Before the Proposed Plan Change One Hearings Panel In Wellington

Under	the Resource Management Act 1991 (the Act)
In the matter of	the Proposed Plan Change One to the Natural Resources Plan – Hearing Stream 2: Objectives, ecosystem health policies, and wastewater.
Between	**Greater Wellington Regional Council** Local authority
And	**Wellington Water Limited** Submitter 151 and Further Submitter FS039

Statement of evidence of Stephen John Hutchison for Wellington Water Limited

Wastewater

Dated 14 March 2025

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Statement of Evidence of Stephen John Hutchison

1 Introduction

1.1 My full name is Stephen John Hutchison.

1.2 I am the Chief Advisor – Wastewater at Wellington Water Limited (**'Wellington Water**'). I have been employed by Wellington Water in this role since January 2016. Prior to that I was employed by MWH New Zealand Ltd in Wellington from 1996 as an Environmental Engineer and then Senior Water/Wastewater Engineer. In my current role I advise on the technical aspects of wastewater engineering across all business units within Wellington Water. This includes the Strategy & Planning, Operations and Risk & Compliance groups.

1.3 This evidence focuses on the provisions of Plan Change 1 ('**PC1**') that relate to wastewater management, and their implications for Wellington Water as the wastewater service provider on behalf of its client councils.

1.4 I have been authorised to give this evidence by Wellington Water.

2 Qualifications and experience

2.1 I have a Bachelor of Technology degree in Environmental Engineering from Massey University, am a Chartered Professional Engineer, a member of Water New Zealand and a Chartered Member of Engineering New Zealand. I have twenty-eight years professional experience in environmental engineering, and more specifically in wastewater engineering.

2.2 I have been closely involved with a number of wastewater schemes throughout my career. In particular, I have been closely involved in the development and management of the Hutt Valley Wastewater System since 1998. In addition to my work in the Hutt Valley, I have also worked on various elements of the wastewater systems for Wellington City, Porirua, South Wairarapa, Kapiti, Whanganui, Palmerston North and Hastings.

2.3 I have contributed to a number of national industry advisory groups in my current role, including for Water NZ Gravity Pipe Inspection Manual (2019), Water NZ Good Practice Guide for Addressing Wet Weather Wastewater Network Overflow Performance (2022), Water NZ Pressure Pipe Condition Manual (2024) and the Taumata Arowai National Wastewater Standards Technical Review Group (2024).

3 Code of Conduct

3.1 Although this matter is not before the Environment Court, I confirm that I have read the 'Code of Conduct for Expert Witnesses' in the Environment Court Practice Note 2023, and I agree to comply with it.

3.2 As a Wellington Water employee, I acknowledge I am not independent. However, I have sought to comply with the Code of Conduct in preparing my evidence (and will do so in giving evidence at the hearing). In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

4 Scope of evidence

4.1 My evidence addresses the following:

a The Wellington region public wastewater network;

b Private wastewater connections to the Wellington Water networks;

c Wastewater network overflows and discharges;

d Other sources of pollution from wastewater;

e The need for investigations to understand the contribution of wastewater to target attribute states not currently being met;

f Changes to the public network that would be required to meet the key requirements of PC1 as notified (i.e. to achieve the containment standard and reductions in (Escherichia coli (**'*E.coli*'**) and enterococci commensurate with what is needed in the receiving environment to meet the target attribute states ('**TAS**') and coastal water objectives ('**CWO**')); and

g Outline of work that could occur over the next 10 years depending on funding and resources; including high level costs associated with those works.

4.2 In preparing my evidence, I have reviewed the following documents:

a HS2 GWRC Technical evidence of Dr Michael Greer

b HS2 GWRC Technical evidence of Mr David Walker Section 42A Hearing Report – Ecosystem Health and Water Quality Policies

c Amendments to the Change 1 provisions attached to the Section 42A Hearing Reports prepared by Mary O'Callahan

5 Summary

5.1 The Wellington region public wastewater network includes about 2,658 km of pipelines and associated pumping stations and treatment plants which provide an essential public health service to the urban areas of Wellington. Wellington Water manages, operates and maintains this public network on behalf of Wellington City Council, Porirua City Council, Hutt City Council and Upper Hutt City Council.

