partial blockages occur;
  - Additional onsite storage and/or emergency storage;
  - Prewired to plug in a standby generator during outages;
  - 24/7 Alarm system to alert pump station attendant of a fault requiring a response with multiple levels of redundancy should there be a sensor failure;
  - A formal inspection and maintenance programme.
- Enforcement of private drainage problems to reduce direct entry of stormwater into the wastewater system;
- Proactive maintenance of the wastewater and stormwater network to ensure it continues to perform as designed;
- Public education, awareness and liaison; and
- Response to overflow incidents – including clean-up and management of public health risk.

As is discussed in the following sections, management of the wastewater network is continuously improved and refined to reduce the extent, frequency and volume of overflows and minimise the risks associated with both wet and dry weather overflows.

A key programme to reduce stormwater inflow to the wastewater network, and substantially reduce wet weather overflows, is Council's DrainWise Programme. This is a multi-faceted programme that integrates all of the above and also includes:

- Strategic direction on Council's wastewater and stormwater network upgrades, renewals, extensions, maintenance, monitoring, and other operational activities;
- The systematic inspection of all private property connections and identification of drainage issues;
- Council fixing minor private drainage issues where possible;
- Requiring illegal drainage to be addressed as a priority;
- Identifying longer term network improvements (for example extending the public stormwater network to better drain private properties);
- Working with landowners and residents to programme works to be done in a way that can be affordable; and
- Providing material to help people understand the role and function of the wastewater and stormwater network, what not to put down it, and how to correct drainage.

Further information on the DrainWise programme in provided in Section 3.

1.5 Scope of Application

Consent for wastewater overflows is required under the Gisborne planning framework – the Tairāwhiti Resource Management Plan (TRMP). The following application is to authorise overflows, subject to a range of actions and measures that seek to progressively reduce overflow frequency, volume and risk and to manage risk where overflows occur.

For the avoidance of doubt, this application relates solely to overflows from the wastewater system that services the Gisborne Reticulated Services Area (see Figure 3) including any new wastewater network that is constructed within this area. It does not relate to wastewater from other areas, for example Te Karaka (which has its own wastewater system), or the discharge of wastewater from the Gisborne Wastewater Treatment Plant (which operates under existing resource consents).

Accordingly, the application covers the following activities:

- The point source discharge of untreated sewage/wastewater, resulting from overflows from wastewater reticulation, during wet weather to land or freshwater.

  Consent for this activity is sought as a **restricted discretionary activity** under Rule 6.2.3(10) of Part C6 of the TRMP.

- The point source discharge of untreated sewage/wastewater, resulting from overflows from wastewater reticulation during dry weather, to land or freshwater.

  Consent for this activity is sought as a **non-complying activity** under Rule 6.2.3(15) of Part C6 of the TRMP.

- The point source discharge of untreated sewage/wastewater, resulting from overflows from wastewater reticulation in both dry and wet weather, to the coastal marine area (CMA).

  Consent for this activity is sought as a **non-complying activity** under Rule 2.6.2(6) of Part D of the TRMP.

  It is noted that there are no known direct discharges of wastewater to the CMA and none are proposed in the future:

  - There are no wet-weather overflow points that direct wastewater to the CMA;
  - As the network is land based and there are no wastewater pipe bridges currently located over the CMA, dry weather overflows would necessarily travel over land or via a river to reach the CMA.

  Accordingly, a coastal permit is only being sought out of an abundance of caution to cover the extremely unlikely event of an unexpected incident that causes wastewater to flow directly to the CMA.

Consent is sought for overflows from both *formal* and *informal* overflow points. This is a conservative approach to cover the potential for discharges from any part of the network during extreme or unforeseeable events.

Consent is sought subject to the improvements and management regime described in the application, which seeks to progressively reduce overflow frequencies and volumes to meet the objectives and targets in Section 4 and to manage and minimise the effects of/risks posed by overflows if they occur.

Consent is sought for a period of 20 years, subject to detailed consent conditions. The basis for this consent term is discussed in Section 8.

1.6 Information Requirements

This application has been prepared in accordance with the requirements of Schedule 4 of the Resource Management Act 1991 (RMA) and the information required in F1.4.1 and F1.4.2 of the TRMP. A completed GDC Application form in accordance with section 88 of the RMA is attached at Appendix A.

1.7 Structure of this Application

This application is structured as follows:

Section 1: Introduces this application and its scope.

Section 2: Describes the wastewater network, its development, components and operation; the causes of overflows; and the performance of the network in respect of overflows.

Section 3: Describes the network operations and management processes that are in place to progressively reduce the occurrence of overflows, ensure that overflows are minimised to the extent possible and respond to overflow incidents should they occur.

Section 4: Identifies the management objectives for the network and relevant performance measures to confirm progress towards these objectives.

Section 5: Describes Gisborne's receiving environments, including their uses and values.

Section 6: Discusses the effects of wastewater overflows on communities and natural environments, both historical and anticipated as a result of the performance and management improvements described in this application.

Section 7: Outlines the results of consultation that has been undertaken with tangata whenua and key stakeholders.

Section 8: Assesses the application against the relevant statutory instruments and addresses the issue of notification of the application.

Section 9: Is a draft set of conditions that are considered appropriate to enable the on-going operation of the network while providing for the appropriate management and progressive reduction of overflows.

Section 10: Provides a summary and overall conclusion to the application.

2 GISBORNE'S WASTEWATER NETWORK

2.1 History of Gisborne's Wastewater System

Gisborne's urban area is serviced by separate stormwater and wastewater networks. The wastewater reticulation was initially constructed in the early 1900s and drained Whataupoko, Cook Hospital, inner Kaiti, the city, Victoria Township (Salisbury Rd, Beacon St, Awapuni Rd) and south east Te Hapara into two septic tanks. The remaining area was served by nightsoil collection. From 1958 to 1965 the system was enlarged with the addition of pump stations to serve its present area, draining via interceptors to the newly constructed ocean outfall, in Tūranganui-ā-kiwa/Poverty Bay (the Bay), which was commissioned in 1965.

Over time there has been a steady increase in development within the city, which has seen an expansion of the wastewater infrastructure in the form of additional pipe work and pump stations. Additionally, community expectations have changed over time and strong cultural concerns regarding the discharge of wastewater to water have received greater recognition such that a discharge of untreated wastewater to the Bay was no longer considered acceptable.

A biological trickling filter WWTP was constructed in 2010 at the current Banks Street site. This treatment system replaced the milliscreen facility at the outfall that was installed in 1990. At present the treatment plant continues to utilise the ocean outfall to the Bay pursuant to its resource consents. An industrial separation project was constructed at the same time as the treatment plant and a separate reticulation system has been constructed for flows from the industries that generate the largest volumes. This industrial waste stream does not go through the biological tricking filter; instead each industry is individually responsible for treatment of their wastewater and the quality and quantity of wastewater is managed via trade waste agreements. The discharge (from the WWTP and the industrial system) is authorised under Consent Number PZ-2008-103653-00.

Historically the capacity of the wastewater system was exceeded during wet weather events due to excessive inflow and infiltration of stormwater into the system and were largely uncontrolled, resulting in discharges (overflows) from the wastewater system to waterways. Over time the network has been upgraded, developed and managed so that the frequency and volume of overflows has been reduced and all uncontrolled overflow points have been completely removed or have had 'sluice' valves placed in them that require manual opening for a wet weather overflow to occur. The opening of these valves allow for WWOs to occur only when absolutely necessary to avoid uncontrolled overflows.

2.2 Public Wastewater System

2.2.1 System Components

The public wastewater network comprises an extensive network of pipes, pumping stations, a treatment plant and other components as summarised in Table 1.

Table 1: Components of the Gisborne Wastewater System

Network Component	Number
Population Served by the Wastewater Activity	32,579
Number of Connections (approx)	15,278
Length of Mains (km)	226
Length of Laterals (km)	91
Number of Manholes (Including Industrial System)	2,856
Number of Pumping Stations (Including Industrial System and Holding Tanks)	40
Number of Treatment Plants (Biological Trickling Filter Plant)	1

Source: LTP 2018 – 2028

The components of the network are shown schematically in Figure 2, and a city-wide map of the network is shown in Figure 3.

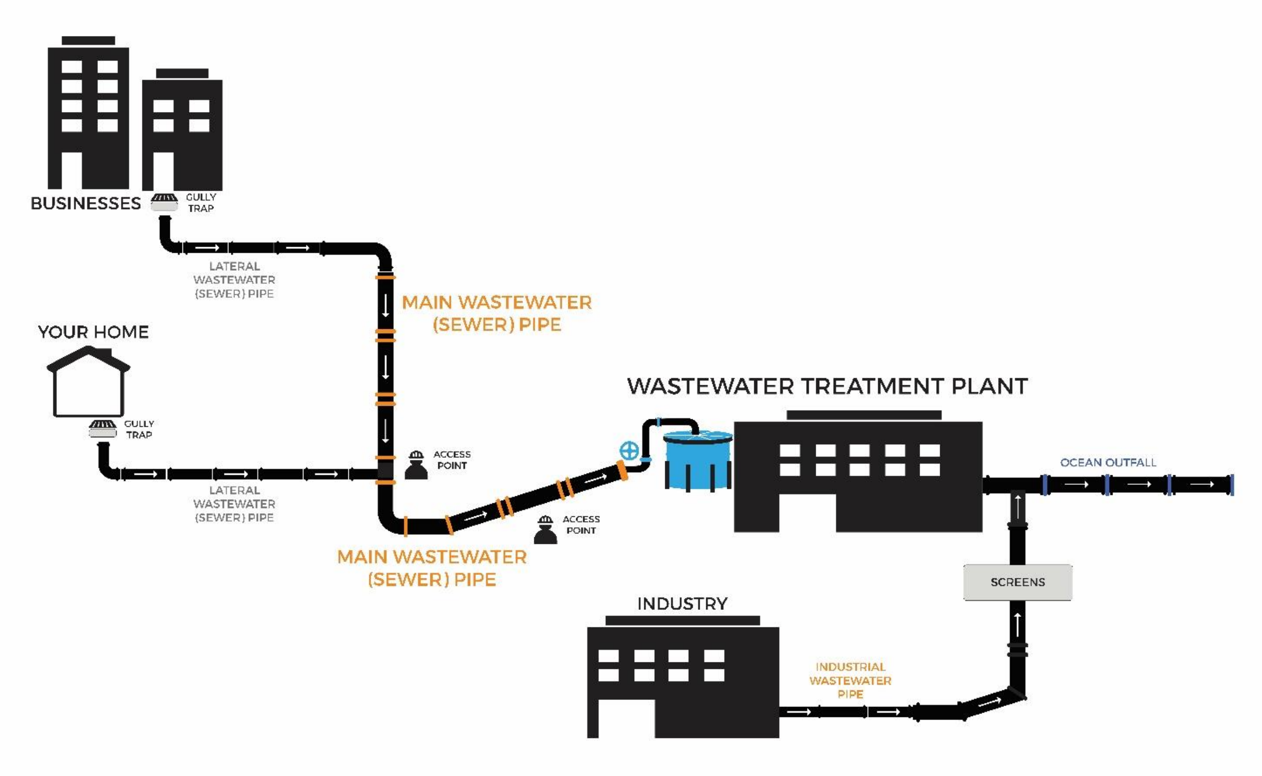


Figure 2: Schematic Diagram of Network

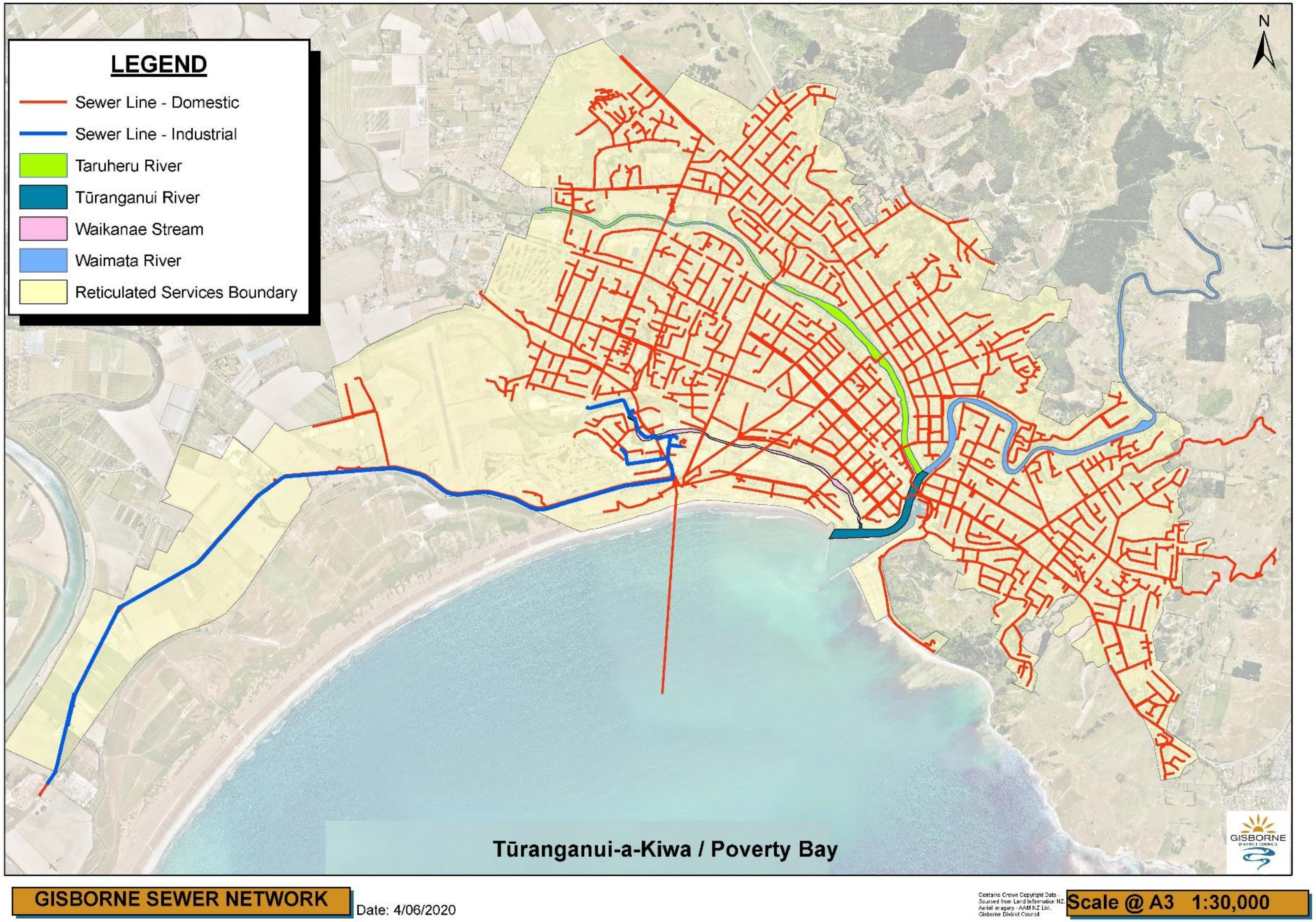


Figure 3: Map of the Gisborne Wastewater Network

The Gisborne urban area is divided into three sectors by the location of the Tūranganui, Waimata and the Taruheru Rivers. As can be seen from Figure 3, the pipes cross these three main rivers eight times in different locations and are potential 'pinch' points (where all the flow comes to those locations to cross the rivers).

Approximately one third of the wastewater network has its sewerage pumped and the remainder relies on gravity to get to the WWTP.

2.2.2 Sizing of the Wastewater Network

The Gisborne wastewater network has been designed and built to manage the wastewater needs of Gisborne households and businesses for growth over the next 30+ years. The public wastewater network was originally designed to take six times ADWF in the upper catchments, and four times ADWF in the interceptors.

Recent modelling undertaken by Beca Limited[3] has confirmed that the Gisborne wastewater network has been designed and constructed adequately to convey six times ADWF without overflowing. A capacity of six times ADWF exceeds Council's design standards which are outlined in its Engineering Code of Practice 2000 (four times ADWF) and is consistent with best practice nationally.

2.2.3 Industrial Wastewater System

As indicated previously, some industrial sites are serviced by a dedicated industrial wastewater line. The current industry line users are:

- Ovation – an abattoir;
- Leaderbrand – a squash packhouse and a retort operation;
- Indevin and Gisvin – both wineries; and
- Cedenco – a food pulp and powder operation.

The location of this line is shown in Figure 3 (above). The industrial line remains separate to the remainder of the wastewater network up to the point of discharge from the treatment plant and the users are required to treat their flows prior to discharging them to the industrial line.

The discharge quantity and quality plus waste reduction requirements are managed though approved Trade Waste Agreements with individual industries.

2.2.4 Location of Formal Overflow Points

It is standard wastewater design practice to install overflow relief points in wastewater networks to protect public health[4] and to protect important infrastructure components.

---

[3] Gisborne Wastewater Network Model Updates and Upgrades. Prepared for Gisborne District Council (Client). Prepared by CH2M Beca Ltd (Beca) 16 November 2017

[4] Noting that GDC has obligations and responsibilities under the Health Act 1956 to provide sanitary works.

The GWS is no different and contains formal overflow points that are used to control discharges of wastewater/stormwater where necessary, in preference to uncontrolled overflows (including on private property). The operation of the system has been developed and refined by Council over time so that overflows are now managed to primarily occur in a hierarchy being:

- Through two primary overflow points (utilised only where necessary);
- Via two secondary points, utilised only in large events (between the 5% and 10% AEP events - 2-year and 10 year ARI) as circumstances require;
- Up to six tertiary overflow points, which may be required to be opened in very large rainfall events (larger than the 10% AEP/10-year ARI).

These primary, secondary and tertiary overflow points, which all require manual opening and closing, are listed in Table 2 and their locations shown in Figure 4.

Table 2: Primary, Secondary and Tertiary Overflow Points

Category	Street Name	Asset Code	Easting[5]	Northing
Primary Overflow Point	Wainui Road	WNUIDO005	2037659.42	5707953.16
	Seymour/Turenne	SEYMDO015	2039016.11	5708096.55
Secondary Overflow Points	Palmerston Road/Peel Street	PALMSO003	2037498.91	5708376.11
	Oak Street	OAK_SO074	2036347.09	5710062.17
Tertiary Overflow Points	Oak Street	OAK_SO080	2036346.60	5710057.28
	Lytton Road	LYTTSO045	2035240.87	5710498.71
	Childers Road	CHILSO264	2035080.77	5709303.76
	Stafford Street	RUSSSO001	2038219.38	5708824.47
	Derby Street	DERBSO001	2037424.05	5708825.96
	Fitzherbert Street	FITZDO115	2037565.64	5708371.24

In extremely heavy and infrequent rainfall events (larger than the 5% AEP / 20-year ARI), where surface water flooding is extensive and deep, numerous gully traps could be overtopped by flood waters and overflows could occur from both the controlled (primary, secondary and tertiary) and uncontrolled (manholes/private property) overflow points. It is noted that the Building Act requires gully trap heights to be set above the 10% AEP / 10 year ARI flood levels.

As indicated in Section 1, consent is sought for all wet weather overflows under all rainfall conditions to provide for this extreme circumstance – even though this is extremely unlikely to occur.

In addition to the overflow valves listed above, the wastewater network also has a series of operational 'scour' valves that enable access to the system for maintenance and repair purposes. These are not utilised as WWO points. The location of these operational scour valves is also shown in Figure 4.