5.2 The public wastewater network and the private pipes which connect to the public network are a significant contributor to *E. coli* contamination to freshwater and enterococci in the urban coastal environment, due to condition and performance during both dry weather and wet weather. The proportionate contribution of the wastewater network to the *E. coli* and enterococci contamination at each location is not known and, in my view, will need further work to quantify.

5.3 The proposed *E. coli* standards will require a major uplift in investigation, repair, renewal and upgrade work to meet. While Wellington Water has undertaken studies on reducing wet weather overflows which contribute primarily to the 95%ile measure I am unable to quantify the degree of that work required due to the proposed standards as the standards are well beyond the level that we have experience with or understanding of. The evidence from Mr Walker appears to me to be a reasonable estimate of the scale of work, noting the significant uncertainties he has outlined.

6 The Wellington region wastewater network

6.1 'Wastewater' is defined in the Natural Resources Plan as 'liquid waste (and liquids containing waste solids) from domestic, industrial or commercial premises, including, but not limited to, human effluent, grey water, sullage and trade waste'.

6.2 Wastewater in the Wellington Water networks is predominantly from domestic sources. Trade waste is also conveyed through the wastewater network, and is managed by trade waste consents under the respective Councils bylaws.

The public wastewater network

6.3 The metropolitan Wellington region that Wellington Water manages includes four separate wastewater catchments. These catchments are largely based on geographical boundaries to convey the wastewater through a pipe network, by gravity drainage as much as practicable.

6.4 There are also a number of pumping stations which combine some of the natural drainage catchments and/or lift the wastewater when gravity drainage becomes impractical. Subject to capacity limitations in wet weather, the wastewater is conveyed to treatment plant sites and then to disposal in the coastal marine area. **Figure 1** provides a map of the four metropolitan wastewater catchments managed by Wellington Water with trunk pipelines, pumping stations and treatment plants also shown. Wellington Water also manages a further four smaller wastewater catchments in South Wairarapa District that I am familiar with however are outside the scope of this Plan Change so not discussed further in my evidence.

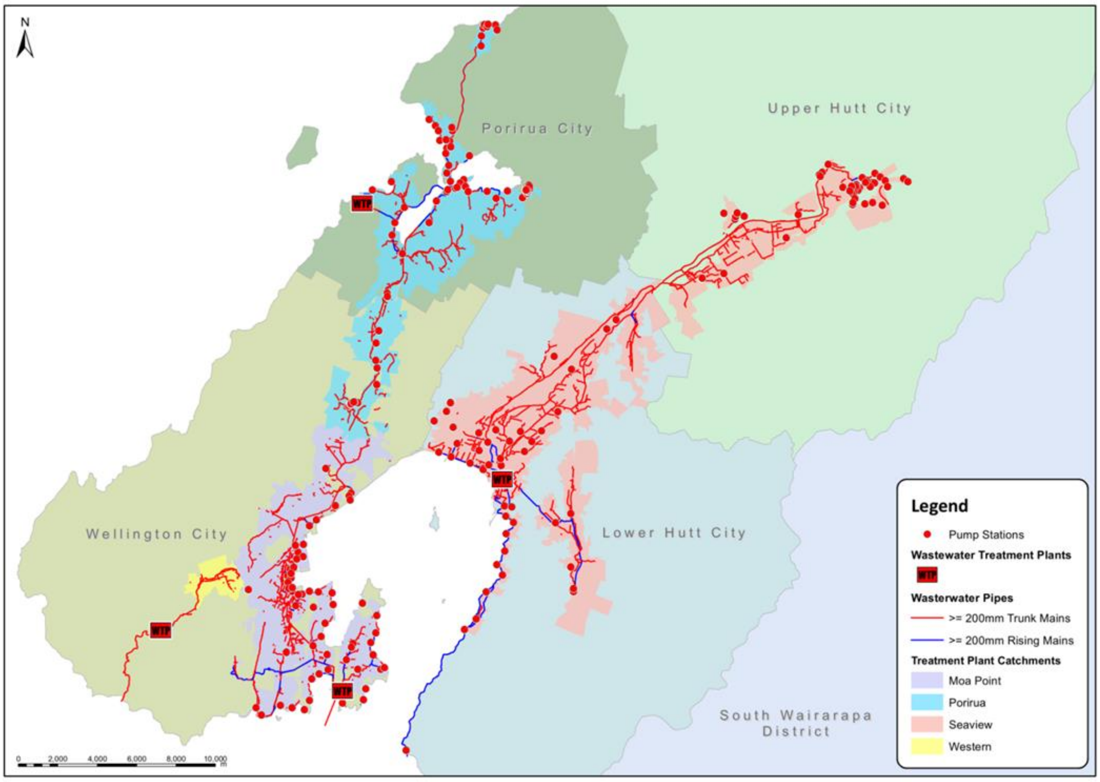


Figure 1: Wellington metropolitan wastewater network

6.5 A total of 2,658km of public wastewater pipes and 209 pumping stations service the four wastewater catchments above. These pipes are made of various materials, including original earthenware pipes from the early 1900s, reinforced concrete pipes from the 1950s, asbestos cement pipes from the 1960s, alongside more modern materials including PVC and high density polyethylene which have been in use since the 1980s.

6.6 The following categories of public assets generally enable the collection, treatment and disposal of wastewater:[1]

[1] See the Wet Weather Overflow Applications, Part 1 Report, page 10.

a Local network reticulation, including local pipes (typically of 150mm to 300mm in diameter), manholes and other similar structures which receive flow from private lateral connections;

b Pumping stations where flow under gravity is not practicable;

c Storage tanks, designed primarily for off-line storage of peak flows and also used for maintenance purposes from time to time;

d Trunk wastewater pipelines – the main sewer arteries and associated manholes conveying wastewater collected from the local network reticulation to the wastewater treatment plants. The trunk network comprises pipes 300mm in diameter or greater; and

e Wastewater treatment plants – which treat raw wastewater to specified standards to reduce its impact on the environment, cultural values and public health risk.

6.7 Wellington Water currently conveys, treats and disposes an average quantity of approximately 155 million litres of wastewater each day in the metropolitan region, the majority of which is domestic sewage from residential properties. However, it also includes commercial wastewater from office buildings and schools, industrial wastewater (also known as 'trade waste') from sources including factories, restaurants, landfill leachate, public swimming pools, and so on. Some groundwater that infiltrates cracks and leaks in the wastewater network is also conveyed. Although separate stormwater networks are provided by Wellington Water's client councils a significant amount of stormwater also enters the wastewater system during rainfall events through misconnections and poor condition pipes.

6.8 Domestic sewage is wastewater from inside homes and businesses including toilets, showers, sinks and washing machines and dishwashers, approximately 175,000 properties. As noted above, the wastewater networks also receive trade waste, which covers a range of commercial, council and industrial sources and includes about 1756 properties, the majority being food premises. Trade waste is controlled and managed through trade waste bylaws to minimise the risk of contaminants that may cause significant harm to the public networks, worker health and safety, and the environment. Wellington Water's most recent estimates are that trade waste was about 5.5% of the total wastewater treated in the past year.

7 The private wastewater connections to Wellington Water networks

7.1 The wastewater system also includes a large extent of privately owned wastewater pipes (the private wastewater connections) that connect properties to the public wastewater network. Property owners play an important role in helping to reduce pollution in the environment by managing their assets within the private network (including gully traps and laterals within private property boundaries).

7.2 The powers that Wellington Water, or indeed any network operator, has to identify faults and require maintenance on the private connections is limited. The current powers are split between the Local Government Act 2002 and the Building Act 2004. Compliance is primarily achieved through cooperation with private owners, however in my experience that has not always achievable, with some property owners refusing to engage or comply with faults that our staff have identified. For example, in work presented later in my evidence as Table 1 while noting that many of the remaining faults will be in progress a total of 75% of the major faults identified had been confirmed as fixed to date.

7.3 Limited control and compliance of private wastewater connections will have a consequential negative impact on the performance of the public system that Wellington Water manages and controls, and therefore its ability to contribute to achieving relevant environmental standards.

8 Wastewater network overflows and discharges

8.1 The role of the public wastewater network is to transport wastewater from homes and businesses and other approved connections to wastewater treatment plants for treatment and disposal. The vast majority of wastewater makes it to the treatment plants, however, wastewater can escape from the public wastewater system in a number of ways. These include:

a When capacity is exceeded (generally referred to as wet weather overflows);

b Blockages or mechanical failures (generally referred to as dry weather overflows); and

c Seepage and/or incorrect system connections from pipes or manholes directly or indirectly to stormwater and watercourses (generally referred to as leaks or cross connections).