[5] NZGD 2000

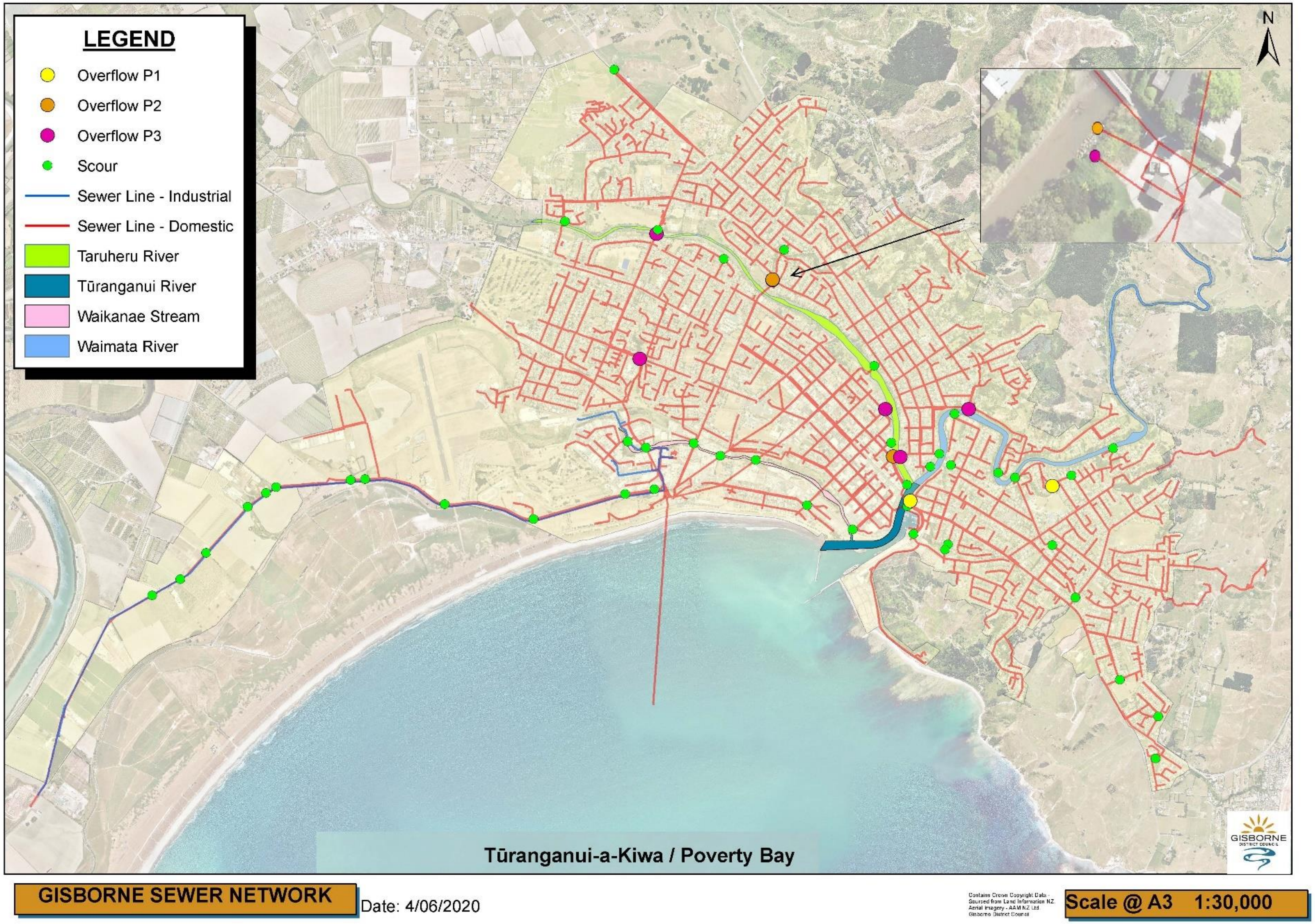


Figure 4: Network Overflow and Operational Scour Valve Locations

2.2.5 Private Wastewater Network

Council owns and manages approximately 50% of the total wastewater system – the public component of the wastewater system. The remaining 50% is owned and managed privately by individual landowners and businesses. The private elements of the wastewater system predominately include wastewater gully traps and lateral pipes that connect into the public system at the property boundary. The delineation of the responsibilities of Council and individual landowners is shown in Figure 5.

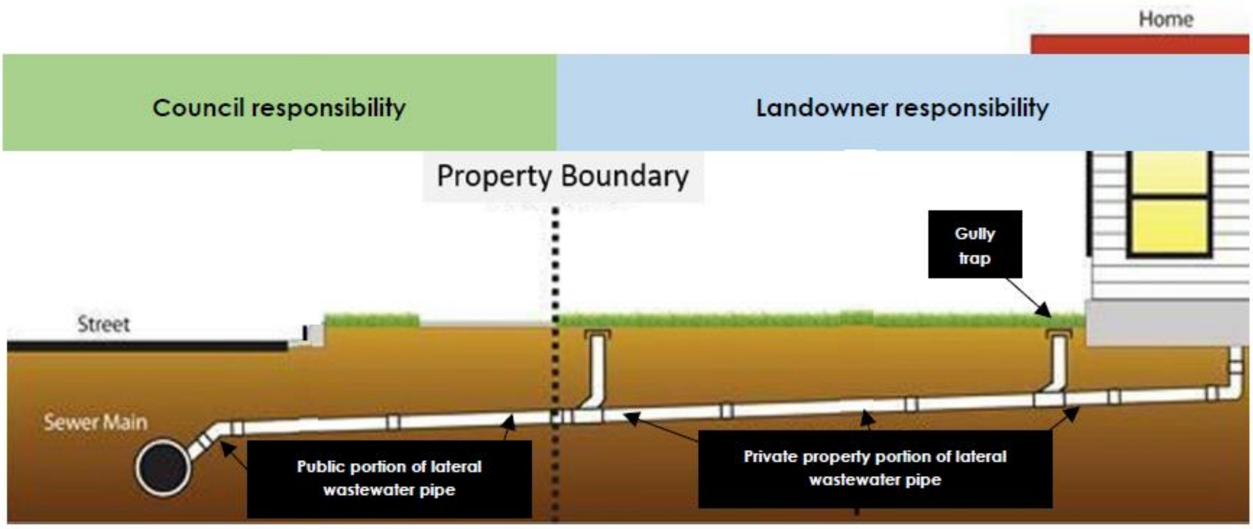


Figure 5: Council Responsibility Versus Landowner Responsibility

(Source: DrainWise)

This joint responsibility for wastewater has significant implications for managing the wastewater network in an integrated way. In particular, as is discussed in the following sections, the primary source of stormwater ingress into the wastewater network occurs on private land. A key focus of reducing the frequency and volume of wet-weather overflows is to reduce the ingress of stormwater from private properties. This is managed through the DrainWise programme as summarised in Section 3 (and at https://www.gdc.govt.nz/drainwise/).

As Council does not own and operate the private portion of the network, and the onus is on private property owners to ensure proper connections and maintain their private infrastructure, there is a reliance on legal (compliance and enforcement) processes for inspections, repair of faults and this raises the social issue of affordability. To assist with this process Council has developed the Infrastructure Improvements on Private Property Strategy (IIOPPS) which is attached at Appendix B.

2.3 Wet Weather Wastewater Overflows

2.3.1 Introduction

Wet weather overflows occur as a result of excessive rainwater/ stormwater entering the wastewater network. A wastewater network is designed and sized to accommodate some stormwater as, over time, stormwater ingress is inevitable. Where the volume of stormwater entering the wastewater network exceeds the capacity of the system, a combination of stormwater and wastewater will be discharged –

either through formal (designed) overflow points and/or via informal overflow points such as manholes and private gully traps – generally at the open point of lowest elevation.

Council opens formal overflow points at the point at which an overflow is inevitable. The resulting discharge to rivers, while not desirable, is undertaken to prevent or minimise informal overflows especially on private property, which presents a greater health and social risk.

2.3.2 History of Network Improvements

Historically, wastewater overflow discharges occurred automatically during wet weather. That is, overflows occurred automatically when the pressure head (wastewater level) became higher than the height of the overflow point and no manual intervention was required. As a result, wastewater would be directed to the stormwater system through formal overflow connections between the wastewater and stormwater networks (emergency relief points) or via informal overflow points. These overflow points did not have any controls or management . This meant that, in the past, overflows could occur in numerous locations across the network without Council being aware of where and when it was occurring. It is possible that stormwater could also flow back into the wastewater network exacerbating the issue. This situation no longer exists as all known automatic overflows are either removed, blocked or valved – with the latter (sluice valves) requiring manual intervention.

Importantly, historically the lack of a stormwater network in many areas contributed significantly to wastewater overflows. In October 1988, Council commissioned a study by Steven Fitzmaurice and Partners into stormwater and wastewater drainage. This report concluded that the sanitary sewer (wastewater) system was *"collecting as much stormwater as the stormwater water system itself"*, advising:

> *"The discovery that the sanitary sewer system is collecting at least as much of the rainfall as the stormwater sewer system highlights the inadequacy of the stormwater system. If illegal stormwater inflow connections on private property are removed from the sanitary sewer system it is essential that an alternative means of disposal for stormwater be readily available. If an alternative is not available then it is inevitable that the illegal overflow connections will be remade. Thus assessment of the availability of stormwater drainage must be carried out concurrently with the inflow abatement programme. Where necessary, the provision of additional stormwater services would be made during the catchment upgrading works. Connections between the stormwater and sanitary drainage system which permit overflow to the sanitary system must be eliminated."*

This started a significant work and capital investment programme, which commenced in 1992 following amalgamation of local Councils into one entity (Gisborne District Council). The initial focus of the improvements was largely on Council assets, including:

a) Upgrading streams to accept additional stormwater ($5M);

b) Upgrading of stormwater catchments with flooding problems ($25M+);

c) Capacity upgrade of sewer mains ($10M);

d) Renewal of old stormwater and sewer mains ($20M);

e) Treatment of wastewater through a new WWTP in 2010 ($40M);

f) Removing interconnections between wastewater and stormwater which were generally automatic; and

g) Blocking or valving off any overflow points so that they require deliberate, manual intervention to release wastewater via constructed overflow points.

In 1994 a city wide questionnaire was undertaken to identify properties with stormwater and wastewater problems, this was used to help prioritise any upgrade work especially relating to stormwater improvements. There have been ongoing private property inspections since this time focussing on illegal connections of stormwater into the sewer network, broken gully traps and faults in sewer laterals.

The above programme of works and site inspections has reduced the extent, volume and frequency of overflows across Gisborne and has ensured that the public wastewater network has sufficient capacity to contain wastewater flows except in heavy rainfall events (see section 2.4.3).

Historically a large number of overflow locations were utilised to minimise the number of on property overflows. Progressively the number of locations used by Council in an event is reducing, with only four key locations targeted (being Wainui Road (Gladstone Road Bridge), Seymour / Turenne Street, Peel Street/Palmerston Road, and Oak Street). In most instances, only two overflow locations are used (Wainui Road (Gladstone Road Bridge) and Seymour / Turenne Street). This has resulted in the quantity being discharged in overflow events being significantly decreased.

A review of the overflow reduction programme was undertaken in 2015 to identify the remaining current drivers of overflows and the actions required to reduce overflows. This included the updating of models of the stormwater and wastewater networks to help identify significant sources of stormwater (direct or indirect), the response of the network to this ingress and the level of reduction that was required to achieve different levels of overflow performance.

The findings of the review are outlined in the Wastewater Discharge Reduction Plan 2016[6]. These findings essentially indicated that the focus should be on the private portion of the network, in terms of both stormwater and wastewater, and remediation works should be permanent fixes to prevent repeat offending. An example is private stormwater pipes discharging into sewer gully traps. Historically the private pipe only was required to be redirected out of the gully trap (temporary fix) rather than piped to an approved outlet (permanent fix). When properties were re-inspected it was discovered that most temporary fixes had been reverted to allowing the downpipe to discharge back into the gully trap.

2.3.3 Wastewater Modelling

In the early 2000s, CH2M Beca (Beca) constructed a new wastewater network model for the GWS using GIS data provided by Council. The model was used to review the effects of Inflow and Infiltration, and development. This model was calibrated against flow survey data in 2007 and used to identify necessary upgrade works.

In 2014, Beca completed a recalibration of the existing model. Part of the recalibration process included updating the serviced population (and associated wastewater flow) in the model to include the 2012

[6] https://www.gdc.govt.nz/about-the-drainwise-project/

census information. The model was then used to assess the storage volumes required for various return period rainfall events to contain the wastewater that would otherwise be discharged to the environment via Gisborne's emergency discharge sluice valves. The bulk reticulation that would be needed to transfer this wastewater directly to the WWTP was also determined. Both of these options were prohibitively expensive and did not address the sources of excessive stormwater entering the wastewater system.

Between 2014 and 2016 a number of improvements were made to improve the accuracy of the model. These included updating levels from survey data, adding in the Western Industrial network, and modelling the inlet to the WWTP to reflect the design.

Using the updated model further analysis was then undertaken by Beca (Appendix C). This assessed the implications of different scenarios for stormwater inflow reduction during a 50% AEP event. These scenarios included:

- 85% of fast response (direct connections into the network) removed;
- 85% of both fast response and property flooding removed; and
- 65% and 75% reduction of both fast and property flooding removed.

The results of this study indicated that the removal of direct stormwater inflows and property flooding has a significant impact on the overflow volumes during a 50% AEP event, as shown in Table 3.

Table 3: Overflow Response to Reduction in Stormwater Inflow

Scenario	Number of Manholes Flooded[7]	Overflow Volume (m^3)
No reduction	154	24,248
65% of gross inflows removed	38	5,661
75% of gross inflows removed	20	1,534
85% of gross inflow removed	4	95

These results illustrate the significance of direct stormwater inflows with respect to the number of wet weather overflow points and volumes and the need to reduce inflow to reduce overflow volumes (and frequencies).

The modelling was also used to identify the network infrastructure upgrade works that would be required to eliminate overflows in a 50% AEP event under the various levels of (direct) stormwater inflow reduction. Incrementally (exponentially) larger investment in storage, conveyance and other infrastructure is required if less stormwater inflow is removed at source than is anticipated i.e. if it is not possible to remove 85% of rapid stormwater inflow.

[7] Note that this would only occur if the relief/scour valves are not opened. As discussed, a purpose of allowing controlled overflow discharges through the relief/scour valves is to avoid indiscriminate overflows from informal overflow points.

Cost estimates for infrastructure upgrades for the three scenarios ranged from $519,000 (85% of gross stormwater inflow removed) through to $5.8 million where only 65% of the gross stormwater inflow was removed[8]. Through this consent application, and the DrainWise Programme, Council is aiming for 85% removal of gross inflow, and has an implementation plan designed to achieve this. Should the results not be realised as expected, then Council will reassess the upgrades required for the 65% reduction scenario. The success of Council's approach will be evaluated on an ongoing basis, by monitoring and assessing changes in the frequency, duration, volumes, and locations of overflows over time.

As a result, Beca (2017) concluded that Council's Wastewater Discharge Reduction Plan to reduce the gross inflow of stormwater into the wastewater network by 85% is a prudent approach. Based on the modelling only relatively small additional works are required to achieve a 50% AEP rainfall event (the adopted containment standard) provided 85% of the stormwater inflow is removed.

As indicated previously, the modelling also confirmed that the Gisborne wastewater network can convey up to six times ADWF, which exceeds best practice (four times ADWF refer NZS 4404).

2.3.4 Contribution of Inflow and Infiltration to Overflows

As a result of the early modelling results discussed above, Council refocussed the Wastewater Discharge Reduction Strategy, with the DrainWise Strategy being produced. In line with the initial models results (and consistent with the updated modelling undertaken in 2017) the actions in the strategy are aimed at substantially reducing the inflow of stormwater into the wastewater network. Council's efforts to reduce rainwater entering the wastewater system also include addressing infiltration into the wastewater network, which will also contribute to achieving reductions in rainwater entering the wastewater system.

Key to achieving this reduction is substantially eliminating the main sources of stormwater inflow – those described as 'high' and 'medium' impact, as shown in Figure 6.

[8] These cost estimates did not assess upgrades to pump stations that may be required.

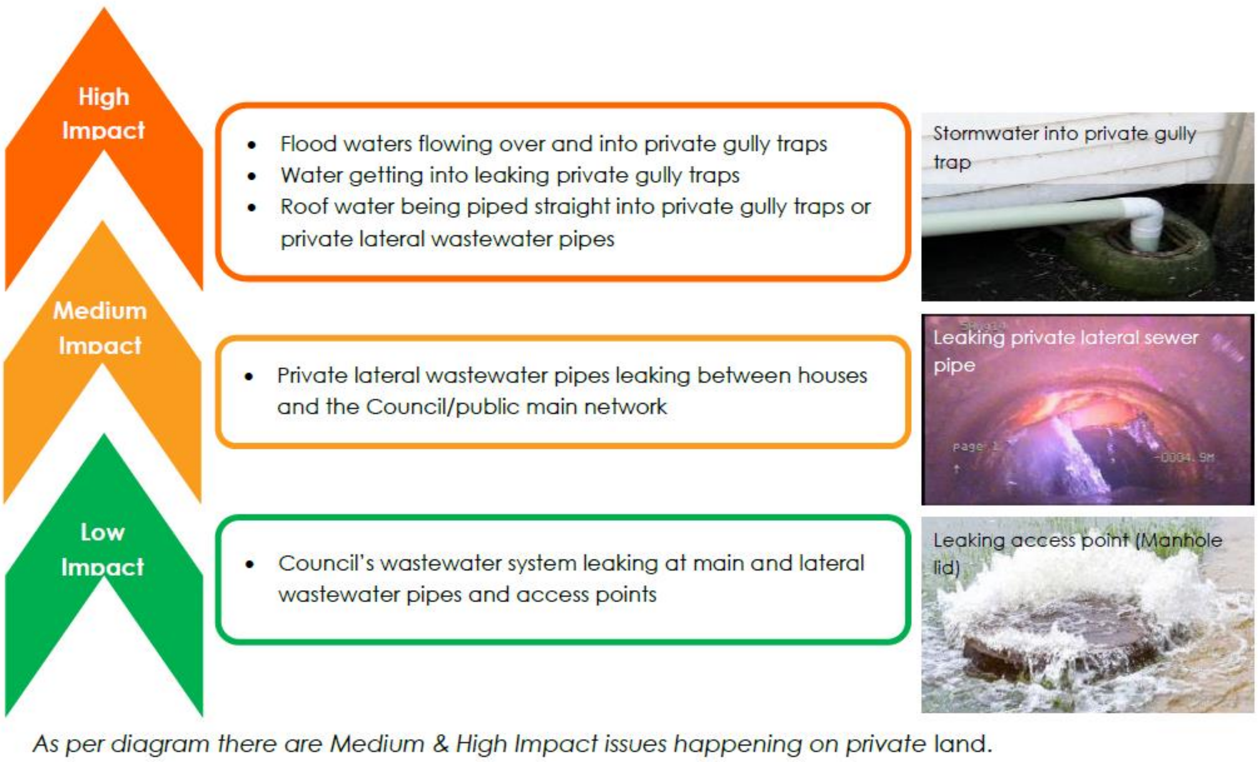


Figure 6: Relative Impacts on the Wastewater Network

(Source: DrainWise)

High impact sources are rainwater that flows directly into wastewater pipes, without first seeping through the soil. These direct, high volume inflow rainwater sources such as rainwater flowing in to gully traps, have the most impact on the wet weather performance of the wastewater network. Underground private lateral wastewater pipes are the next highest contributor known as rain derived infiltration (RDI), although their contribution is substantially less than that of the direct inflow sources.

Leaks in the public network provide the smallest contribution. While the privately owned and operated wastewater network accounts for approximately half of the overall piped network (with the other half being the public network), they have a substantially higher contribution to overflows because of factors such as:

- Their age (60% of Gisborne's houses are more 60 years old);
- Minimal maintenance and asset replacement, when compared to the public network;
- The private network infrastructure is 'connected' to the land surface through inspection chambers, gully traps, and terminal vents, which all allow inflow into the wastewater system if these are broken or cracked.

In contrast, the public network is all below the ground except for manhole lids, but these are sealed, are subject to regular inspection, and are generally not in depressions where water can collect.

The current status of DrainWise, together with the key actions and outcomes to date, is discussed in Section 3.

2.4 Past Overflow Performance

2.4.1 Wet Weather Overflow Events

The operation of WWOs from the wastewater network has, for some time, required manual intervention and the opening of sluice valves to discharge overflows to main rivers, in preference to allowing wastewater to backup and flood private property. The opening and closing of valves is logged, and records provide information on the number of overflow events (and individual valves opened during that event) and the duration of the overflows. Modelling also enables an estimate of overflow volume (comprising both rainwater [stormwater] and wastewater) to be calculated.

Wet weather overflow information from 2006 to 2019[9] is provided in Table 4.

Table 4: Wet Weather Overflow Performance 2009 to 2018

Year[10]	Number of Events	Date	Number of Overflow Points Activated	Maximum Duration of Overflow (hours)[11]	Estimated Volume (m^3)
2006/07	3	6 July 2006	1	2.17	Not Available
		18 July 2004	1	15.83	
		10 September 2006	2	11.75	
2007/08	1	19 June 2008	1	7	Not Available
2008/09	1	29 June 2009	7	75.50	Not Available
2009/10	2	18 July 2009	2	9	Not Available
		28 May 2010	2	20	Not Available
2010/11	3	13 October 2010	2	19	Not Available
		22 March 2011	5	22	Not Available
		26 April 2011	4	26	29,937
2011/12	4	5 July 2011	4	32	32,922
		23 July 2011	2	22	16,630
		20 March 2012	9	38	46,080
		4 April 2012	10	78	72,288
2012/13	3	24 July 2012	3	93	44,210
		Unknown	1	12	Not Available
		13 November 2013	4	13	14,858

[9] Note that overflows are reported by financial year (1 July to 30 June) to reflect LTP targets

[10] In accordance with asset reporting requirements, and consistent with national practice, overflows are reported over a financial year 1 July to 30 June

[11] The longest time that a single overflow point was open for during an overflow event

2013/14	4	13 July 2013	4	49	35,551
		11 August 2013	4	25	24,823
		18 April 2014	7	25	35,232
		11 June 2014	12	47	65,222
2014/15	1	4 August 2014	11	44	48,159
2015/16	1	20 September 2015	8	37	42,081
2016/17	4	4 April 2017	8	18	27,253
		13 April 2017	5	12	10,501
		12 May 2017	3	11	9,915
		29 May 2017	2	14	7,127
2017/18	3	3 September 2017	1	22	8,931
		4 June 2018	2	26	11,279
		11 June 2018	6	48	36,956
2018/19	3	6 August 2018	1	24	9,680
		7 September 2018	1	43	10,087
		13 June 2019	2	13	6,020
2019/20	1	15 October 2019	1	29.5	9,796

It is important to note that overflow frequency and performance is not directly comparable from year to year as it is rainfall event related – overflows will occur more often in years with a larger number of heavy rainfall events and less often in years with fewer heavy rainfall events. However, some overall conclusions can be drawn on the basis of this information over the past 14 years:

- There has been a maximum of four overflow events in any one year, and several years where only one wet weather overflows occurred;
- The average number of overflows per year is approximately 2.5;
- The average volume of overflow (from 2011 to 2019 where information is available) is 28,000 m^3;
- Total annual wastewater volumes have reduced over time (Figure 7); and
- Assuming a ratio of 4 parts stormwater to 1 part wastewater[12], approximately 7,000m^3 of wastewater is discharged in an average overflow event.

[12] This is based on a pipe size of five times ADWF; this is precautionary as modelling has shown the pipe sizes to have a capacity of 6 times ADWF or more.

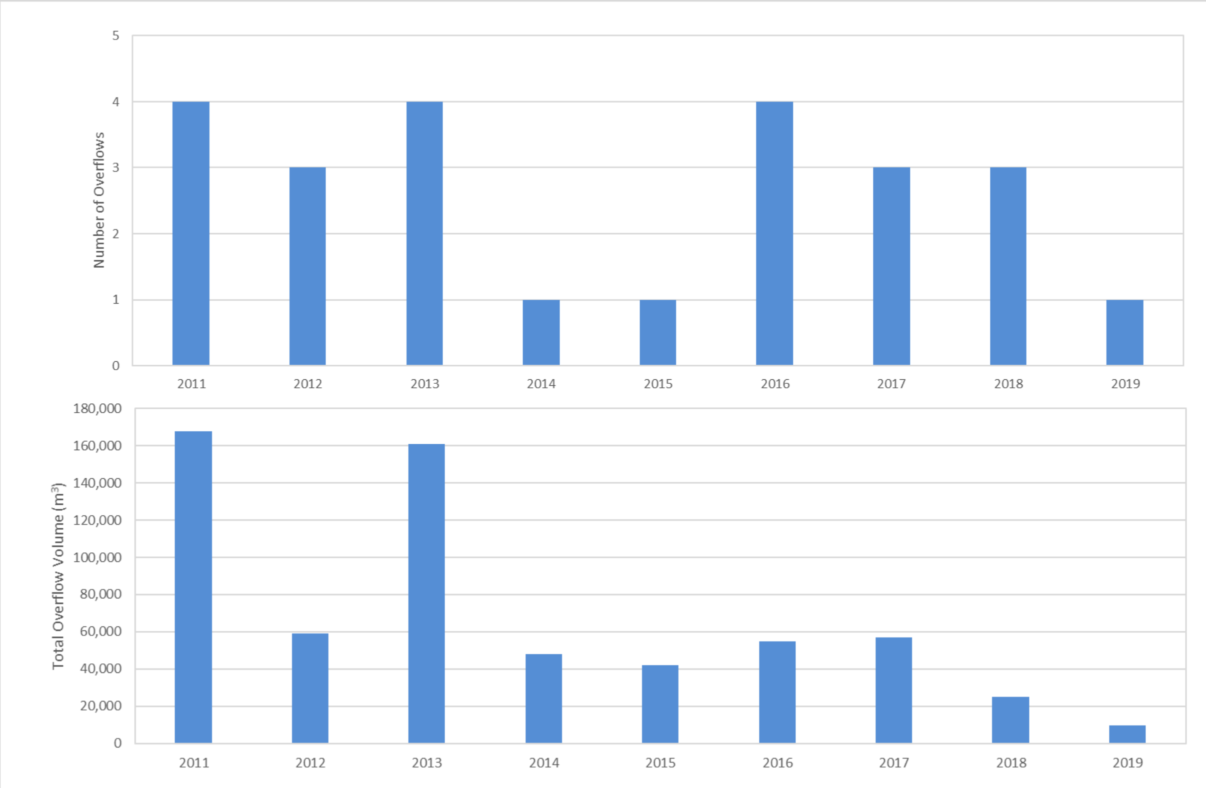


Figure 7: Overflow Number and Volume by Year (2011 to 2019 FY)

2.4.2 Correlation of Overflows and Rainfall

As discussed previously, WWOs occur as a result of heavy rainfall and excessive ingress of stormwater to the wastewater network, exceeding the capacity of that network. Accordingly, rainfall and overflows are related – although it is a complex relationship that not only depends on the magnitude, intensity and duration of a rainfall event but also antecedent conditions. Rain events in Gisborne can also be very localised, affecting only parts of the network and not others.

Figure 8 shows rainfall and the occurrence of overflows from 2006 to 2020, while Figure 9 provides more detail in respect of more recent overflow events (2014 to present day) – reflecting current performance.

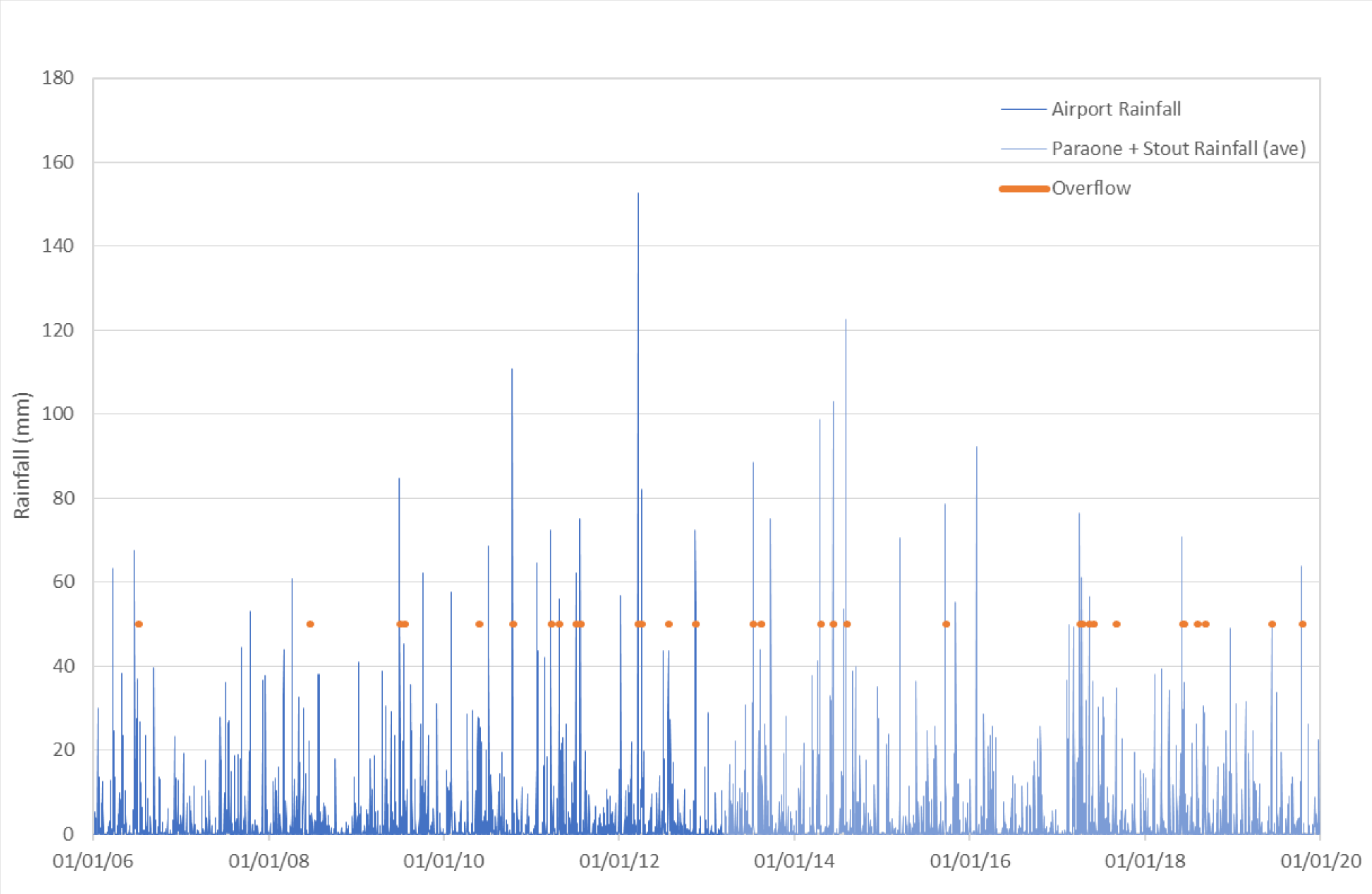


Figure 8: Rainfall and Overflows, 2006 to 2020

Rainfall is from the Niwa @ Gisborne Airport from 2006 to March 2013 at which time GDC commenced operation of rain gauges at Paraone and Stout Street – which are located close to areas of high stormwater ingress into the wastewater network. This latter rainfall data has been used from March 2013 to 2020 as it is considered more representative in respect of overflows

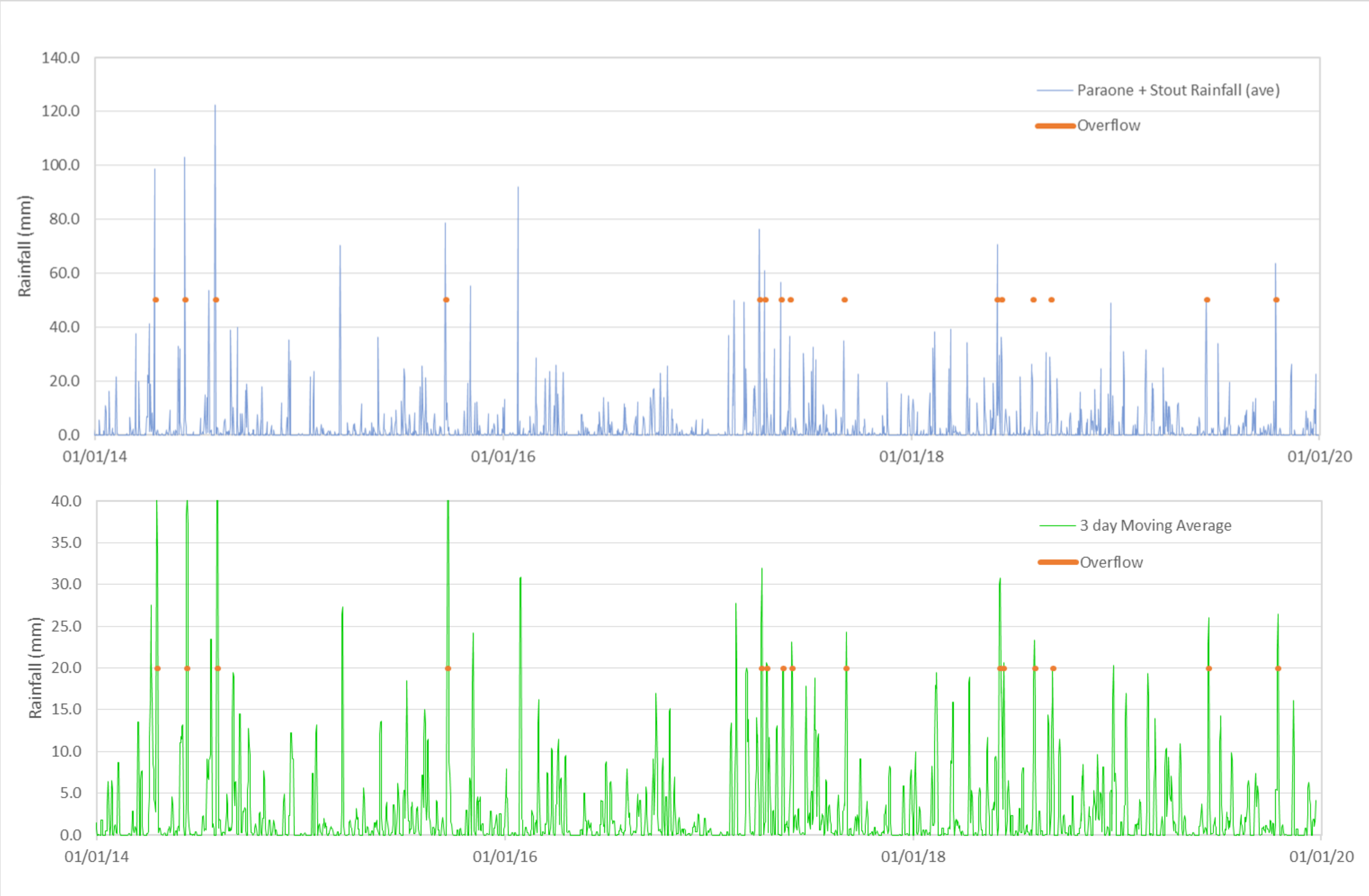


Figure 9: Rainfall and Overflows, 2014 to 2020

This information shows that while there is a clear correlation between very large rainfall events and overflows (Figure 8 and the top graph in Figure 9), in some instances overflows also occur in smaller events.

More detailed analysis of overflow events between 2014 and the present day indicates that overflows are not just related to a high rainfall event, but also sustained heavy rainfall over several days. All overflow instances between 1 January 2014 and the present day occurred where these was a sustained rainfall of 20 mm (or more) per day for three days (Figure 9 – lower graph). No overflows occurred in rainfall of a lesser duration/intensity and in some instances the network did not overflow in larger events – the latter may be due to rainfall being very localised and affecting only a part of the network or dry antecedent conditions.

2.4.3 Statistical Analysis of Overflow Events

To further assess the correlation between rainfall events and overflows, Council undertook a detailed statistical analysis of rainfall and overflow events. The assessment is provided in Appendix D.

The aim of the assessment was to identify whether there was a clear correlation between rainfall duration/intensity and the opening of the scour valves and comprised examination of both rainfall events when the scours have to be opened and large rainfall events when the scours remain closed.

An Average Recurrence Interval (ARI) (in years) was obtained for the rainfall data at each site (considering different durations) using the National Institute of Water and Atmospheric Research's (NIWA) web-based programme, known as HIRDS (High Intensity Rainfall Design System) (version 4). The HIRDS tables provide rainfall depths at any location in New Zealand for different durations (including 10 minutes, 20 minutes, 30 minutes, 1 hour, 2 hours, 6 hours, 12 hours, 1 day, 2 days and 3 days) and for different ARIs (including 1.58, 2, 5, 10, 20, 30, 40, 50, 60, 80, 100 and 250 years). Return periods outside of these ARIs were interpolated (or extrapolated).

Rainfall information was sourced from five sites around Gisborne, in recognition that rainfall in Gisborne is often very localised. The sites used were:

- Gisborne Airport Metservice Station;
- Paraone Rd RG (rain gauge);
- Stout Street RG;
- Waikanae Stream at Customhouse Street Bridge; and
- Wheatstone Rd.

See Appendix D for the location of the rainfall sites.

Table 5 provides the analysis of the estimated rainfall return period for each overflow event from April 2014 to October 2019.

Table 5: Overflow/Rainfall Intensity

Overflow Event	Highest ARI (years)	Duration	Site
18-Apr-2014	12.9	12 hours	Paraone Rd
11-Jun-2014	5.3	1 day	Stout St
4-Aug-2014	10.4	1 day	Stout St
20-Sep-2015	9.8	1 day	Wheatstone Rd
4-Apr-2017	2.4	1 day	Paraone Rd
13-Apr-2017	5.9	2 hours	Stout St
12-May-2017	1.7	1 day	Wheatstone Rd
29-May-2017	1.8	10 min	Paraone Rd
3-Sep-2017	1.7	20 min	Stout St
4-Jun-2018	3.8	20 min	Paraone Rd
11-Jun-2018	1.5	1 day	Stout St
6-Aug-2018	1.1	3 days	Paraone Rd / Stout St
7-Sep-2018	1.0	3 days	Stout St
13-Jun-2019	89.3	30 min	Wheatstone Rd
15-Oct-2019	2.8	6 hours	Stout St

As can be seen from this analysis, there is no clear 'critical' rainfall event that leads to an overflow, with the maximum return period duration ranging from an intense 10 minute rainfall (within a wider rainfall event) to a prolonged 3-day rainfall event. However, this analysis shows that the valves were opened on seven occasions when the ARIs were less than 2 years at all sites and for all durations and the valves were opened on eight occasions where rainfall had an ARI of more than two years at one site at least. Some of the rainfall events that caused overflows could also have been so localised that they were not entirely captured by the city rain gauges.

The analysis of large rainfall events that did not lead to WWOs indicated that there were some instances where the overflow valves were not opened in a rainfall event greater than the 2-year ARI – including for longer duration (1-year ARI intensities). However, it is difficult to establish why the scours have to be opened in one event and not another due to the complexity of the wastewater network and the variability of rainfall events.

The analysis indicates that each rainfall event is different and there is no clear relationship between rainfall duration/depth and the point at which the scour valves are required to be opened. However, the following observations are made:

- The scour valves were opened on eight occasions where the rainfall had an ARI of more than two years. However, the duration of the rainfall that exceeded the 2 year ARI event was variable and included:
    - Localised, short duration, high intensity rainfall event (13-Jun-2019). The high rainfall intensities make this event stand out from all the other events.

- Short and medium durations (up to 12 hours): 13-Apr-2017.
- Medium and long durations (6 hours to 1 day): 4-Apr-2017.
- All durations (short, medium and long): 18-Apr-2014; 11-Jun-2014.
- Different durations at different sites (no clear pattern to rainfall events) on 4-Aug-2014; 20-Sep-2015; and 4-Jun-2018.

- There is therefore no clear indication of the ‘critical’ rainfall event that leads to the scour valves being opened. Both short duration/high intensity and long duration/lower intensity events can give rise to overflows.
- There were also eight occasions where the scour valves were opened for rainfall events when the ARI was less than 1.58 years – indicating that the current network overflow performance is lower than the 1.58 year ARI rainfall event. However, HIRDS is not designed for sub-annual return periods and hence it has not been possible to determine the smallest return period event that has resulted in the scour valves being opened. However, there have also been instances where rainfall has exceeded the 2 year ARI event, but the scours have not been opened.
- Rainfall depth for any specific interval might not be the direct cause of the scours being opened – it may also depend on when and where the rain occurred and the travel time within the network.
- Based on the Paraone Road rain gauge, rainfall lasts for 17 hours (in general) before the scour valves are opened. There tends to be either no gap in the rainfall event or one that lasts for no more than an hour. In most events the maximum hourly rainfall exceeds 9 mm.
- Elevated shallow groundwater levels may be a source of water ingress into the pipes. When groundwater levels are examined in the north-west of the city, it shows that most overflows occur when the shallow aquifer is recharging rather than declining. Rainfall is seasonal and as the autumn and winter progress, there is more rainfall and the shallow aquifers are recharging.

While this analysis has not currently yielded any clear relationship between rainfall intensity/duration, Council considers it beneficial to continue to analyse and report on rainfall intensity and duration for overflow events. Further analysis may provide a clearer indication of critical rainfall events, which in turn may aid management and refine priorities for upgrades. Accordingly, a condition of consent is proposed requiring a similar analysis to be provided on an annual basis as part of consent performance reporting.

In addition, climate change may affect further rainfall patterns, in particular seasonal rather than annual rainfall. Winter rainfall is projected to decrease by 2 to 13 per cent in Gisborne while Spring rainfall is projected to decrease by 3 to 15 per cent (by 2090). However, summer and autumn rainfall are both expected to increase[13].