8.2 I discuss each of these further below. How wastewater enters and can escape the network and end up in the environment is also illustrated in **Figure 2** below.

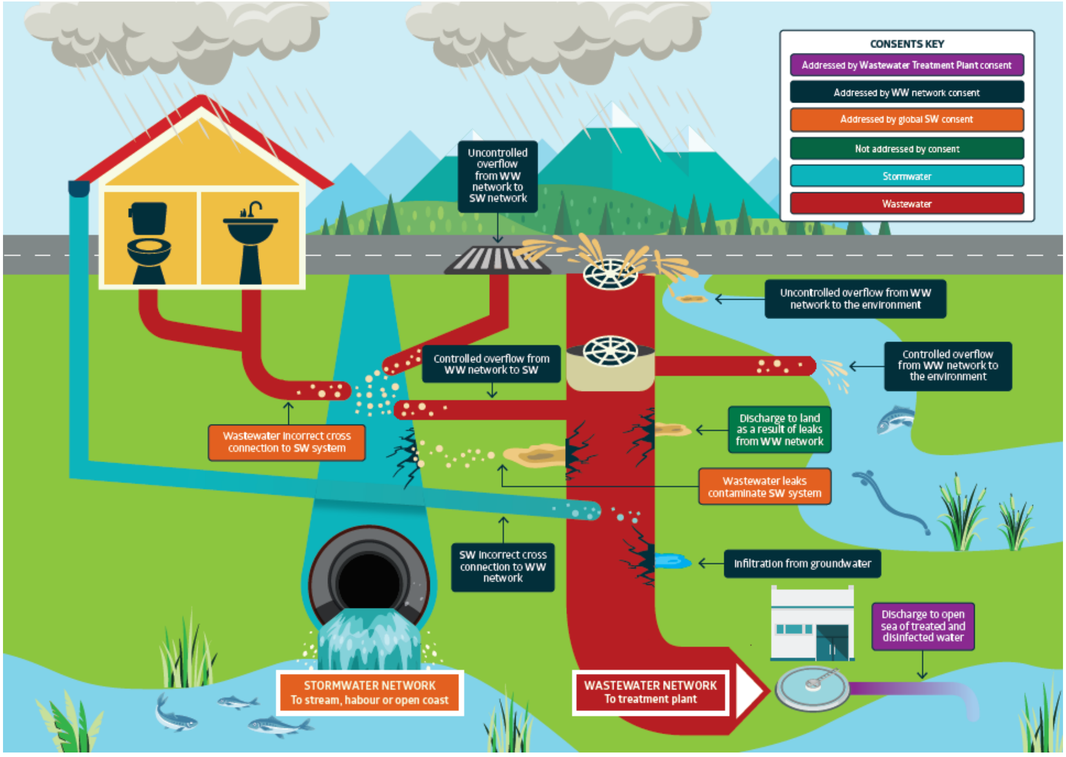


Figure 2: Different types of overflows and discharges to and from the wastewater network

8.3 I note that Water Services Authority - Taumata Arowai suggests using slightly different terminology. To avoid confusion the terms used in this evidence correspond to the Taumata Arowai terms in the following way:

Wellington Water term	Taumata Arowai definition
Wet weather overflow Wellington Water generally use this term to describe a system capacity exceedance caused directly from rainfall ingress to the wastewater system and indirect entry of groundwater to the wastewater system. Note Wellington Water also commonly differentiate between "controlled" discharge points, which are engineered structures intended to allow for emergency and/or wet weather capacity overflows, and "uncontrolled" points, typically manhole lids or gully traps where wastewater may discharge from in event of a system capacity overloading. The difference is significant in terms of the degree of direct exposure risk to the public.	**Capacity exceedance** Wastewater overflow due to the wastewater network capacity being exceeded. This might be due to an excessive ingress of stormwater or groundwater e.g. overflows (both contained and uncontained) from pump stations, pipes, manholes, and engineered overflow structures.