2.5 Dry Weather Overflows

2.5.1 Causes of Dry Weather Overflows

An overflow of wastewater from the network can also occur during dry weather i.e. it has not been caused by too much rainwater entering the wastewater system. This typically occurs as a result of a pipe

[13] https://www.mfe.govt.nz/climate-change/likely-impacts-of-climate-change/how-could-climate-change-affect-my-region/gisborne

blockage generally due to fat, sanitary wipes or foreign objects (such as clothing and children's toys) being put into the wastewater network. In rare instances DWOs can result from failure of a system component, for example pump station faults or pipe breakages, or operational error (very rare). A large portion of the piped network is relatively flat, resulting in a build-up of material in pipelines and increasing the risk of DWOs.   Figure 10 shows a selection of foreign objects, which have caused blockages of the network, following their removal.

Figure 10: Objects and Material Removed from the Wastewater Network

As DWOs generally occur as a result of specific circumstances in a specific location in the network, and can occur almost anywhere across the network, they are impossible to predict in advance and rely on Council being informed of the overflow and responding promptly to address it. Council undertakes maintenance (e.g. jet-cleaning) and surveillance (e.g. monitoring key manholes, monitoring of key manholes) to reduce the risk of these overflows.

In most circumstances DWOs discharge from the lowest gully traps or manhole upstream of the blockage, with wastewater flowing across adjacent land and the environmental impact is mostly localised. Discharges to water are rare and generally a result of the above ground overflow point, e.g. the gully trap described above, being in close proximity to a water body and there is insufficient time for Council's contractor to respond or it is not reported to Council soon enough to prevent it entering water. A contractor response plan has been developed and is part of standard operating procedures (SOPs).

DWOs have been formally catalogued since 2015/16 and these are shown in Table 6. Of the twelve events that occurred in 2015/16, three reached a waterway via overland flow. Nine occurred in 2016/17, of which one reached a waterway. Only two DWOs occurred in 2019/20, both of which reached a waterway. This demonstrates the variability of dry weather overflow events. However, it indicates that over the past 5 years, approximately 25% of DWOs reached a waterway.

Table 6: Dry Weather Events

Financial Year	**Dry Weather Events**	**Number of Events That Reached Water**
2015/16	12	3
2016/17	9	2
2017/18	9	1
2018/19	4	1
2019/20	2	2
Total	**36**	**9**

The volume of wastewater discharged into water in a DWO event is estimated to generally have been between 100 and 2,000 litres, rarely more, and the duration of an overflow normally less than a couple of hours. This is based on discussions with Fulton Hogan (Council's wastewater operations contractor). The exact volume is difficult to determine as this depends on how quickly the overflow is detected and the size of the 'upstream' wastewater 'catchment'.

DWOs generally occur out of manholes in roads or gully traps on properties, being readily visible. Gully trap discharges are unlikely to get to water, sewer manholes are closer to stormwater sumps but discharges from manhole are generally very small because of the weight of the lid. DWOs are also possible from pump stations (e.g. when rags and wet wipes stop wastewater pumps), but these events are quickly noticed as the pump stations are remotely monitored.

There have been more significant events, such as the Oak Street overflow in 2017, which lasted approximately 2 hours (although the repair took approximately 8 hours).

http://www.gdc.govt.nz/assets/Uploads/17-185-Oak-Street-Overflow.pdf

During this event Council employed sucker trucks to pump out wastewater from the system, to reduce the volumes reaching the waterbody. Council also notified the community of the DWO. Following such events Council has then made improvements to mitigate the risk of a similar event in the future.

When DWOs take place they are generally to relatively large waterbodies where mixing will quickly occur, if it is a small waterway the discharge is generally contained and the discharge recovered by using a suction truck. In terms of effects on communities and water users, DWOs are generally very localised and generally do not present elevated health risks as they are contained. If a discharge is large such as the Oak Street incident the health risks are assessed at that time and appropriate warnings and monitoring are put in place. Council has in place a protocol for reacting to wastewater overflows, and this includes work by Pollution Control to mitigate health risks (and notify the public is there is a health risk).

2.5.2 Management of Dry Weather Overflows

There are five key methods by which DWOs are managed and minimised to the extent possible:

- System controls and duplication. These are controls that are built into the design of key elements of the system to provide advance warning of potential problems and enable these to be addressed before an overflow occurs. An example of this is the multiple control systems and alarms that are built into pump stations, providing sequential warnings in respect of pump station levels (Figure 11).
- Trade waste compliance. Ensuring commercial activities (for example cafes and restaurants) have grease traps and other facilities in place to manage their discharge to the wastewater network.

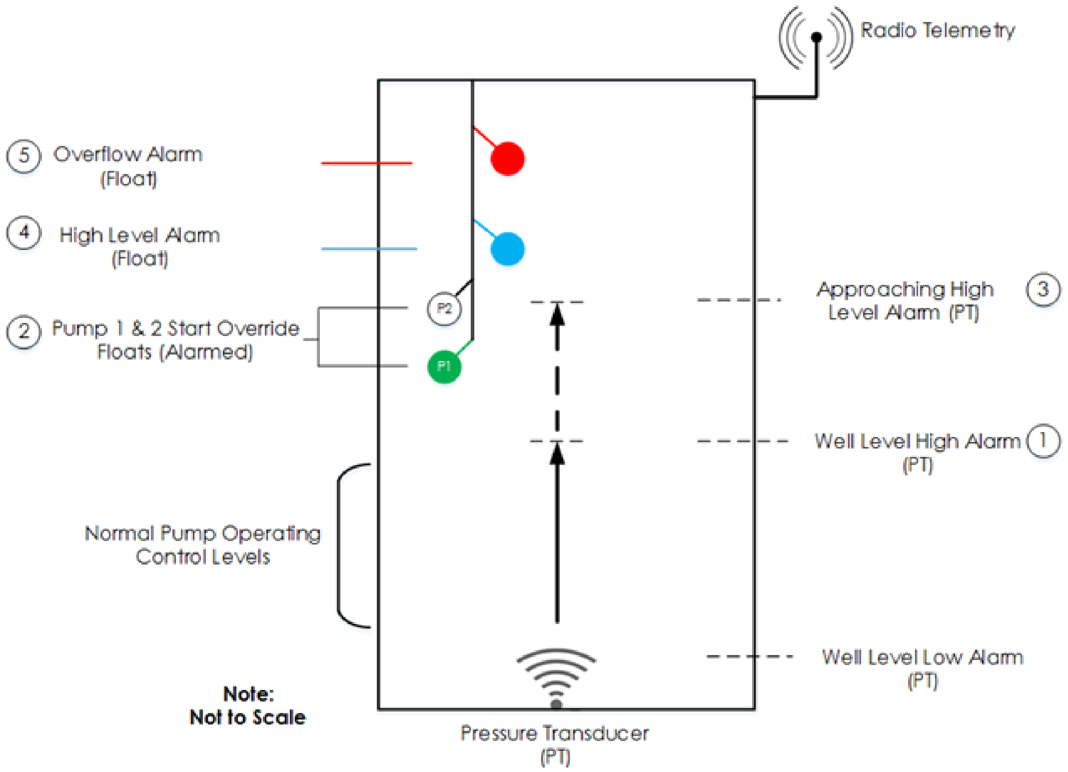


Figure 11: Pump Stations - Multi Alarm and Control Redundancy

- Proactive maintenance of the system. As indicated previously, much of Gisborne's wastewater network is constructed at low grades which increases the potential for the build-up of sediment and other material. To address this, Council undertakes regular jet cleaning of critical components and known problem areas to maintain pipe capacity and conveyance.

- Public education. A major cause of DWOs is the inappropriate disposal of material into the wastewater network. These include wipes/rags, fat from cooking which solidifies when cooled, grass clippings (disposed of down manholes), and objects such as toys and cutlery. Council engages the community about what not to dispose of down the wastewater network, via social media, newspaper and campaigns. See: https://www.gdc.govt.nz/drainwise-education-resources/ and Section 7 for information on the education campaigns.
- Prompt response and clean-up. As DWOs can occur anywhere at any time, a key method of minimising effects is responding promptly, containment as fast as possible, fixing the problem, cleaning up the discharge and public notification if there is a health risk. As these overflows can occur from gully traps and manholes, and contain undiluted wastewater, they can pose risks to human health (and the environment should they enter small waterways). Accordingly, prompt and effective response is a critical element of Council's wastewater network management contracts.

Section 3.2 provides more information on Council's proactive maintenance and response processes.

2.6 Overflow Performance Benchmarking

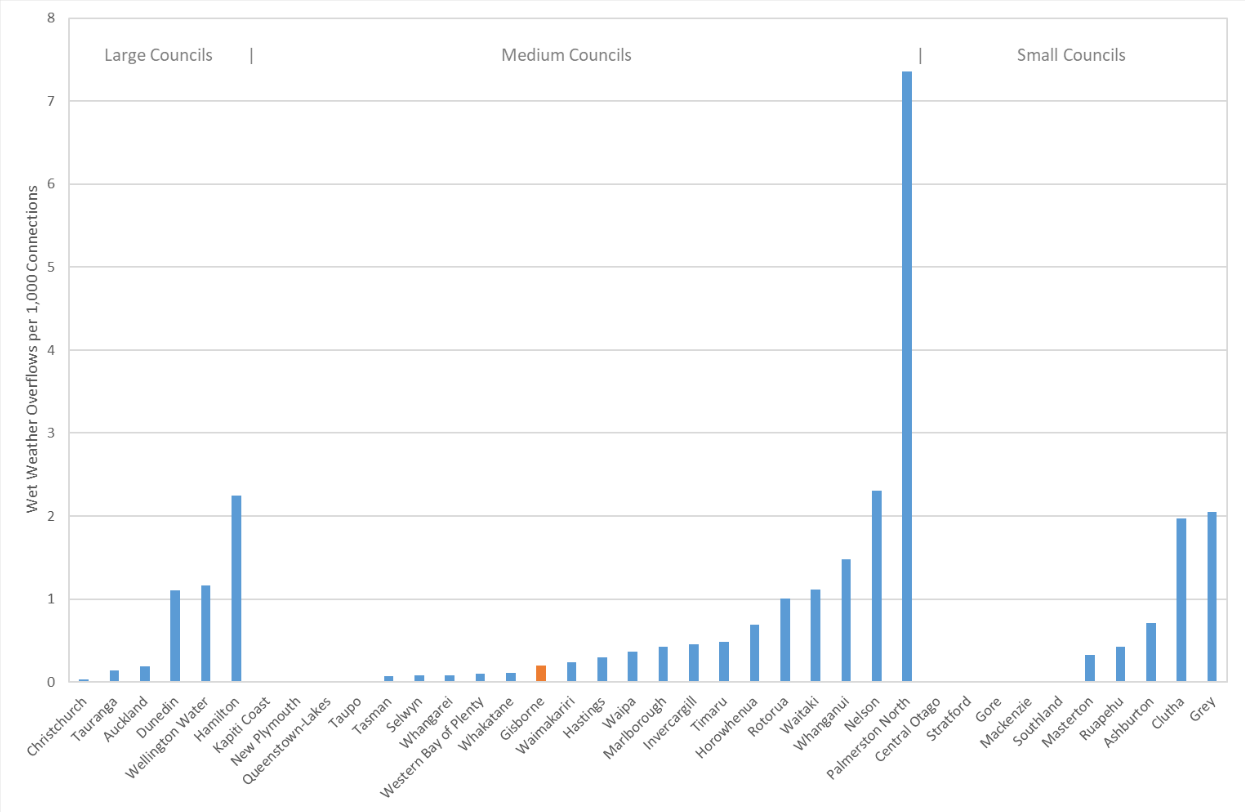
To provide a national context for the performance of the GWS, it has been 'benchmarked' against reported performance from other Councils for the 2018/19 financial year, as reported in the Water New Zealand National Performance Review 2018/19. In this review, participant councils[14] have provided Water New Zealand with their wet weather and dry weather overflow performance, expressed as a number of overflows/1,000 connections. The overflow performance is shown in Figure 12. In the data extracted from the data portal, DWOs have also been classified in terms of council size, with a 'medium' council being one with more than 20,000 – 90,000 water + wastewater connections. Gisborne, (approximately 15,000 wastewater and 13,000 water connections) is therefore classified as a medium council.

Some caution should be exercised in drawing comparisons as overflow information is collected and reported differently by councils – particularly for WWOs. Some councils report WWOs by complaints (which may underestimate the number of overflows that actually occurred), while other report based on modelling or monitoring. As (Gisborne) Council is required to manually operate sluice valves for WWOs to occur, its WWO data is of high accuracy. Additionally, each district will be subject to different rainfall events – hence the number of overflows is not a true reflection of WWO performance across councils. In respect of DWOs, which are more unpredictable in their nature, most councils are likely to report these based on complaints and identification through operations and maintenance, and hence the data is more likely to be comparable.

Notwithstanding these caveats, the benchmarking data indicates that Council's (2018/19) wet and dry weather overflows/1,000 connections is at the low (better) end of the range of participant council performance – both in respect of similarly size councils and across all councils. This indicates that the Council's wastewater system and associated management is comparable to national practice.

---

[14] Gisborne District did not participate in the 2018/19 survey. Its overflow performance has been added to that downloaded from the survey portal.



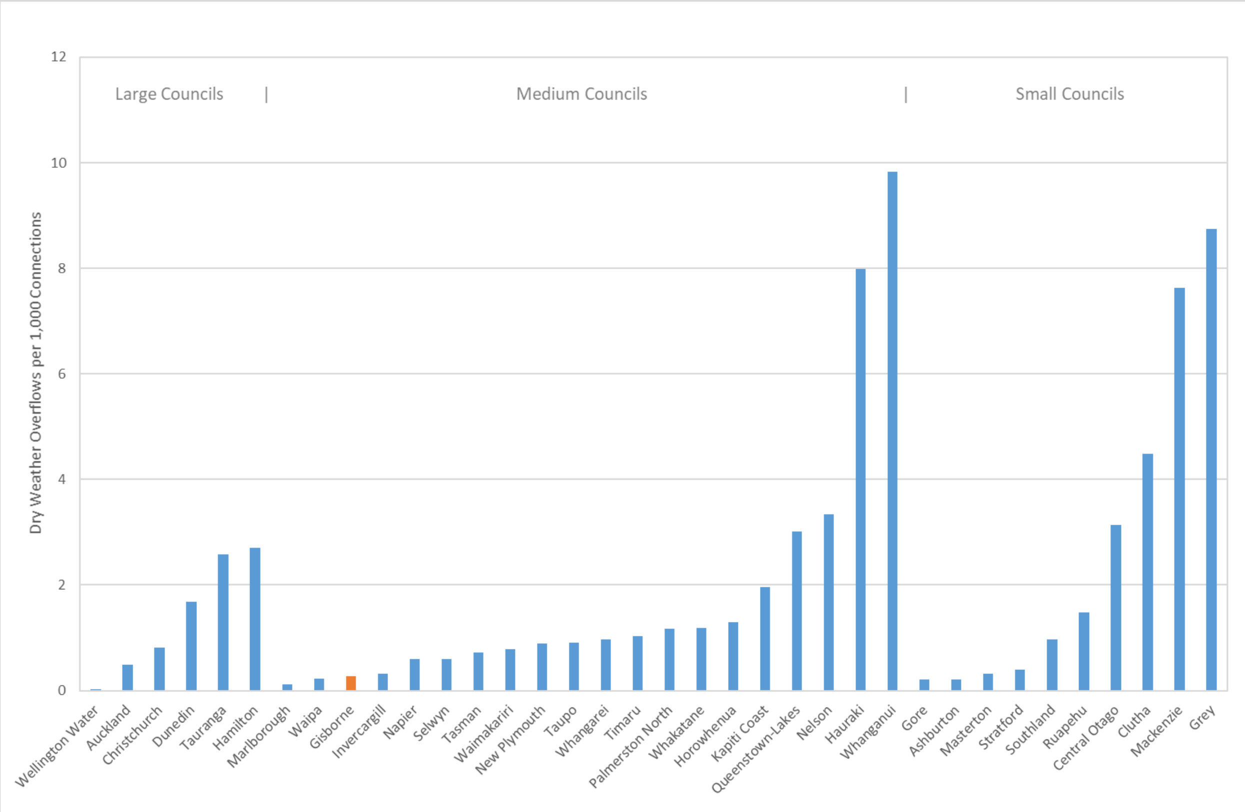


Figure 12: National Overflow Benchmarking (2018/19)

(Source – Water NZ)

3 NETWORK OPERATIONS AND MANAGEMENT

3.1 Governance and Delivery

3.1.1 Governance Structure and Management Responsibilities

Council's management structure is shown in Figure 13. Responsibility for the operation and management of the wastewater network is managed in Council's Community Lifelines Department.

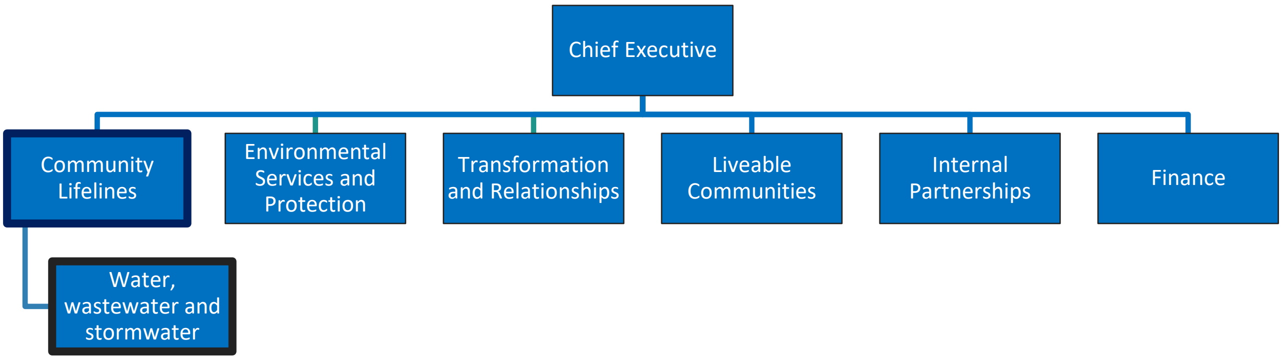


Figure 13: Council's Management Structure

Wastewater management, and other operational functions of Council, are reported to Council's Operations Committee. Council also has a dedicated Wastewater Management Committee (WMC), comprising four elected members and four iwi members, which has an overview role across Council's WWTP resource consents and other aspects of wastewater management.

The functions of the WMC include monitoring compliance with permit conditions, ensuring the development of appropriate educational information to encourage reductions in domestic and industrial wastewater, and developing and administering the Tūranganui-a-Kiwa Water Quality Enhancement Project.

Council is responsible for the Tūranganui-a-Kiwa Water Quality Enhancement Project, with the project defined and developed by the WMC as a vehicle for integrated research, monitoring, planning and specific projects that will aim to improve the mauri and the water quality of Tūranganui-a-Kiwa as related to wastewater matters.

The WMC established the KIWA Group to assist in this work - the purpose of the KIWA Group is to provide expert cultural and technical advice as directed by the WMC to support the development of wastewater management in Gisborne. This may require members of the group to liaise with and to seek the advice of wider kaumatua, hapū, iwi and other technical experts (such as those within Council). As discussed in Section 7, the KIWA Group was engaged to assist with tangata whenua input into this resource consent application.

3.1.2 Overflow Management Responsibility

As discussed previously, WWOs now require manual intervention (to open and close valves). For the past 10 years, Council has instituted a robust process to ensure that valve opening only occurs where necessary and only for as long as necessary. This protocol is presented in more detail in Section 3.3

below. Responsibility for opening and closing overflow valves lies with the 4 Waters Operations Manager and Wastewater Team Leader, after notifying Council Senior Management.

3.1.3 Long-Term Plan

Under s10 of the Local Government Act 2002 (LGA) the purpose of local government is to:

(1) The purpose of local government is—

(a) to enable democratic local decision-making and action by, and on behalf of, communities; and

(b) to promote the social, economic, environmental, and cultural well-being of communities in the present and for the future.

The provision of critical network infrastructure enables Council to promote the four well-beings (social, economic, environmental and cultural) in the present and for the future.

Council must, at all times, have a long-term plan (LTP) in place. Council's current LTP "Our Future Plan" covers the 2018 – 2028 period. One of Council's strategic priorities is for *"intelligent infrastructure"* – *"Invest in existing and future core infrastructure needs, with a focus on cost efficient and effective designs".* Council's strategic priorities are reflected in the LTP's projects and activities.

3.1.4 30 Year Infrastructure Strategy (2018/28 LTP)

Under the LTP Council is required to have a 30 year Infrastructure Strategy. The purpose of the strategy is to identify the significant infrastructure issues for Council, the principal options for managing these issues and the implications of the options.

The fixed asset value of Council's wastewater and stormwater assets is provided in Table 7.

Table 7: Council Fixed Asset Value (Source: 2018/28 Infrastructure Strategy)

Asset	Replacement Cost	Book Value (Depreciated Replacement Value)
Wastewater	$161m	$90m
Stormwater	$85m	$50m

In terms of wastewater issues, both WWOs and DWOs are identified as strategic issues. A number of options are included to address these issues. These are discussed in Section 4.

3.2 Asset Management

3.2.1 Operations and Maintenance

The wastewater network is maintained with the assistance of a dedicated Tier 1 Contractor (currently Fulton Hogan). The contract is for seven years (2019 to 2026) to encourage investment into new and modern equipment and ensure network familiarity can be developed.

The maintenance strategy is both preventive (proactive) and reactive. The Contract outlines the levels of service Council wishes to maintain, response times, material standards, workmanship and health and safety requirements. This is supported by a series of Operation Maintenance and Management Plans (OMMP) designed to simplify procedures and processes for the contractor's staff without the need for referring to the extensive contract document.

Preventative Maintenance

Preventive (proactive) maintenance focuses on regular inspection, cleaning and/or servicing regime with frequency linked to the criticality of the asset to ensure performance is maintained. These are programmed into Council's Asset Management System (AMS). A work order is generated and dispatched to the contractor to undertake the work. The contractor is required to log on the work order what work was undertaken and identify any additional work/repairs required but not undertaken at that time that is then scheduled for resolution. Areas where preventative maintenance is undertaken include:

- Sewer Pump Stations;
- Wastewater Treatment Plants and oxidation ponds;
- Jet Cleaning parts of the piped network;
- Pre wet weather inspections and preparedness;
- Standby generators;
- Telemetry/ Supervisory control and data acquisition (SCADA);
- Condition assessments;
- Performance Inspections;
- Inspections critical assets (pipe bridges etc.); and
- Odour management.

Reactive Maintenance

Reactive maintenance normally occurs when a request for service (Rfs) from the public is lodged, or as a response to an alarm from Councils Telemetry or SCADA system. Performance against agreed response times for the contractor to these events are closely monitored and is a key performance measure of the contract. The response times and procedures focus on minimising disruption to the network so as to maintain its performance and to prevent/contain any health or environmental effects from the disruption such as a sewer overflow.

Reasons for reactive maintenance include:

- Faults at Pump stations (Telemetry);

- Faults at Treatment Plants (SCADA);
- Blockages in piped network, mains and laterals (Rfs/inspections);
- Surface collapses due to broken pipes (Rfs);
- Odour smells (Rfs/inspections);
- Displaced manhole lid or rattling lid (Rfs);
- Overflow from Gully trap or manhole (Rfs);
- Emptying non-return valve tanks prior or during wet weather events;
- Response to power outages.

Asset Management System

Council has maintained an AMS since 1999, it records the work history of all work undertaken on the network and can be used to analyse the network performance. Through this analysis, preventive maintenance and renewals can be programmed and undertaken. The system also manages the regular preventative maintenance programme, issuing work orders to contractors as reminders to do certain work. This system ensures institutional knowledge of the network and a history of works and actions is retained.

3.3 Wet Weather Overflow Management and Response

In addition to network upgrades, renewals and the systematic reduction of stormwater inflow through the DrainWise Implementation Programme, Council's approach to the management of WWOs has also evolved over time:

- Historically, WWOs occurred automatically when volumes/pressures in the wastewater network exceeded system capacity (surcharged). This resulted in widely dispersed and uncontrolled overflows, including into water and onto private property.
- From approximately 1995 to 2016, Council blocked all known automatic overflows points and if a discharge point was to be retained a valve was installed which then required manual intervention to deliberately open the relief/scour valves when this was necessary – to direct overflows to Gisborne's main rivers in preference to overflows onto private property from gully traps or at toilets. While it is appreciated that overflows to rivers (and subsequently to the wider Bay) are not desirable, the health and social impacts are considered significantly less than would occur if the scour valves are not opened.
- From 2015, additional infrastructure and management improvements have been implemented to further reduce the number of overflow locations and the duration/volume of overflows including:
  - A flowmeter was installed in 2015 to monitor flows from the complete Kaiti Catchment, which now assists in monitoring the network performance and assist when to open the Wainui Rd scour valve;
  - The approach to opening scour valves is to only open those necessary to reduce overflows to private property and to close them as soon as possible to reduce the total discharge of diluted wastewater as far as practicable;

- Only two priority (primary) valves are opened, unless the magnitude of the rainfall event requires additional, secondary (or in rare circumstances tertiary) valves to be opened. Priority is given to valves located lower in the catchment and as close to the sea as possible (to promote flushing). This also limits the extent of localised adverse effects to two overflow locations, other than in extreme circumstances;
- Additional emergency storage has been installed at Steele Road (92m^3) to remove the requirement to overflow to the Kopuawhakapata Stream and to further reduce the risk of overflows to the Wainui Stream;
- A new dedicated rising main from the Russell Street Pump station to reduce overflows from Russell Street, which is also supported by an existing emergency storage tank (100m^3);
- Diverting the Portside Pump Station rising main from the Hirini Street manhole with the aim of reducing overflows during large wet weather events;
- Documenting all new procedures in an updated Operations Manual;
- Continuing to implement Council's DrainWise programme to reduce stormwater inflow and infiltration as a primary means of reducing the locations, frequency, volume and duration of overflows.

Network and management improvements continue to be implemented to reduce overflows. The current process for opening and closing valves is provided in Figure 14. This process, together with the specific locational and operational details of the key overflows, is provided in Appendix E.

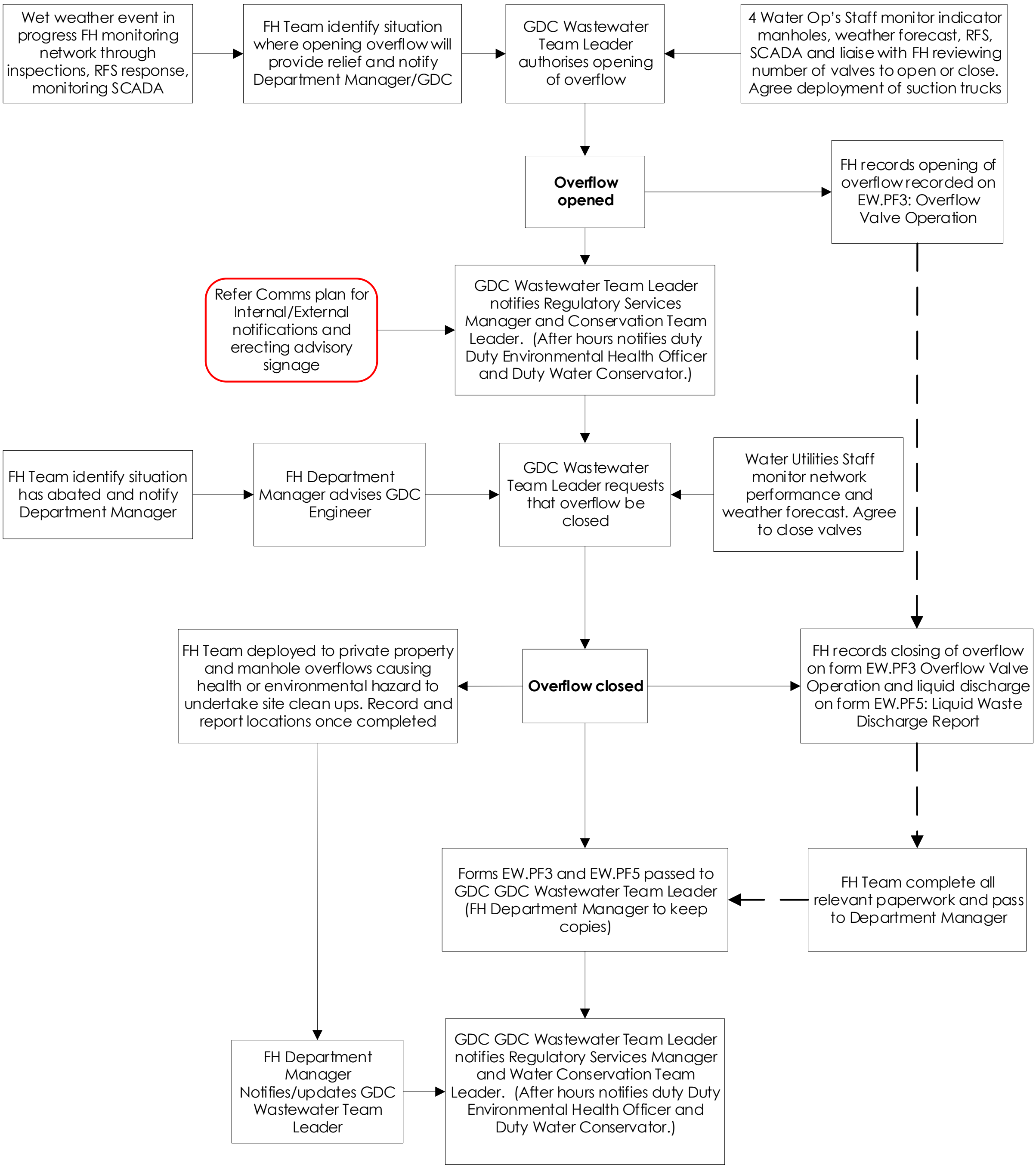


Figure 14: Overflow Opening and Closing Procedures and Responsibilities

The process in Figure 14 above can be summarised as follows:

- Preparation begins before a heavy rain event. When MetService issue a heavy rain warning for the city, sewer manholes, pump stations and private property non return valves are checked and cleared as necessary. This is to ensure they are working as they should. Parts of the stormwater network are also checked, namely open drains and kerb inlets; to reduce the likelihood of on-property flooding.
- Network hot spots are monitored to provide an early warning of potential problems. Pump stations have alarms that indicate when flows are reaching problem levels due to the network becoming surcharged (see Figure 11).
- When a critical stage is reached and the wastewater network is overloaded with stormwater, and the risks of wastewater overflows onto private property is too high, then overflow valves are opened where necessary to relieve the pressure in overloaded pipes. This then avoids more serious health risks and other issues in and around people's homes.
- Where circumstances allow (for example there is sufficient lead time and access to critical locations) other measures such as using tanker trucks to pump this extra water out of overloaded pipes and manholes are used in an effort to avoid opening the valves into the river.
- Where overflows occur, Council issues a series of notifications:
  - The District Medical Officer of Health is notified and temporary warning signs are erected at swimming and recreation sites;
  - Council's Pollution Hotline - the pollution officer contacts our Communications and Environmental Health teams.
  - Residents are advised via Council's Facebook page, website and other media channels;
  - An email is sent out to a distribution list.

  A copy of Council's WWO Discharge Communications Plan is attached at Appendix F.
- Water quality testing is carried out as soon as possible after the scour valves have been opened and then samples are taken daily for a minimum of 5 days after a scours opening event (and longer if the valves are open for more than one day). The procedure and sampling locations are provided in Appendix G.
- The pollution hotline is informed when the valves are closed and information is posted on Council's Facebook page and website.
- Standard practice is for the health warning signs to be removed five days after the discharge valves are closed, but this period may be extended based on monitoring.

As heavy rainfall alone can lead to elevated microbial concentrations in rivers and the Bay from other catchment sources including stormwater and agricultural runoff, a conservative approach is taken to recommend that people do not swim for up to three days after any heavy rain, regardless of whether there has been a sewage discharge or not (see: https://www.gdc.govt.nz/environment/maps-and-data/swimming-waters).

Accordingly while the direct discharge of wastewater overflows to rivers and the Bay are not desirable, and significant work is being undertaken to reduce them, health effects are mitigated through a series of actions and a transparent and extensive public health warning system to minimise risks and impacts as far as possible.

3.4 Wastewater Overflow Reduction - DrainWise

3.4.1 Introduction

Council's DrainWise programme is the umbrella programme that seeks to progressively reduce stormwater ingress into the wastewater network and reduce the frequency and volume of overflows. Information on the programme can be found at: https://www.gdc.govt.nz/drainwise/.

The programme is multi-faceted, and includes the following:

- Stormwater and wastewater network upgrades, renewals and extensions;
- Property inspections to identify problems and associated repairs;
- Enforcement of public-funded works on properties;
- Focus projects; and
- Education and awareness.

This work is supported by desktop and other investigations that serve to direct where we do our work, and what aspects to focus on.

3.4.2 Programme Components

It is important to note that the 2018-28 LTP has set funding levels for operations and capital requirements and these have been agreed with the community as part of a consultation process. Every three years the LTP is reviewed, consulted and funding prioritised around affordability, Council/Community priorities and Council debt levels. Council can make minor changes annually as part of the annual plan process, but any major changes would require a consultation process.

Stormwater Network Upgrades and Renewals

The capital budget in the 2018-28 LTP for stormwater upgrades is $10.9m and stormwater renewals is $3.5m. A total of $14.4m will therefore be spent over the next 10-years improving the performance and capacity of the stormwater network, and ensuring asset condition is acceptable. This reduces the risks of on-property flooding (and consequent inflow and infiltration into the wastewater system) related to the Council-managed public network. Budgets and key programmes can be found in Council's LTP 2018-2018.

An example of this is the Kaiti stormwater upgrade ('Rutene Road Stormwater Upgrade') which is designed to provide more capacity in the Kaiti stormwater network to help reduce the risks of flooding in the area. A reduced risk of flooding delivers a reduced risk of inflow and infiltration of rainwater into the wastewater system. The first stage of this upgrade is currently underway, with the second stage scheduled to follow. For more information go to:

https://www.gdc.govt.nz/services/stormwater/stormwater-improvements-and-upgrades.

Stormwater Public Network Extensions (Public Drains on Private Property)

In addition to the capital budget for extensions to and renewals of the public network, Council has also specifically provided for additional public stormwater drainage on private land that has a public benefit. A total of $6m has been budgeted for this work between 2018 and 2028.

Many private properties cannot easily connect into the public stormwater system. This can be for a number of reasons, including grade limitations (e.g. there may not be sufficient fall from the house to the public stormwater pipe), distance from the public stormwater pipe (e.g. back-lot properties), and expensive road crossings (e.g. when the public stormwater pipeline is located on the other side of the road, and the road kerb/drain is inadequate).

Much of Gisborne is located on flat land and defined overland flow paths are often absent and are difficult to manage. In addition to poor natural land drainage (flat grades), fences, raised gardens, and other structure on properties can block and divert overland flows. Coupled with large areas of clay, this means surface water does not get away readily and deep ponding can occur on residential properties. This can take place irrespective of whether or not a private property roof spouting is connected to the public stormwater network. Often the only solution to this localised flooding is to provide formal land drainage by means of sumps at ground level that allow floodwaters to flow from private property into the public stormwater network (see Figure 15). Almost no private properties have stormwater sumps at ground level.

Figure 15: Examples of Drainage Sumps

Extensions and improvements to the public stormwater network are therefore being constructed across private property to make it easier for private property owners to connect into the public stormwater network, and to enable surface waters to drain away. This is resulting in new public drains, pipes and sumps on private land that allow for easier private connections and that are configured in a way that surface waters and ponding areas are also intercepted

Council commissioned work in the 2017/18 financial year to support the identification of suitable projects. This included desktop work such as depression and overland flowpath mapping, improving GIS platforms, and undertaking ground-truthing of flood/ponding extents during heavy rainfall events.

The project team started in the worst affected area – the Kaiti catchment (all areas draining to the Gladstone Road bridge over the Turanganui River). Over 20 potential sub-catchments for suitable projects were investigated in the 2018/19 financial year, with 7 construction projects completed in that year. This work has carried on into the 2019/20 financial year, with a further 8 construction projects to be finished before 1 July 2020.

All of Kaiti is scheduled to have been investigated by the end of the 2020/21 financial year, after which the project team will move onto other parts of Gisborne City. This work spans over the duration of the 10-year LTP.

Wastewater Network Upgrades and Renewals

As indicated previously, Council's wastewater network is currently sized to meet best practice. However investment continues to upgrade the network as the need and opportunity arises, to renew/replace aging components of the network, and mitigate inflow and infiltration issues. The capital budget in the 2018-28 LTP for wastewater upgrades is $1.6m and wastewater renewals is $15.7m (total of $17.2m over ten years). Budgets and key programmes can be found in Council's LTP 2018-2018.

Private Property Inspections and Minor Repairs

Property inspections are a key component of the DrainWise programme and over time inspections of all properties that connect to the wastewater network will be undertaken. The aim is to comprehensively inspect all properties to identify all potential stormwater and wastewater drainage problems (private and the adequacy of adjacent public infrastructure) as far as possible. Accordingly, property inspections include visual observations to check condition of gully traps and downpipes into gully traps, smoke testing stormwater and wastewater pipelines to identify illegal cross-connections and pipe failure, and also inspecting pipelines with CCTV. All data is recorded on tough-pads and downloaded into the Council assets database. This information is then used as part of project work – both on the property or as part of Council's wider programme as discussed above.

Simple problems that are identified are fixed by Council at no cost to the landowner. These include repairs such as disconnecting downpipes (spouting) from gully traps, repairing cracked gully traps, and raising gully traps where it is feasible. Some repair work is carried out as part of the inspection process.

To date, the inspection programme has focused on the Kaiti Area, which has been identified as one of the key areas of stormwater inflow and infiltration. Some 3,345 properties have been inspected, with 2,360 of these having been smoke testing to try and identify cross-connections between the stormwater and wastewater networks, and 443 private wastewater laterals have been inspected by CCTV. A snapshot of the results of the inspections to March 2020 is provided in Table 8.

Table 8: DrainWise Inspections to March 2020

(Note that one property may have multiple records – for example, more than one gully trap)

Issue	Number of Records	Number of Failures	Percentage of Failures
Gully trap broken / damaged (cracks, absent, holes, completely damaged - allowing inflow)	4,921	2,709	55%
Gully trap too low (allowing inflow when ponding is higher than the gully trap, and water flows into the gully trap)	4,921	1,230	25%
Terminal vent issues (broken, absent - affecting performance of the private system or letting rainwater in)	2,405	273	11%
Spouting incl. downpipe (poor condition, not connected to outlets, discharging onto the ground, absent - promoting ponding and inflow and infiltration)	11,220	6,297	56%

In addition to the above:

- Of the 443 laterals inspected by CCTV, 37% have issues that need to be fixed.
- 84 downpipes into gully traps have been found, with only four ***not resolved*** at this date. This represents a significant reduction in stormwater inflow.
- There were 89 cases of smoke coming out of the ground or other areas identified, indicating significant problems with wastewater laterals and the underground components of gully traps and terminal vents. These are being investigated.

The above highlights the significant extent of private drainage issues.

There are some 15,000 connections to the wastewater network. In addition, 60 % of Gisborne's housing stock is older than 60 years and 22% is older than 100 years. As such, the potential scale and extent of the drainage problems are significant when considering cost and contractors ability to effect repairs/replacements.

Council started a Rapid Inflow Assessment (RIA) in February and March 2020, intended to be rolled out in key areas of Kaiti before winter. The aim of the RIA was to identify and fix as many sources of inflow before winter. Unfortunately COVID-19 affected progress this project. Work will restart once it is possible to do so.

Rectifying Private Stormwater Drainage Problems

Addressing drainage problems on private property is not an easy task due to affordability, low home ownership (approximately 60% of Gisborne's urban residential properties are rented) and the difficulties of Council undertaking work on private land or Council requiring property owners to undertake work.

Where clearly illegal drainage is identified, this is either remedied on the spot (if simple) or homeowners are required to fix it. However, more difficult private drainage issues require more complex and costly solutions – which may involve multiple parties. For example, floodwaters that overtop a gully trap on a specific property may be the result of inadequate stormwater drainage upstream (water coming from other properties). To aid Council's decision making as to how best to address complex drainage issues, it has prepared the decision matrix (Table 9). This assists in providing a consistent approach to allocating responsibility for drainage issues.

Table 9: Responsibility Decision Matrix (Source: IIOPPS)

Where is the Water Coming From?	Who Should Pay?	What Will Council do in This Scenario?
Rainwater flows from Council asset, for example, road, easement or Council land	Council	Arrange for contractors to fix the issue.
Rainwater flows from neighbour's property	Neighbour	Mediate the discussion between the property owner experiencing the water ponding issue and the owner of the property causing the issue (this is a building code compliance matter).
Rainwater flows from multiple neighbouring properties (catchment area), ordinarily by means of an overland flow path	Council or property owners	Property owners will be required to ensure roof water is connected into the public network. If flooding is caused by more than mismanaged roof runoff, Council will investigate public infrastructure solutions to capture surface flows.
Directly off the roof or driveway of the same property experiencing the ponding issue	Property owner	Work with the owner to find the most effective fix at the lowest cost. Issue a Notice to Fix and return to re-inspect after the set timeframe has expired.