Wellington Water term	Taumata Arowai definition
Dry weather overflow[2] At present, Wellington Water are distinguishing between wet weather and dry weather for the purposes of mandatory Department of Internal Affairs reporting and use a definition of 1mm of rain in the preceding 24 hour period to make that distinction. These are generally as a result of pipe blockage, pipe breakage, or mechanical or power failure.	**Overflows caused by blockage** Wastewater overflow due to blockages e.g. due to fat, oil, grease build-up, or tree root intrusion. **Overflows caused by plant or equipment failure** Wastewater overflow due to a plant failure or equipment damage e.g. pump station ragging, power outages (including those from the electricity supplier's network), or mechanical pump failure etc.
Seepage related leaks and/or cross connections[3] Leaks from seepage, sometimes referred to as exfiltration, can enter surrounding ground, groundwater and/or nearby stormwater or waterways. Cross connections are where a stormwater or sewer connection are incorrectly connected to the wrong pipe. In the case of sewer to stormwater this will lead to direct contamination of waterways.	Not covered

Capacity exceedance (wet weather) overflows

8.4 The majority of the public wastewater network was originally designed to contain and convey four to six times the average dry weather flow of the anticipated developed catchment to allow for some entry of groundwater and stormwater into the system including the diurnal fluctuation of flow during the day. The wet weather peaking factor allowance was set out in the Councils engineering codes of practise of the day for each respective area, hence some variation, and in recent years has been primarily covered by the Wellington Water Regional Standards for Water Services. This increase of wastewater flow occurs during wet weather when:[4]

a Groundwater enters private and council pipes through cracks, leaking joints, incorrectly connected sub-soil drains and other faults (infiltration);

[2] We note that PC1 also defines "dry weather discharge" as discharges that occur when it is not raining. Wellington Water has sought changes to focus more on the cause of the discharge.
[3] We note that PC1 refers to this as "exfiltration"
[4] See the Wet Weather Overflow Applications, Part 1 Report, section 2.6.

b Rainfall from roofs and/or yards is incorrectly directed to the wastewater system instead of the stormwater system (inflow); or

c Rainfall runoff from ground surfaces enters surface, or low level or damaged gully traps or external wastewater drains (inflow).

8.5 In wet weather, the capacity of some of the public network pipelines or pump stations is regularly exceeded, leading to intermittent overflows of diluted wastewater. The frequency of these intermittent overflows vary, and in some cases are regular events that are induced with moderate levels of rainfall. In the two most frequent locations in Wellington these currently occur around 20 times per year, and there are several other locations that discharge around 10 times a year. In total across the metropolitan region WWL have reported between 307 and 681 such capacity exceedances in the Water Services Authority - Taumata Arowai annual performance reporting in the past four years[5].

8.6 For the purposes of Department of Internal Affairs reporting, more than 1mm rainfall in the 24 hours preceding an overflow has been used to define wet weather to comply with their audit requirements and in some cases previous reporting may have included some dry weather blockages as ‘wet weather’ for this reason. Water Services Authority - Taumata Arowai are currently consulting on a national standard for reporting overflows that should improve the reporting of the extent of these discharges. The most regular known locations have monitors of some form installed on them.

8.7 Network overflows occur at either a controlled overflow point (typically a constructed chamber where a high level pipe is in place to divert peak flows to stormwater) or at an uncontrolled overflow point (typically a surcharging manhole). In some cases they can occur at a private gully trap however backflow prevention devices are generally installed where these are made known to Wellington Water and are assessed as related to network capacity.

8.8 The wastewater system is operated to contain and convey the maximum amount of wastewater that it physically can. To be clear, there is no deliberate pumping or opening of valves to deliberately divert wastewater to the environment. The constructed overflows serve a public health function to minimise the chance of direct human exposure of wastewater contaminants and have historically been a requirement of respective Councils engineering Codes of Practise. There will be an elevated risk of indirect human contact through water-based activities or food gathering, however that is far preferable, in my view, than the alternative

[5] https://www.taumataarowai.govt.nz/assets/Water-services-insights-and-performance/Taumata-Arowai-Network-Environmental-Performance-Report-202223_online.pdf

sometimes suggested to block constructed overflows. If the existing constructed overflows were all to be blocked, this would result in discharges from manhole lids to public and/or private land, or from gully traps attached to private dwellings depending on where the next hydraulic low point in the network was.

8.9 There will always be the potential for higher flow events than the networks have capacity for, and controlled discharges are safer to manage than uncontrolled discharges.

8.10 A map of previous Wellington Water hydraulic modelling is presented in **Figure 3** below to show the extent of expected wet weather overflows at a 1 year Average Recurrence Interval rainfall event. Blue dots are controlled locations, brown dots are uncontrolled locations on the public network. Note that this is a modelling output and is representative at a broad scale but overflows have occurred at other locations in the past, depending on specific event rainfall intensity, partial blockages or the infrastructure not being completely accurately represented in the model.

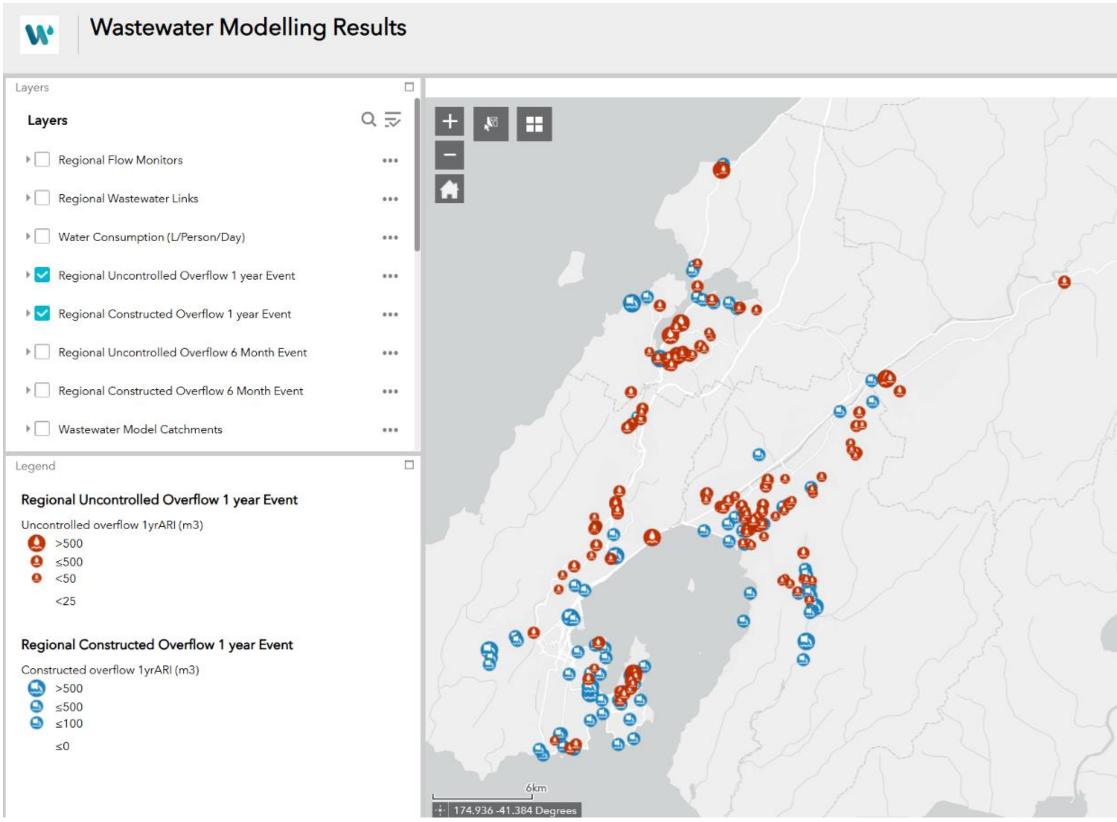


Figure 3: Modelled wet weather overflows discharges from the Wellington region wastewater network from 1 year average recurrence storm event

Blockages, plant and equipment (dry weather) overflows

8.11 Other overflows also occur regularly due to pipe blockage, and occasionally from plant and equipment failure. These overflows from the public wastewater network are generally caused by blockages resulting from fat, roots, wet wipes or sanitary items becoming stuck in the wastewater network. A significant blockage will generally result in a dry weather discharge.[6] Minor blockages may contribute to a wet weather discharge.

8.12 Between 431 and 655 blockage related overflows per annum have been recorded and responded to by Wellington Water operations crews in the past four years. These are in the public wastewater networks and these figures do not include private connections as they are considered private discharges and dealt with by a plumber directly engaged by the property owner. Most of these are small volume discharges which are generally contained on land with no or minor impact on freshwater or marine environments.

8.13 Mechanical or electrical failures at pumping stations may also result in occasional dry weather overflows. These facilities have provisions designed to minimise such discharges, including approximately 4 hours dry weather flow in wet wells, standby pumps in most cases and standby generators in some cases. These are relatively infrequent compared to blockage related discharges.