Once the problem and solution have been identified, and responsibility allocated, the timeframe and affordability for private drainage works becomes the next challenge to be addressed. Affordability for private drainage works is a key issue. Average household incomes are amongst the lowest in New Zealand, with the median annual income being $25,900. Median income is lower for Māori, who comprise 50% of Gisborne's population[15]. Private property repairs by homeowners can therefore only be implemented over time in line with the ability of the community to pay.

In terms of striking a balance between homeowner responsibilities (to pay for works on their property), the individual's ability to pay, and getting the job done / resolving the problem, Council developed the Infrastructure Improvements on Private Property Strategy (IIOPPS) which is attached at Appendix B.

The IIOPPS sets out a compliance and enforcement approach that promotes voluntary compliance using the 4E model (Engage, Educate, Enable, Enforce), while reverting to enforcement if voluntary compliance is not undertaken. When considering homeowners that simply cannot afford the repairs, IIOPSS provides for hardship loans and grants, with details still being developed. The IIOPPS will be supported by Standard

[15] Quick stats about population counts for Gisborne Region (2018 Census) and Census 2013.

Operating Procedures (SOPs) for property inspections, notices to fix and debt repayments (amongst others).

The IIOPSS has required consideration of who is responsible for stormwater management (with Table 9 above summarising the outcomes). Compliance and enforcement therefore focuses on what is directly attributable to the private homeowner.

Every Notice to Fix issued by Council has a timeframe for the work to be completed by. The IIOPPS affords authorised Council staff with discretion to increase timeframes as informed by affordability issues. This discretion allows for case-by-case considerations to make it possible for property owners to afford the works. Council is actively investigating alternative ways to fund private property work.

Gisborne District Council previously approached the Eastland Community Trust regarding assisting private property owners with private repairs. However, Council was advised that this work does not fit within their funding criteria.

A number of external funds, including the Provincial Growth Fund, have also been considered for additional funding. Unfortunately this work does not fit within those funding criteria. Most recently, in response to potential central government funding opportunities related to the COVID-19 pandemic, two DrainWise funding applications were lodged with MBIE for private stormwater and wastewater repairs and bringing forward public stormwater network extensions proposed as part of the DrainWise implementation programme (Crown Infrastructure Projects).

Reductions in wastewater overflows are inherently and substantially linked to the pace at which homeowners can fix their private property drainage issues including the ability of the community to pay for the public network improvements. Another key constraint to delivery of the work is the capacity of the drainlayer / construction industry to undertake such works. If the above funding requests are successful, the capacity of local drainage contractors would have to be augmented with workers from elsewhere in the region and further afield (because of the large volume of work).

Education and Awareness

Significant effort has been put into increasing DrainWise 'visibility', with distinctive branding having been developed. This branding has been placed on all DrainWise vehicles. The branding is also on the Council website, with a webpage dedicated to this work. A comprehensive set of community education and awareness consultation material has been developed as part of the DrainWise programme, and has been delivered via various media. This included a multi-media approach and focussed on five key messages. The campaign focussed on engaging the public to take personal responsibility and be a part of the solution to the wastewater overflow and drainage issues in Gisborne. This work is ongoing and will continue to be rolled out periodically. (see: https://www.gdc.govt.nz/council/major-projects/drainwise)

Focus Projects

A number of 'focus' projects have been implemented to accelerate outcomes. These include:

- Hotspot investigations: Inspecting areas at high-risk of stormwater inflow, including low-lying properties, houses and wastewater manholes in the path of overland flow paths and in modelled flooding zones, gully traps in depressions / modelled ponding areas, properties receiving hillslope runoff, and at-risk properties identified through questionnaires and requests for service.

- Rapid Inflow Assessment (RIA): This entails identifying and remedying easily observable sources of rainwater inflow into the wastewater network, working through all of Gisborne City to identify and resolve as much inflow as possible as quickly as possible, to reduce overflow effects as much as possible in the short term.
- Direct Inflow Register and Enforcement: This is based on information obtained through the RIA, hotspot investigations, smoke testing, property inspections, and other work. The focus is on 100% confirmed direct inflow, with a strong enforcement impetus. Properties that require inflow 'fixes' are placed on a register, and Council staff work with the property owner to remedy any issues. This includes e.g. downpipes directed into gully traps and cross-connections between stormwater and wastewater.
- Working with property managers to enable and promote change: Council has created a forum to make landlords / property managers aware of the DrainWise Programme and provide them with information to manage their properties; including workshops, creating a database of rented properties, property agents, and supporting Kāinga Ora and Gisborne Holdings Limited (GHL – a Council-controlled trading organisation).
- The secondary stormwater network / overland flow paths: This comprises GIS investigations on the role of the secondary stormwater network in adapting to and mitigating the effects of climate change, reducing the risk of inflow and infiltration as a consequence of predicted higher intensity storms due to climate change. It also will provide flood hazard mapping, integrating flow path, depth, and velocity into a hazard layer (based on OLFPs) which will be overlaid on the house footprint layer to identify gully traps, wastewater laterals, and houses at risk of flooding (and Inflow and Infiltration).
- Improving flow data: Additional flow meters on interceptors (Mangapapa/Western) and telemetry monitoring of key indicator manholes is also being looked at to give real-time network performance. A pump station data analysis is also planned to improve understanding of how the wastewater network operates / reacts in wet weather events.

Prioritisation and Sequencing

A DrainWise Implementation Programme is currently being rolled out. This plan directs where Council focusses its efforts and budgets – differentiating on high, moderate and low impact sources of inflow and infiltration. The DrainWise Implementation Programme identifies work tasks around each of these impact categories, prioritising activities based on relative impact – that is, resolving 'High Impact' issues takes preference, followed by 'Medium Impact' issues and finally 'Low Impact' issues. Ongoing evaluation of how the programme is progressing, and whether changes to the implementation programme are required, will be periodically undertaken and any additional funding will be requested as part of the three-yearly LTP cycle.

3.5 Alternative Management and Reduction Options

3.5.1 Wet Weather Overflows

The selected approach to reducing WWOs has evolved from significant investigations and modelling to understand the cause of WWOs and the main sources of stormwater that contribute to them. This has led to the approach to reduce stormwater inflow at source, which also has the benefit of reducing on-property flooding and associated dampness issues. This is consistent with the Residential Tenancies (Health Homes Standards) Regulations 2019 which includes a range of moisture ingress and drainage standards, including that tenancy buildings must have a drainage system that efficiently drains storm water, surface water, and ground water to an appropriate outfall, and that the drainage system must include appropriate gutters, downpipes, and drains for the removal of water from the roof.

The main alternatives to the selected option are:

1) Increasing wastewater pipe capacity

   While this option has been considered:

   - The cost of increasing pipe capacity is prohibitively expensive as it would involve the up-sizing of a large proportion of the wastewater system;
   - The public component of Gisborne's wastewater network currently meets (and exceeds) national design practice.
   - This approach will result in more (diluted) wastewater reaching the wastewater treatment plant, which would cause this plant to exceed its treatable capacity more frequently – in turn leading to substantial upgrade costs if this was to be addressed.
   - This option does not address the issue of aging and failing private pipe laterals, which will continue to worsen over time, nor the issue of property flooding.

2) Increase storage in the wastewater network

   Increasing network storage is a feasible option in some circumstances and is used strategically to address issues in some areas. However, it is not considered a viable network-wide solution at this stage as:

   - Excessive stormwater inflow requires substantial storage to reduce overflows. The cost of this storage is very high, and there are few locations where effective storage can be provided.
   - The cost and area requirements of average and maximum overflow discharges were calculated based on the wastewater storage tanks previously constructed in Steele Road. Based on this the costs varied from $130m (7 ha land area) to $250m (10.5 ha land area) for current average and maximum wastewater overflow volumes. These figures are likely to be conservative, as costs would likely exceed the Steele Road costs because of the need to purchase homes and the likely effect on other infrastructure significantly.
   - The practicality of purchasing and constructing a number of storage facilities across the city, requiring the purchase of homes and land in built-up areas next to the rivers, would be challenging and impractical at this scale.
   - The wastewater storage option does not reduce on-property flooding and all of its associated health risks.
   - Storage requirements will continue to increase as the performance of aging infrastructure worsens and more stormwater enters the network. Council considers it preferable to address this issue by ensuring a well-maintained and functioning private and public wastewater (and stormwater) network is in place.
   - The storage option can be revisited in the future, when the success of the current DrainWise programme is evaluated and remains a tool to be considered moving forward. Storage

options become more viable if Council is successful in achieving 65 to 85% direct inflow reductions. Table 3 above illustrates the volume reductions anticipated through the current DrainWise programme and matters such as the requirement for additional storage and its location can be considered once the inflow reductions have been progressed.

3) Greater public contribution to private drainage

This option entails Council providing a greater rated financial contribution for drainage on private land. While this option provides the same outcomes as the selected approach, it raises significant issues of equity, asset ownership and public costs. This option was considered through the Infrastructure Strategy/LTP 2018-2028 as discussed in Section 4, and closely considered public/private benefit and the differentiation between private and public legal responsibility. The extent of public funding for private property fixes was considered in the LTP, within the options the community considered.

3.5.2 Dry Weather Overflows

For DWOs, the options considered in the Infrastructure Strategy/LTP 2018-2028 included:

- Option 1 – Increasing surveillance;
- Option 2 – Increased Jet cleaning;
- Option 3 – Additional emergency storage and pump stations;
- Option 4 – Education.

Rather than being alternatives, the options are different management elements that can be incorporated into a programme. The selected option includes both additional operational costs for jet cleaning interceptors and the reticulation network and surveillance to detect blockages. Significant education and awareness activities are already a component of the DrainWise programme. Some additional emergency storage at pump stations is budgeted for over the ten years of the LTP.

4 OVERFLOW MANAGEMENT OBJECTIVES

4.1 Introduction

Table F1.4.1 of the Tairāwhiti Plan requires that AEEs for discharges of emergency overflows should provide:

B *A description of the strategic objectives sought for the wastewater discharges, diversions and associated activities and receiving environments, including:*

- *the social, ecological, economic, amenity and cultural objectives;*
- *the community and iwi consultation undertaken in determining the strategic objectives;*
- *identified milestones required to achieve those objectives.*

These objectives should address the long term aim of reducing the wastewater overflows

This section presents the strategic objectives and associated milestones that have been derived for the wastewater overflow consent application. These have been information by the TRMP (particularly Policy 9 a and b), derived as a result of a range of assessments of network performance and an understanding of the primary causes of overflows (Sections 2, 3 and 5), and communicated through Council's DrainWise programme and LTP. These objectives were then refined through engagement with tangata whenua and key stakeholders as described in Section 7.

The following section provides an overview of the Council's overarching strategic vision, strategic management options that were considered and confirmed through Council's Infrastructure Strategy and LTP.

4.2 Council's Strategic Direction

Council's Strategic Direction is presented in its LTP, comprising its Vision, Community Outcomes, Strategic Priorities and financial, infrastructure and other strategies. Council aims to achieve its outcomes, and deliver on the strategies, in order to promote the social, economic and cultural wellbeing of Tairāwhiti's current and future communities, together with maintaining and enhancing the quality of the environment.

The aim is to work in partnership with others to identify ways that Council can support its community to thrive. Over the next ten years, this includes:

- A focus on building, renewing and maintaining critical infrastructure by increasing borrowing to a sensible level;
- Delivering on work programmes that address what the community identifies as priorities – roading, water, wastewater, stormwater and flood control, environmental regulation, and important community facilities; and
- Finding additional sources of income, enabling Council to keep rates affordable through grants and dividends, partnerships and some increases to user pays systems.

4.3 Vision and Community Outcomes

Council's vision is as follows:

Tairāwhiti First!

Tairāwhiti Tangata First to see the light

Tairāwhiti Taonga First choice for people and lifestyle

Tairāwhiti Wawata First choice for enterprise and innovation

First place for the environment, culture and heritage

The vision speaks of a region of firsts; locally, nationally and globally. A place where people want to be and are proud to live. A place that is home to productive and innovative businesses and where agriculture and natural resource strengths are leveraged into value-added job rich opportunities. A place where the environment is cared for as an integral part of the community's lifestyle. A place rich in history that celebrates and keeps alive its language, culture and traditions.

Council's community outcomes that support this vision are:

Tairāwhiti Tangata **(our people)**	Gisborne's greatest asset is its people. We are a cohesive, connected, culturally rich and creative community. We have access to and celebrate those things that foster our wellbeing including quality arts, recreational, cultural and educational opportunities; strong health; infrastructure and good jobs.
Tairāwhiti Taonga **(our environment culture and economy)**	Gisborne is blessed with many natural assets. Our rich coastline, fertile soils, warm climate and abundant freshwater are key to our community's well-being and prosperity. Our unique cultural heritage is a source of enduring pride. We celebrate our dual heritage and collaborate for a healthy future.
Tairāwhiti Wawata **(our aspirations realised)**	Gisborne is a district where we achieve our aspirations, not only locally, but nationally and globally. We are a district that leads and advocates for itself. Citizens are actively involved in community life and Council engages the community in its decision making to achieve our aspirations.

4.4 Strategic Priorities

Council has developed strategic priorities aligned to its vision and community outcomes. These focus Council's focus on its sphere of influence and where its activities can be most effective. The three strategic priorities for Council for its current LTP are:

Tairāwhiti Wai	Improve the wellbeing of our waterways and coastal environments, including protection of healthy soils.
Intelligent Infrastructure	Invest in the existing and future core infrastructure needs, with a focus on cost efficient and effective designs.
Intelligent Investment	Make sensible, long term decisions on investments and borrowing, and always seek the best value for community money.

4.5 Infrastructure Strategy - Wastewater

Wet weather and dry weather wastewater overflows have been identified as significant issues in Council's Infrastructure Strategy, signalling the important of these issues.

4.5.1 Wet Weather Overflow Strategic Options

In developing its forward programme to address wet weather overflows, Council considered three main options to address the key cause of wet-weather overflows – primarily being the direct inflow of stormwater from private property into the wastewater system (draining straight into gully traps, or being piped from flooded areas or roofs into gully traps/wastewater laterals). Table 10 summarises the strategic options and assessment.

Table 10: Options Assessment – Wet Weather Overflows

(from LTP - Infrastructure Strategy, page 3-25)

Main Option	Explanation	Cost Estimate
Option 1: Council Funds Flood Reduction Projects	This option assumes that Council coordinates and funds all projects to address private property flooding that impacts directly on the wastewater network. This option provides the greatest certainty of reducing inflow.	$13.2 m capital investment by Council
Option 2: Medium Level of Council Funding of Flood Reduction	Council would coordinate and fund projects to address flooding under limited conditions: there is insufficient capacity in the public network, a lack of suitable stormwater connection in the vicinity or where development has been allowed in low areas with no suitable drainage solution.	$8.4 m capital investment by Council

	Council could also use enforcement/regulation to encourage landowners to address flooding that contributes to stormwater inflow, providing partial subsidies.	
Option 3: Lower level of Council involvement focused on public drains	Council would coordinate and fund public drain projects to address flooding in the limited conditions as above. Council could also use enforcement/regulation to encourage landowners to address flooding. No subsidy would be provided for the projects considered 'private'. This option provides the greater risk of delays in achieving reductions.	$5.4 m capital investment by Council
Adopted Option	Due to other competing financial pressures, Council has adopted Option 3. However, it will continue to explore the possibility of public-private partnerships and external funding. Renewal of 54km of earthenware pipes will be staged over 30 years to reduce the financial impact.	

The adopted option was Option 3. In selecting this option, Council considered the apportionment of public/private benefit of the works. Option 3 represents 40% of the cost being 'public benefit' and will extend some public drains onto private property, while requiring property owners to resolve their own private stormwater flooding issues which are deemed to be of private benefit.

Council's investment is primarily to:

- Replace existing public wastewater drainage infrastructure to reduce infiltration as it reaches the end of its life.
- Fund public stormwater infrastructure where there is:
  - Insufficient capacity in the public stormwater network
  - A lack of suitable stormwater connection in the vicinity
  - Where development has been allowed in low areas with no suitable drainage solution
- Undertake compliance and enforcement where required to ensure private property fixes are completed.

Further stormwater capacity projects will be confirmed on completion of stormwater network modelling.

4.5.2 Dry Weather Overflow Strategic Options

Council also assessed different options to reduce DWOs, as shown in Table 11 .

Table 11: Options Assessment- Dry Weather Overflows

(from LTP - Infrastructure Strategy, page 3-26)

Main Option	Explanation	Cost Estimate
Option 1: Increasing surveillance	Implementing a programme of manhole inspections to actively identify pipe blockages before overflows occur would help reduce the risk. Increased surveillance of trade waste compliance would also assist to reduce blockages.	$50,000 operational costs per year for manhole inspections and disposal of solids; $50,000 for increased trade waste compliance inspections.
Option 2: Jet cleaning	Gisborne's wastewater network relies on gravity but is built with low grades and comparatively few pump stations. This makes it particularly vulnerable to blockages. An increase in pressurised cleaning of pipes to remove debris and fat build up would help to reduce the risk of overflows. However pressurised cleaning presents a risk to the 54km of brittle earthenware pipes. This will need to be monitored closely.	Increased cleaning - $100,000 per year for reticulation and $100,000 per year for interceptors.
Option 3: Emergency storage and pump stations	Pump station failure is considered a focus area for risk reduction - overflows have a high risk of entering waterways since pump stations are located in low points, often next to waterways/drains. A risk assessment was undertaken to identify which pump stations present the greatest risk. Eight pump stations were identified that present a high risk – being located near waterways and currently providing less than one hour of storage before overflow would occur.	$500,000 construction costs for each pump station on average.
Option 4: Education	Education could help reduce the disposal of fat and rubbish into the wastewater system that cause blockages.	
Adopted Option	Additional operational costs will be allowed for jet cleaning interceptors and the reticulation network; Increased surveillance to detect blockages and increased trade waste surveillance. Renewal of the earthenware pipes is assumed to occur over thirty years. Given the other infrastructure challenges Council faces, emergency storage at pump stations will not be prioritised in the ten years of the Long Term Plan.	

The adopted option for reducing dry weather overflows is a combination of increased proactive maintenance (jet cleaning) and increased surveillance of both network and trade waste 'hotspots'. This will reduce the likelihood of blockages of the network and known problem areas. Progressive replacement of the existing earthenware pipes will continue, to improve the performance and ability to clean these pipes.

Additionally, significant public education through the DrainWise programme has been undertaken, and discussed in Section 7, and will continue.

4.6 Progress and Plan for the Next 10 Years

Table 12 provides a summary of the LTP 'Our progress and plans for the next 10 years'. These provide the high level approach to achieving the performance objectives

Table 12: Progress and 10 Year Plan Summary

(from LTP – Our Activities, page 4-39)

What has been done	What will be done in next 10 years
The DrainWise Plan has been produced to provide guidance on how to reduce overflows on private property and into waterways to one event every two years. Comprehensive DrainWise inspections of private property throughout the Kaiti area are ongoing. The annual renewals work was completed for sewer replace Council's old leaking earthenware pipes mains in Crawford Road, Barton Street, Childers Road, and Aberdeen Road, including the rising main from Steele Road pump station. Renewal of sewer pump stations at Anzac Park and Steele Road including additional storage at Steele Road. Trade waste compliance has improved with major industries implementing waste plans that outline how they will comply and manage risks.	**Years 1 to 3** Reduce overflows onto private property and into our waterways using the DrainWise plan to: ▪ fix and replace old private property sewer laterals ▪ improve network performance through more pipe cleaning and surveillance ▪ inspect properties for stormwater illegally getting into wastewater pipes ▪ improve network resilience (generators). Apply for resource consent for emergency discharges to waterways under the Freshwater Plan. New infrastructure in the Taruheru Block to allow for future growth. **Years 4 to 10** Continue to implement the DrainWise plan. Monitor and maintain network performance by: ▪ pipe cleaning ▪ renewing old pipes ▪ continuing surveillance. Ensure the continuation of trade waste compliance. Update bylaws as required but the LGA.

As can been seen from this approach, implementing the DrainWise programme is a key method to reduce stormwater ingress into the wastewater network, and hence reduce the frequency and volumes of wastewater overflows. The LTP performance targets associated with the 10-year plan are provided in Table 13. It is noted that these targets are those that were published in the 2018 – 2028 LTP and will be reassessed in subsequent LTP revisions following the granting of the resource consent to reflect updated performance targets.

4.7 Strategic Objectives, Outcomes and Performance Targets

Table 14 proposes the following strategic objectives and performance targets/measures to be adopted in the resource consent. These should be read in conjunction with the proposed conditions in Section 9, which also address matters such as Operations and Maintenance, Overflow Response and Monitoring and implementation of the Drainwise Programme.