Seepage related leaks and/or cross connections

8.14 Cross connections, cracks or leaks in the public wastewater network and private connections can also cause wastewater to escape and end up in the environment, contributing to elevated *E. coli* indicator microorganism measurements.

8.15 Cross connections and significantly leaking public or private networks are typically identified as a result of targeted projects analysing the performance and condition of the networks. This can include:[7]

a Inflow and infiltration surveys;

b CCTV pipe inspection surveys;

c Manhole inspections;

d Reactive investigations to reported potential contamination; and

e Planned water quality monitoring and follow up investigations.

[6] See the Wet Weather Overflow Applications, Part 1 Report, section 2.8.
[7] See the Wet Weather Overflow Applications, Part 1 Report, section 3.4.1.

8.16 For some years, Wellington Water has undertaken regular water quality monitoring programmes across networks as a surveillance programme to detect abnormally high levels of *E. coli* that are at levels most likely to originate from the wastewater system. As of 2016, Wellington Water was collecting monthly grab samples from approximately 71 regular freshwater monitoring sites across the four metropolitan cities, separate to GWRC State of Environment monitoring and the Recreational Water Quality monitoring programme. That monitoring programme has evolved with the subsequent Global Stormwater Consent, that was introduced late 2016 however still forms the basis of our wastewater cross connection and blockage detection monitoring.

8.17 Wellington Water also undertakes reactive monitoring, mainly in response to customer reports of seepage, odour or visible contamination. These investigations can sometimes result in the location of a fault in the network, generally being seepage from poor condition pipes and in some cases direct cross connections between wastewater and stormwater

8.18 In recent years Wellington Water has run the "Knowing Your Pipes" project which started in 2021 as part of Wellington Water's work to reduce the level of wastewater pollution entering waterways. This has been an evolution of monitoring and investigation work undertaken in previous years with a particular focus on private connections. This approach uses information from routine stormwater monitoring to target sub-catchments with poor water quality, with follow up actions developed in response to the nature and scale of issues identified, including requests to private owners to repair faults, arranging repair of faults on the public network and in some cases referring the catchment to the Network Engineering Team at Wellington Water for further investigation and larger scale capital renewals. An example of their investigation work in Porirua is included in **Figure 4** below, with C noting cross connections found, and the other markers various forms of tests.