Table 13: LTP Levels of Service and Performance Measures

(from LTP 2018-2028 p4-40 and 4-41 – updated to reflect current (2018/19 performance)

Level of Service	**Performance Measures**	**Current (18/19)**	**Target**	
			Years 1-3	Years 4-10
We provide a well-managed wastewater reticulation and treatment system which protects public health and the physical environment.	**System and Adequacy:** The number of dry weather sewage overflows from the territorial authority's sewerage system, expressed per 1000 sewerage connections to that sewerage system (Department of Internal Affairs).[16].	0.27	1	0.6
	Management of environmental impacts: Compliance with resource consents for discharge from the wastewater system: Measured by the number of: a) abatement notices; b) infringement notices; c) enforcement orders; and d) convictions (Department of Internal Affairs).	0	0	0
	Response to wastewater system faults attendance at wastewater overflows resulting from a blockage or other fault in wastewater system: a) Median attendance time: from the notification of the fault to the time that service personnel reach the site (hours).	0.28	1	0.5
	b) Median resolution measured from the notification of the fault to the time that service personnel confirm resolution (hours) (Department of Internal Affairs).	3.25	12	6
	Customer Satisfaction: Complaints about odour; system faults; blockages; AND Council's response to issues with its wastewater system: The total number of complaints per 1000 connections received (Department of Internal Affairs).	10.03	15	13
	Percentage of residents satisfied with the Gisborne district's wastewater system as found in the Resident Satisfaction Survey.	55%	50%	60%
	The annual number of events where sewerage is discharged from Council's reticulation into rivers or streams (in a less than a 1 in 10-year rain event).	2	≤4	≤4

[16] Territorial Authority mandatory measure

Table 14: Summary of Wastewater Overflow Consent Objectives and Targets

Issue	Objective	Measure/Target	Target Timeframe	Reporting (annual based on financial year)
Wet Weather Overflow Frequency Level of Service	Progressively reduce frequency of overflow events	Progressive reduction in frequency (indicative)	On-going – indicative until target below.[17]	Number of overflow events Duration of each overflow event Return period rainfall assessment for each overflow event
		No overflows in events up to and including 50% AEP rainfall event	**10 years** after commencement of consent	
Wet Weather Overflow Volume	Progressively reduce volume of overflow events for a similar size rainfall event.	Progressive reduction in volume for same AEP rainfall event (indicative)	On-going – indicative.[18]	Volume of each overflow event Return period rainfall assessment for each overflow event Total volume of overflow per year
Overflows opened in a wet weather event	Limit overflows to primary and secondary overflow points in all but very large rainfall events	Primary only – up to 50% AEP event Secondary – only opened in events larger than 50% AEP Tertiary – only in events > 10% AEP	**5 years** after commencement of consent	Overflow locations opened Return period rainfall assessment for each overflow event
		Primary and secondary – only in events larger than 50% AEP Tertiary – only in events > 10% AEP	**10 years** after commencement of consent	

[17] Indicative because change will take some time to become fully evident

[18] Indicative because relationships between AEP and volumes are complex and require further assessment

Dry Weather Overflow frequency	Minimise dry weather overflows to the extent practicable	≤1 dry weather overflow per 1,000 connections (no more than 15 in total) per year	**Upon commencement of consent**	Number and location of DWO per year Cause of overflow Whether overflow reached a waterway and which one Measures undertaken to mitigate effects, including response time Estimated discharge volume
		≤0.6 dry weather overflows per 1,000 connections (no more than 9 in total) per year	**2 years** after commencement of consent	
DrainWise Works	Progressively reduce stormwater inflow into the wastewater network on private property, where private property owners are responsible for improvements of private infrastructure	50 % of all properties in the Gisborne reticulated services area with connections to the wastewater network inspected for drainage problems	**5 years** after commencement of consent	Number of properties inspected Types and numbers of problems found Types and number of problems resolved Programme for resolution of unresolved problems
		100 % of all properties in the Gisborne reticulated services area with connections to the wastewater network inspected for drainage problems	**10 years** after commencement of consent	
Public wastewater network management and upgrading	Ensure public wastewater network is upgraded and maintained to achieve wastewater overflow performance objectives and targets as required to achieve the outcomes of the modelled 85% inflow reduction scenario	Annual Plan capital works programme delivered	**Annual**	Works undertaken
		Annual sewer cleaning and maintenance programme delivered	**Annual**	Works undertaken
	Ensure appropriate monitoring and response to overflow events	All overflow events responded to in accordance with Overflow	**Each event (that reaches water)**	GDC Pollution Hotline and Environmental Health notified Monitoring undertaken as specified

		Response Procedures and Communications Protocol		Signage – out/in Website/Facebook warnings posted as required by Pollution Control
Public stormwater drainage improvements	Scope and deliver public solutions for private property flooding, where individual private property owners are not responsible for flooding issues and there is a public benefit)	Properties within modelled significant ponding/flood areas in catchments inspected and scoped for solutions	**10 years** after commencement of consent	Inform capital works for the Public Pipes of Private Property programme (budget allocated $5.4M over 10yrs)
		Deliver projects required to mitigate significant ponding/flooding	**Annual**	Works undertaken in accordance with the Public Pipes of Private Property programme.
	Undertake public stormwater network upgrade works required to achieve the outcomes of the modelled 85% inflow reduction scenario	Annual Plan capital works programme delivered	**Annual**	Works undertaken (relevant to reducing wastewater overflows)

5 DESCRIPTION OF THE RECEIVING ENVIRONMENT

5.1 Introduction

Depending on the location, overflows can discharge to land and/or water.

As discussed previously, WWOs occur as a result of excessive ingress of rainwater (stormwater) into the wastewater network, causing the network to surcharge and then overflow via informal or formal overflow points. Council manages WWOs by opening scour valves to allow the overflows to discharge to rivers to reduce the likelihood of uncontrolled discharges to water and land and, in particular, private property.

However, some discharges to land are inevitable during heavy wet weather events – for example those larger than the 10 year ARI storm event. This event can lead to flooding at levels that may be above the design height (or legal height) of wastewater gully traps[19] on private property. When this occurs, rainwater then gets into the wastewater system, and wastewater has the potential to flow up and out of gully traps on private properties. Flood waters on private property will then contain some wastewater.

Dry weather overflows, which generally occur as a result of a blockages in the wastewater network, are likely to discharge to land – in some instances they may be at a location where the overflow reaches a waterway (this is the case for approximately 15% of DWO events). These discharges to land can occur on private or public property. Because they occur as a result of unpredictable events, their locations and hence the land (or water) they affect cannot be determined in advance. Where they occur, Council responds to address the source of the problem and implements clean-up and mitigation to manage adverse effects including health risk.

5.2 Land

The Gisborne urban area, together with adjacent water receiving environments, has the potential to be affected by wastewater overflows.

5.2.1 Land Use

Land use in the urban area is predominantly general residential, with commercial to the east of the confluence of Taruheru and Waimata Rivers. Industrial land use is located to the south of the commercial zones (Figure 16).

Most of the areas affected by overflows, being the Kaiti, Whataupoko and Mangapapa catchments, are predominantly residential (Figure 17).

[19] The Building Act requires a gully trap overflow level to be no less than 25 mm above paved surfaces or 100 mm above unpaved surfaces – or up to the 10 year ARI flood event

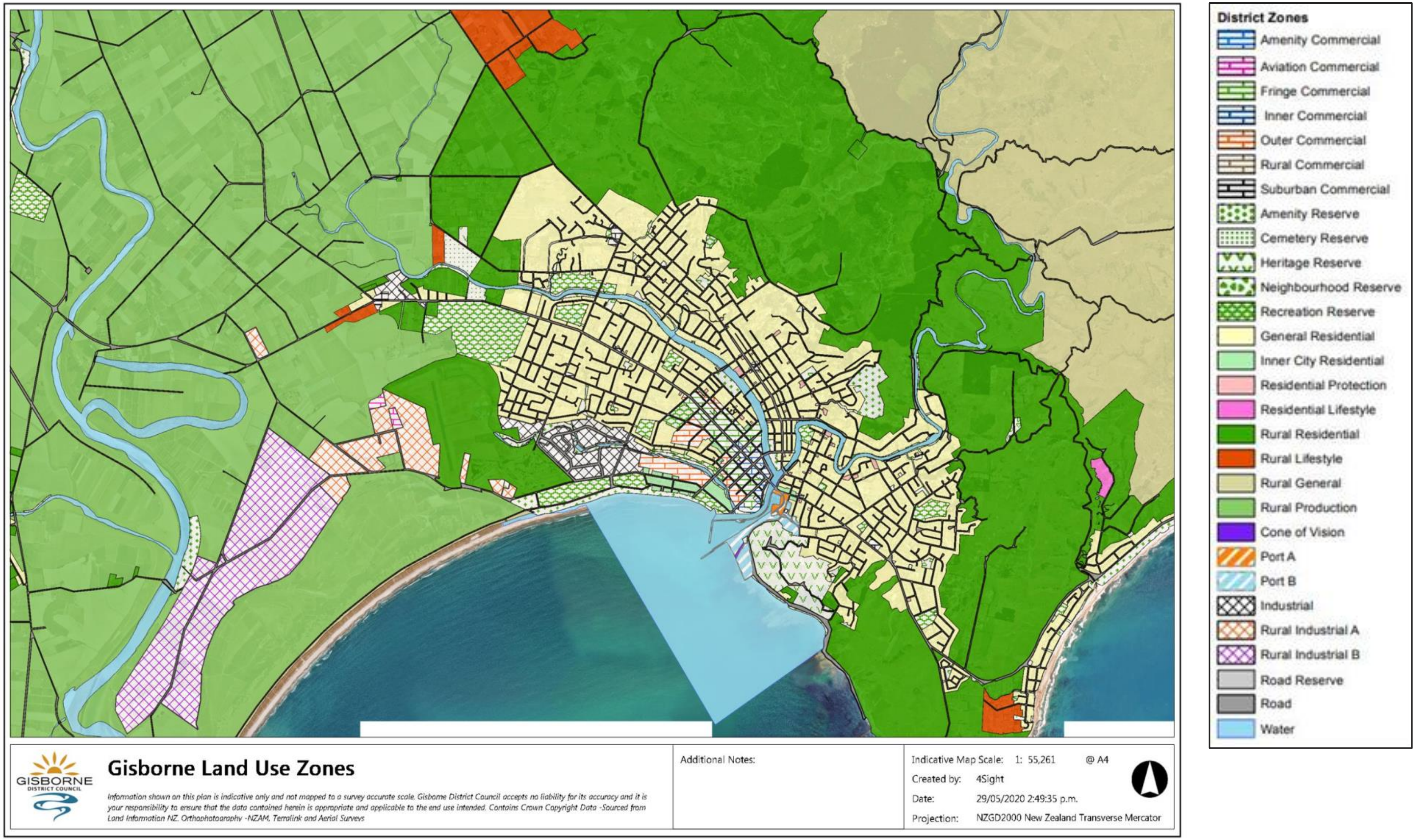


Figure 16: Gisborne Land Use Zones

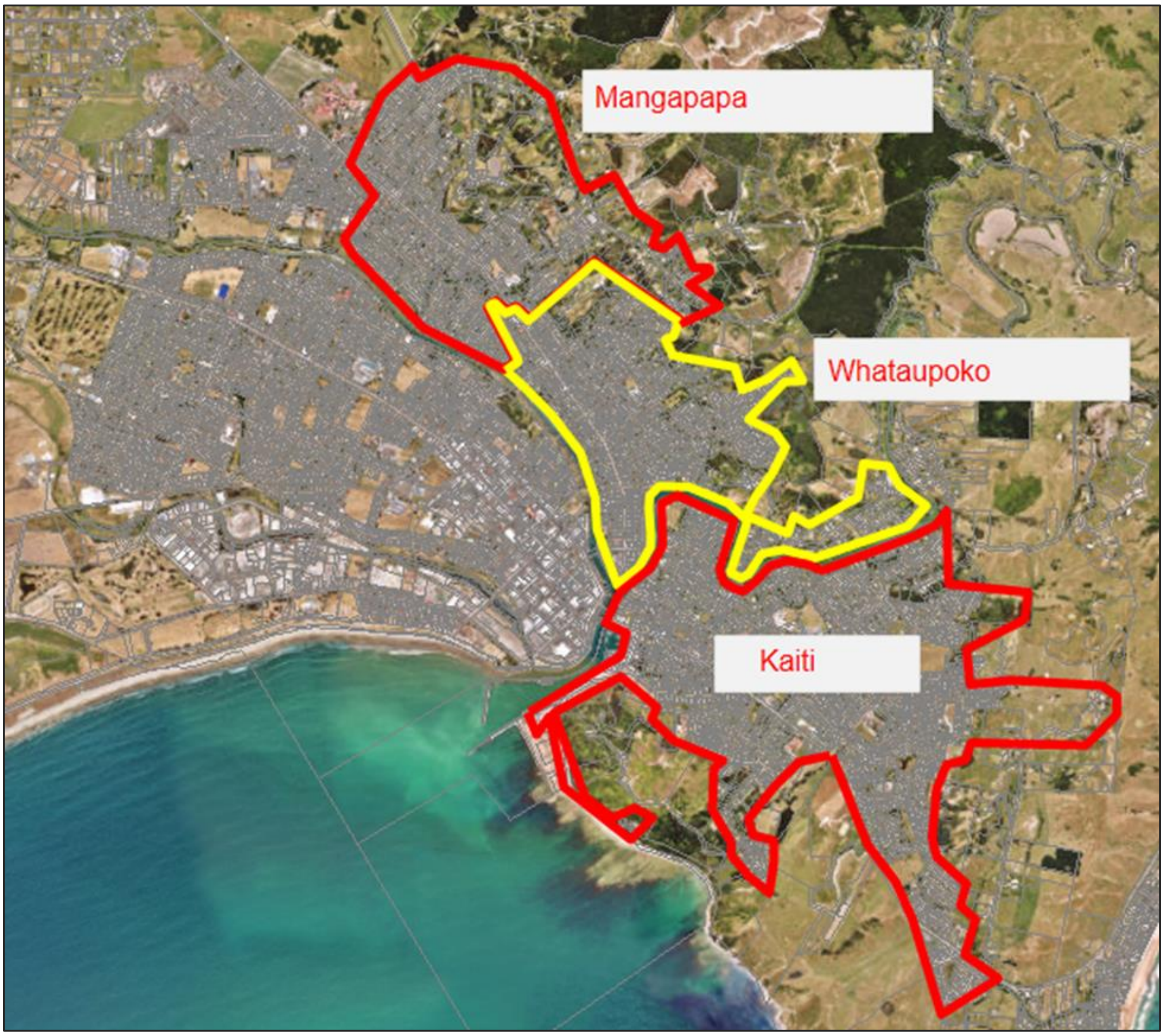


Figure 17: Gisborne and Selected Wastewater Catchments

(catchments most affected by wet weather overflows)

5.2.2 Topography

The Gisborne urban area is flat and low lying, with much of the urban area being at an elevation of less than 10 metres above sea level, with some areas to the eastern Kaiti catchment of up to 20 metres above sea level.

As previously discussed, this flat topography has implications for both stormwater and wastewater drainage.

5.2.3 Geology and Soils

The Gisborne urban area is founded on quaternary alluvial sediment that overlies Miocene sandstone, which is exposed in the hills around the city[20]. Soils include silt and sandy loams and areas of clay.

5.3 Freshwater/Estuarine

Gisborne is built around the confluence of two main rivers, the Waimata River and the Taruheru River, which combine to form the Tūranganui River. To the southwest of the town, the smaller Waikanae Stream flows into the mouth of the Tūranganui River. A number of smaller tributaries flow into these main rivers, including the Mangapapa, Matokitoki, and Kopuawhakapata.

A description of the freshwater / estuarine environments can be found in Kelly and Sim-Smith (2020) (Appendix H). The description of the main rivers has been summarised from the attached report below; however, the reader is directed to the report for further information and detail, including photographs and references.

5.3.1 Waimata River

The Waimata River system has the largest catchment of approximately 22,700 ha. Predominant land covers in the Waimata catchment include steep grasslands, exotic forest and manuka/kanuka. Approximately 3.5 km of the river runs through urban parts of Gisborne, of which, around 2 km is downstream of the only primary outfall in its catchment (Seymour Rd/Turenne St). No secondary outfalls drain to the Waimata River system. Urban reaches of Waimata River are adjoined by a mix of public and private open space and residential development, and limited agricultural areas.

Native riparian vegetation is scarce along the Waimata River downstream of the Goodwin Road Bridge. Further upstream, the percentage of riparian vegetation increases, transitioning from weedy exotic species to pioneer species e.g., manuka/kanuka, to mature mixed canopy broadleaf species.

The river is tidal through its lower reaches with a modelled mean flow of 2.98 cubic metres per second (cumecs) and a mean annual low flow (MALF) of 0.17 cumecs[21] at the William Petty Bridge.

5.3.2 Taruheru River

The Taruheru River system drains a catchment of around 8,400 ha. The river system flows through a low-lying floodplain before reaching Gisborne city. Land uses in the catchment are dominated by cropping, orchards and grasslands, with urban development in the lower catchment.

The gradient of the river is very flat through the approximately 5 km urban section, and for 10 km upstream. As a consequence, river water levels are strongly affected by sea levels. The average Taruheru River tidal extent is upstream of Tucker Rd but does not appear to extend as far as King Road[22]. Spring

[20] https://www.gns.cri.nz/Home/Our-Science/Land-and-Marine-Geoscience/Regional-Geology/Urban-Geological-Mapping2/Gisborne

[21] National river flows environmental reporting - https://data.mfe.govt.nz/layer/53309-river-flows/ - note that this is a high level national model estimate

[22] Paul Murphy, GDC, pers comm

tides are reported to raise water levels almost as far upstream as the Tucker Road Bridge. The lower 1.3km river section, being that potentially affected by the proposal, is likely to be characterised mostly by high salinity clean coastal water other than for short periods around the time of low tide and during significant rainfall events when salinity may be lowered.

The Taruheru River has a modelled mean flow of 0.91 cumecs and a MALF of 0.13 cumecs at the Peel Street Bridge[23].

A flood management scheme dating back to the 1960s, including stopbanks, channel deepening and riverbank armouring, enabled major changes in land use from pastoral to horticultural. Despite this, low lying areas remain vulnerable to surface flooding. The impacts of river modification and surrounding land uses have adversely affected the natural character of the river, which was scored as low by a River Expert Panel using the River Values Assessment System (RiVAS)[24]. Two secondary outfalls discharge along Taruheru River (Oak St and Palmerston Rd/Peel St).

Most of the native riparian vegetation along the Taruheru River has been removed and replaced with introduced grass, shrub and tree species, with large sections of the river simply edged with grass. Urban modification, including retaining walls, prevent the natural migration of the river, with a functioning terrestrial-aquatic interface between the river land largely diminished or absent. The pest Spartina was planted in the lower river in the late 1950s and spread rapidly over the next 20 years, reaching densities of up to 100% coverage in some areas. Spartina traps silt, raising the level of estuarine mudflats. In areas where Spartina cover is incomplete, small patches of saltmarsh vegetation exist e.g., Raupo (*Typha orientalis*) *Juncus kraussii subsp. australiensis,* and oioi (*Apodasmia similis*). Areas dominated by Spartina have low ecological value, in addition to impacting flood conveyance.

5.3.3 Waikanae Stream

The Waikanae Stream system is around 7.5 km in length and borders the southwestern edge of Gisborne city. It is a low gradient, groundwater fed stream that drains a catchment of around 1100 ha. The stream is tidally influenced, with the saline intrusion evident at least 4 km upstream from the sea. Land use in the upper catchment is dominated by orchards and horticulture, while the mid to lower catchment is dominated by mixed urban (including significant industrial) development, and significant areas of urban parkland or open space are also present. There are a number of closed landfills adjacent to the Waikanae Stream. The stream has been heavily impacted by human activities and was assessed as having low natural character[25]. No primary or secondary outfalls discharge to Waikanae Stream.

The stream has a modelled mean flow of 0.16 cumecs and a MALF of 0.05 cumecs at the Grey Street Bridge[26]

---

[23] National river flows environmental reporting - https://data.mfe.govt.nz/layer/53309-river-flows/ - note that this is a high level national model estimate

[24] Booth, K., Callis, J., Cave, H., Fogle, S., Gaddum, M., Hudson, K., Warmenhoven, T. (2012) Natural character in the Gisborne District: application of the River Values Assessment System (RiVAS). Lincoln University, Canterbury.

[25] Also Booth et al (2012)

[26] National river flows environmental reporting - https://data.mfe.govt.nz/layer/53309-river-flows/

Little riparian vegetation occurs along Waikanae Stream. The upper reaches of the stream are mostly devoid of any woody riparian vegetation or shading, resulting in high summer water temperatures and low habitat value. Low value riparian vegetation is present along the majority of the middle reaches of the creek. However, a dense patch of raupo (*Typha orientalis*) has been planted adjacent to Te Kuri a Tauai Marae, which has begun to facilitate the development of brackish wetland and salt meadow habitats that include the 'At Risk–Naturally Uncommon' plant, native musk (*Thyridia repens*). Further downstream, large areas of the pest Spartina are present, that have encouraged sediment accumulation.

5.3.4 Other Streams

A number of small, fragmented urban streams feed into the main rivers – for example the Mangapapa and Matokitoki (into the Taruheru) and Kopuawhakapata (into the Tūranganui). These streams are highly modified, relatively narrow and incised, and include vegetated riparian margins in places – although these sections are commonly interrupted by piped, lined and channelised reaches, or reaches with no riparian cover. The Matokitoki extends further out of the urban environment and into agricultural areas, with comparatively greater ecological values than the Mangapapa and Kopuawhakapata.

5.3.5 Macroinvertebrate Communities

A number of programmes/investigations have assessed macroinvertebrate communities in Gisborne's urban, and surrounding rural, streams and rivers, using the Macroinvertebrate Community Index (MCI) as a key indicator of river and stream health. The MCI uses the mix of macroinvertebrates at a site to classify stream health as poor, fair, good or excellent.

MCI scores for the GDC's rural freshwater monitoring sites closest to Gisborne township (Waimata River at Goodwins Road and Taruheru River at Tuckers Rd) are within the "poor" range. These two sites also have lower percentages of EPT taxa3 (0–15%) and low abundances of EPT taxa (0–3%). Similar results have been obtained from other urban and peri-urban streams. Similarly low scores have been found at a peri-urban Waikanae Stream (at Airport) site, and above and below Gisborne Port's upper logyard stormwater discharge to Kopuawhakapata Stream.

These results are consistent with those from other rural and urban areas where multiple, interacting stressors combine to produce relatively predictable outcomes for macroinvertebrates. In urban areas, a reduction in ecological condition typically occurs with increasing imperviousness. Multiple national and international studies have shown that ecological condition rapidly drops above a threshold in impervious cover, which typically falls between 6 and 20% total imperviousness.

Accordingly, irrespective of any potential influence of overflows, it would be reasonable to expect macroinvertebrate communities to be degraded in most (if not all) of Gisborne's urban streams, with slightly better condition possible in upper urban reaches with natural stream beds and riparian cover.

5.3.6 Fish

The most common freshwater fish reported to occur in the Taruheru and Tūranganui River systems are eels (*Anguilla spp.*) and the common bully (*Gobiomorphus cotidianus*). Other species that have been occasionally reported include banded kokopu (*Galaxias fasciatus*), inanga (*Galaxias maculatus*), goldfish (*Carassius auratus*) and mosquitofish (*Gambusia affinis*), the latter two species being introduced. Other freshwater species may also occur.

A similar suite of fish has been recorded from the Waimata River including long and short-finned eels (*Anguilla dieffenbachia* and *A. australis*), common bully, torrentfish (*Cheimarrichthys fosteri*), inanga, Cran's bully (*Gobiomorphus basalis*), bluegill bully (*Gobiomorphus hubbsi*) and goldfish.

Short and long-finned eels, inanga, common bully, giant bully (*Gobiomorphus gobioides*), mosquitofish and goldfish have been recorded from the upper reaches of Waikanae Stream.

5.3.7 Fish Passage in Rivers and Streams

Consent is only sought for wastewater overflows (discharges) and not for the associated wastewater infrastructure. Wastewater discharges (or infrastructure) do not provide an impediment to fish passage.

5.3.8 Hydrology and Uses

Wastewater overflows have the potential to affect the lower, urban reaches of the Gisborne's streams. In these areas, the streams are tidally influenced and estuarine and there are no abstractions from the rivers at this point. The hydrology of these rivers will not be significantly affected by infrequent wastewater overflows.

5.4 River Background Water Quality

The background water quality in the four 'urban' water bodies: Taruheru River, Waimata River, Waikanae Stream, and Kopuawhakapata Stream and been assessed in: River Water Quality Monitoring Report (Appendix I). Monitoring results were analysed from routine (state of the environment) sampling from sites that have the potential to be affected by wastewater overflows (Figure 18).

Monitoring was conducted by Council from 2015 to 2019 to ensure it best represents current information. Samples collected specifically around a wastewater overflow or other pollution event were excluded to ensure the data only related to background water quality (ie not during a wastewater overflow event). The assessment considered those parameters that are most likely to be also contained in wastewater overflows (faecal bacteria, nutrients, sediment, and heavy metals).

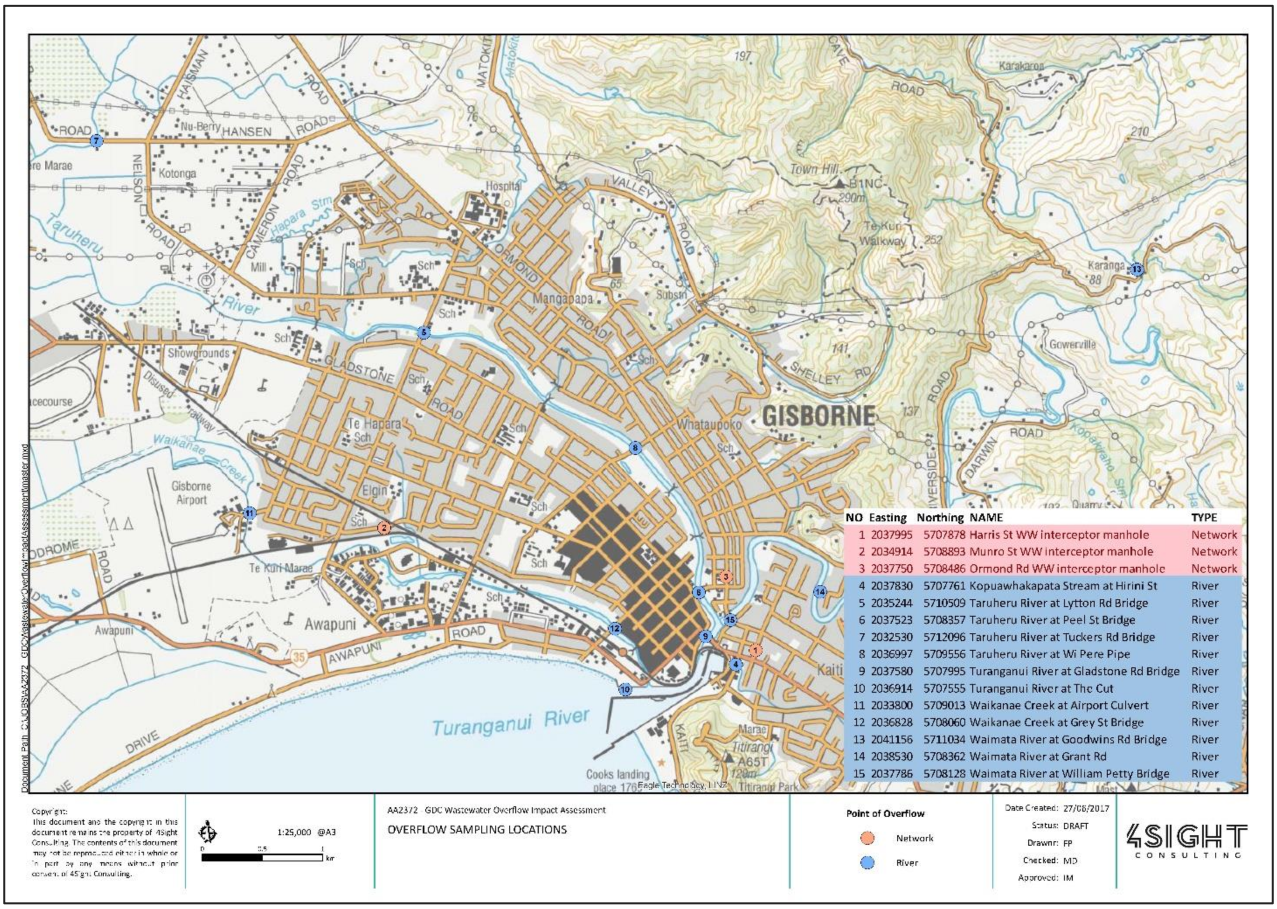


Figure 18: Water Quality Sampling Sites

(note that the network locations do not relate to background water quality, but overflow events, and are assessed in Section 6)

5.4.1 Guideline Values

There is a range of typical water quality parameters that are usually used as indicators of 'ecological health' or as an indicator of contact recreational risk of a water body. The parameters used to measure instream health during the study, together with relevant guideline values, are summarised in Table 15.

Table 15: Water Quality Parameters and Guideline Values

Water Quality Parameter	Relevance	Guideline Value	Unit
Ecological Health			
Turbidity*	Amenity, deposition/accumulation	5.6[1]	NTU
Total Nitrogen	Can cause nuisance plant growth	0.281[1]	g/m^3
Total Phosphorus	Can cause nuisance plant growth	0.023[1]	g/m^3
Ammonia (toxicity)	Can cause nuisance plant growth/toxic to aquatic life	Annual median ≤1.3[6] Annual maximum ≤2.4[6]	g/m^3
Fluoride	Toxic to aquatic life	0.12[2]	g/m^3

Copper	Toxic to aquatic life	0.0014[3] 0.0025[4]	g/m^3
Zinc	Toxic to aquatic life	0.008[3] 0.031[4]	g/m^3
Contact Recreation/Public Health			
Enterococci	Human health risk	Annual median <280[6] Annual 95th %ile <500[6]	CFU(ent)/100 mL

** No guideline for TSS has been established. Refer to the New Zealand specific guideline for turbidity. The correlation between TSS and turbidity is strongly positively correlated.*
[1] ANZG (2018) guideline value for New Zealand Warm Dry Low-elevation rivers (80th %ile of data)
[2] Canadian environmental quality guidelines for the protection of aquatic life (1999)
[3] ANZG (2018) toxicant guideline value for the 95% protection of species in freshwater
[4] ANZG (2018) toxicant guideline value for the 80% protection of species in freshwater
[5] Microbiological Water Quality Guidelines for Marine and Freshwater Areas Recreational Water Quality Guidelines (2002)
[6] Limit outlined in the Tairāwhiti Management Plan for the Gisborne Urban Freshwater Management Unit

5.4.2 Enterococci

Enterococci is the primary faecal bacteria used to indicate the suitability of the water for recreational use in saline environments. Enterococci is used, rather than E. coli, as the lower reaches of the Gisborne urban rivers are tidally influenced (i.e., river estuaries). The TRMP Gisborne Urban Freshwater Management Unit (Urban FMU) defines an annual median of <280 CFU(ent)/100 mL and an annual 95th percentile of <500 CFU(ent)/100 mL for rivers in the Urban FMU.

Over the analysed period of routine monitoring, enterococci concentrations spanned a broad range, covering five orders of magnitude. The concentrations are typically highest during and following rainfall events. Table 16 provides summary statistic for enterococci concentrations from the monitoring and these are shown in Figure 19.

The median enterococci concentration at all sites except Tuckers on the Taruheru River and Hirini on the Kopuawhakapata Stream were within (less than) the Urban FMU (annual median) guideline of 280 CFU/100mL. No sites, however, were within (less than) the Urban FMU 95th percentile guideline of 500 CFU/100 mL. As background water quality was assessed for data that excluded overflow events, this is likely due to high levels of microbial contaminants being discharged from (non-wastewater overflow) catchment sources during rain events – particularly those in the upper non-urban catchment.

Median levels of enterococci in the Kopuawhakapata Stream in particular indicate chronic microbial contamination that is not related to wastewater overflow events.

The Taruheru River shows a clear trend of higher concentrations of enterococci in the upper non-urban catchment (Tuckers) and lower concentrations in the lower urban catchment (Peel). This suggests that the upper non-urban catchment is the primary source of enterococci, with greater dilution by stormwater during rainfall events downstream. This pattern is not as noticeable with the other rivers as they have fewer monitoring locations.

Table 16: Summary Statistics of Enterococci Concentrations (CFU(ent)/100 mL)

River	Site	5th %ile	Median	95th %ile	No. Samples
Taruheru	Tuckers	33	360	5,970	55
Taruheru	Lytton	30	200	4,780	87
Taruheru	Wi Pere	10	94	3,440	63
Taruheru	Peel	5	74	2,670	62
Waimata	Goodwins	*Insufficient data*			
Waimata	Grant	5	69	1,030	66
Waimata	William Pettie	*Insufficient data*			
Waimata	Gladstone	4	83	2,645	112
Waikanae	Airport Culvert	*Insufficient data*			
Waikanae	Grey	5	97	6,500	64
Waikanae	The Cut	2	25	2,990	63
Kopuawhakapata	Hirini	639	3,050	32,700	72

* Insufficient data where there are less than 10 samples. Possibly not collected for routine sampling.

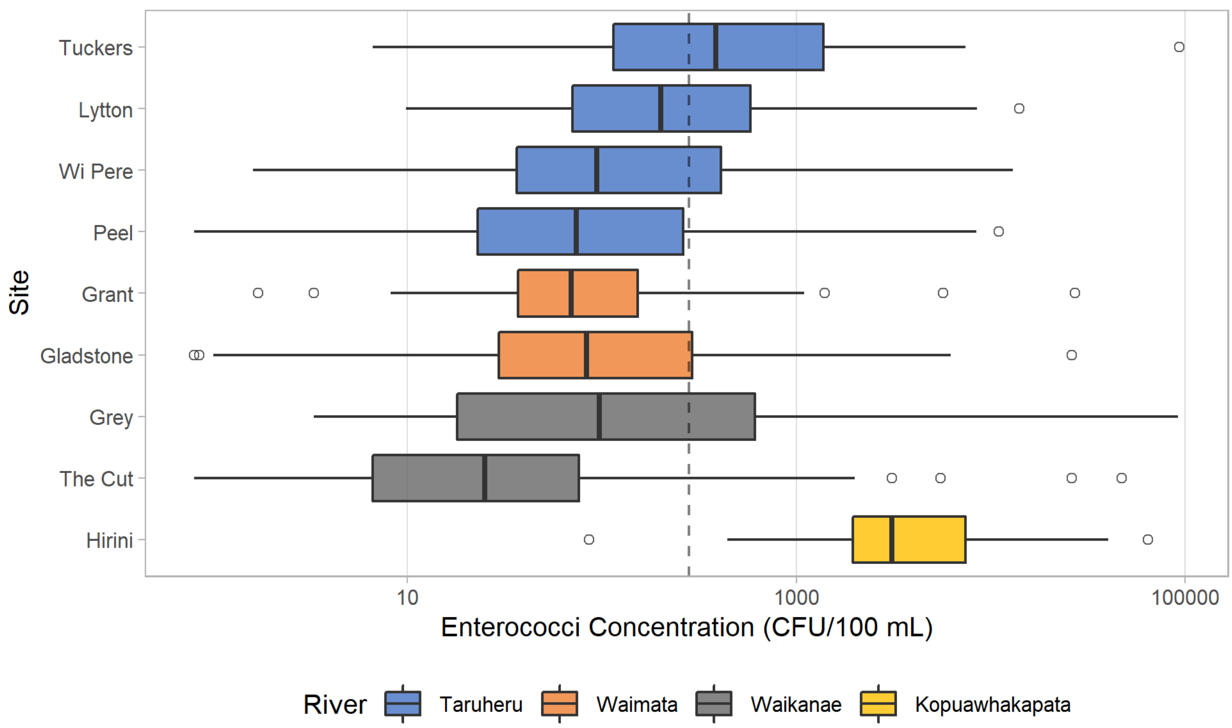


Figure 19: Summary of enterococci concentrations (routine sampling) from 2015 to 2019

(note the log scale on the x-axis). The boxes show the lower- and upper quartiles of the data (the interquartile range) and the solid black line, the median. Open circles show results that are more than 1.5 times the interquartile range. The vertical dashed line denotes the Gisborne Urban Freshwater Management Unit median guideline of 280 CFU/100 mL.

5.4.3 Other Parameters

In respect of the other parameters that were assessed:

- The highest concentrations of nutrients and sediment were typically measured at the most upstream sites. This indicates that, in general, the primary source of these is from the upper catchment. The exception to this is the Waimata River, where there was an increase between the most upstream site (Goodwins) and the nearest downstream site (Grant). This indicates that the predominant source of most contaminants is between these two sites. It is not possible to identify whether this is a result of the rural or urban land use in this area without further information or studies.
- Total nitrogen, total phosphorus, and total suspended solids all exceeded relevant guideline levels at all sites, indicating elevated background levels of these contaminants in the rivers.
- Ammonia (toxicity) was low at all sites and the median concentration was well below the guideline value.
- Metal concentrations were below the analytical level of detection in most samples; however they were, at times, up to an order of magnitude higher than their respective guideline values. Again, these high levels are likely to be associated with heavy rain events, and most likely urban stormwater derived.
- The Kopuawhakapata Stream had the highest metal concentrations, which exceeded the toxicity guideline for 95% protection of species for copper and zinc on 26% and 67% of sampling occasions, respectively.

5.4.4 Summary

Analysis of the background water quality indicates that background microbial water quality in Gisborne's urban rivers is generally acceptable, other than during periods of rain, with downstream sites generally being better than those upstream – particularly in the Taruheru River. Nutrients and suspended sediment exceed their respective guideline values, particularly in the most upstream sites, indicating that, in general, the primary source of these contaminants is from the upper catchment.

During rainfall, enterococci levels can be elevated and exceed health guidelines (in the absence of any wastewater discharges) and accordingly, the 95%ile value is substantially higher that the level set for the Urban FMU in the TRMP.

5.5 Tūranganui-a-Kiwa / Poverty Bay

The city of Gisborne (Tūranga) has developed around the mouth of the Tūranganui River - and is well recognised for the distinctive character of Tūranganui-a-Kiwa / Poverty Bay (the Bay). The Bay's visual character includes the long white cliff headland of Te Kuri a Paoa (Young Nick's Head) which projects out into the Bay, contrasting the low-lying flood plain of the Poverty Bay Flats and the facing Tītīrangi maunga and Tuamotu Island.

The Bay stretches for 10 kilometres from Te Kuri a Paoa in the southwest to Tuaheni Point in the northeast. Land use clockwise around the Bay is primarily rural (predominantly horticulture) from Te Kuri a Paoa to the Gisborne urban area and Gisborne Port, Kaiti Hill Reserve, and rural-residential through to Tuahine Point.

The coastal marine environment of the Bay is diverse and dynamic because of islands, headlands, escarpments, rock shelves, river mouths and associated lagoons and wetlands. For generations Te moana nui a Kiwa has supported cultural practices such as mahinga kai, and activities such as sport and fishing.

The primary rivers that enter the Bay are the Waipaoa (catchment area - 2,205 km^2), Taruheru (84 km^2), Waikanae (11km^2) and Waimata (227 km^2) Rivers. The significant size of the Waipaoa Catchment means that it is the predominant source of runoff into the Bay and contributes some 15 million tonnes of mud, silt and sand per year to the Bay[27].

5.5.1 Water Quality

The primary potential water quality effect on the Bay associated with wastewater overflows is the discharge of microbial contaminants and associated pathogens and associated potential risks to human health. Much of the near shore waters of the bay are classified as either Class SA (Kaiti coast) or otherwise Class SB. The standards for both these classes include that water shall not be rendered unsuitable for bathing by the presence of contaminants. In marine waters, enterococci is used as the water quality indicator from a public health perspective and Council routinely monitors water quality at identified bathing sites[28] including the following sites that are in proximity to the Tūranganui River:

- Tūranganui River (Gladstone Bridge);
- Waikanae Beach (at Grey Street);
- Midway Beach (at the surf club); and
- Kaiti Beach (at the yacht club).

The bathing beach monitoring results from 2016 through to 2019 are shown in Figure 20. This information shows that while the significant majority of water samples return results below 'alert' levels, water quality in the Bay near the outlet of the Tūranganui River can be above both 'alert' and 'levels not suitable for swimming' – with levels of up to 200,000 CFU(ent)/100 ml.

The recreational water quality monitoring information presented in Figure 20 is the cumulative result of all discharges that ultimately end up in the Tūranganui River and the Bay. As indicated in the assessment of background water quality above, water quality in Gisborne's rivers is also affected by up-catchment sources and runoff from rural areas in particular is a significant contributor of microbial contaminants.

While there are broader catchment issues, wastewater discharges include human-derived pathogens and other contaminants, which can pose different risks to those from animal-derived pathogens. Both are however a concern. A key difference is the cultural and social effect of human wastewater discharges versus other discharges.

[27] Sate of the Environment: The Coast 2013-2015

[28] https://www.gdc.govt.nz/can-i-swim-here/