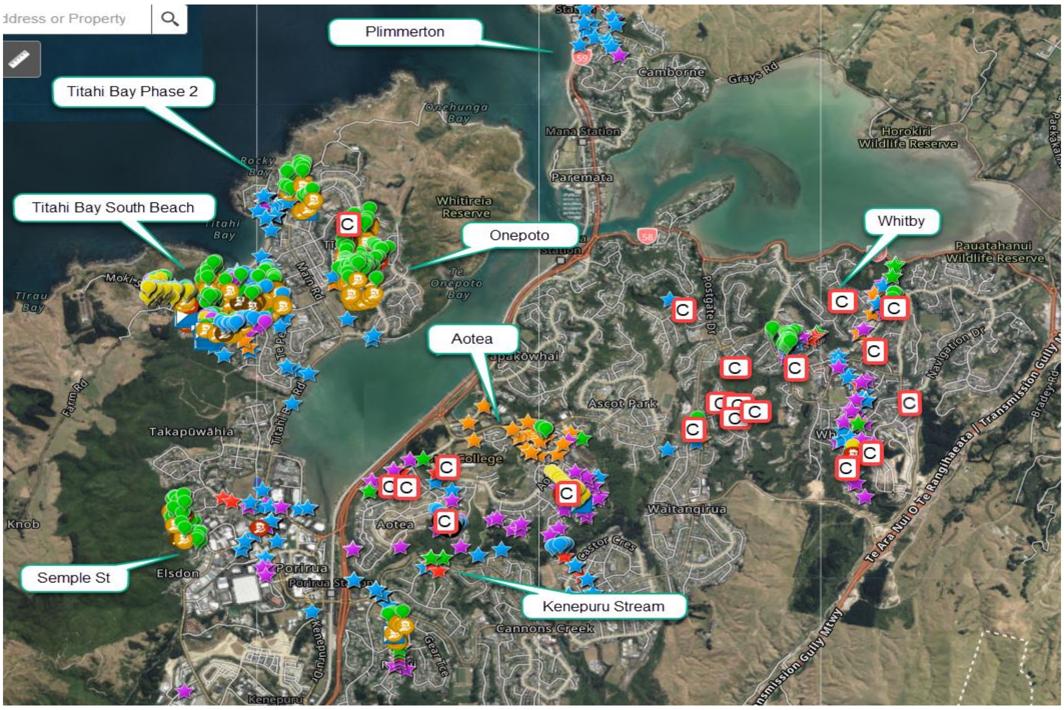


Figure 4: Investigation work undertaken in several Porirua catchments

9 Other sources of pollution from wastewater

9.1 The key contaminants in from wastewater are associated with faecal matter and inorganic flushed contaminants for example wet wipes, and sanitary items. The adverse environmental effects on waterways (setting aside social and cultural considerations) are typically measured by:

a suspended solids (turbidity);

b oxygen demand (typically measured as biochemical oxygen demand or dissolved oxygen);

c nutrients (typically measured as ammonia, total nitrogen and total phosphorus);

d microbiological pathogens (typically measured as E.coli, faecal coliforms and enterococci indicator organisms); and

e other various contaminants (fats, heavy metals, and emerging organic contaminants such as flame retardants, phthalate plasticisers, surfactants, antifouling agents, pesticides and microplastics).

9.2 As noted above, key sources of domestic wastewater include:

a Wet weather overflows

b Blockage related overflows

c Seepage from leaking public or private wastewater networks;

d Cross connections between wastewater and stormwater; and also

e Septic tanks where they are present, albeit very rarely in urban areas.

9.3 Other contaminant sources can be from trade waste, which may include higher levels of industrial chemicals, heavy metals, fats and oils, or other contaminants depending on the nature of the industrial activity at the site.

9.4 Out of the pollution sources entering the wastewater network listed above, Wellington Water only has control over trade waste. Trade waste is an input to the wastewater system. Wellington Water and its client councils manage trade waste to ensure that it is not received at concentrations that may damage the network, compromise the biological wastewater treatment process or biosolids, or endanger worker health and safety. When wastewater discharges to the environment via an overflow for example, then the effect of having the trade waste in the wastewater would generally not be disproportionality worse than just domestic wastewater alone, largely due to the effects of dilution from the domestic wastewater and further dilution from groundwater or stormwater in wet weather, noting that trade waste is a relatively small proportion of the wastewater flow.

10 The need for investigations to understand the contribution of wastewater to target attribute states not currently being met

Non Wastewater Sources

10.1 The contribution of wastewater to the *E.coli* and enterococci target attribute states is not well understood by Wellington Water and it is of concern to me that other faecal sources may be mistakenly being attributed to wastewater. Wellington Water does not generally undertake more specific analysis than the common microbial indicator organisms due to the high cost and limited value of the more sophisticated analytical methods.

10.2 Additional Faecal Source Tracking, or Microbial Source Tracking investigations are expected to be required in future to clarify whether the *E. coli* being detected by monitoring is related to human wastewater. Avian sources and naturally occurring *E. coli* may be a significant contributor. My understanding of the science is limited so I cannot comment in detail however given the potentially high costs associated with making changes to wastewater assets to seek to reduce *E.coli* levels to achieve target attribute states I consider that the source(s) of the contamination needs to be understood as a first step.

10.3 I do acknowledge that GWRC s.42 evidence[8] acknowledges that more work will be required in specific consents to determine a commensurate contribution to *E.coli* and other contaminants.

Wastewater source identification

10.4 The sources of wastewater from underground pipes are inherently complex to locate and resolve. As noted above, Wellington Water primarily relies on planned and reactive monitoring of microbial indicator organisms for its investigations. At present, the standard that is being used in global stormwater consent WGN 290035[34920] monitoring is an annual average of 1,000 cfu/100mL, or one reading in excess of 10,000 cfu/100mL *E. coli*. For context, untreated wastewater contains in excess of 1,000,000 cfu/100mL *E. coli*, so there is a significant level of dilution before the current standards is breached. Microbiological indicators are the most sensitive measurement, as other contaminants such as BOD and ammonia are quickly diluted below background levels in the receiving environment more quickly than microorganism indicators (e.g. *E. coli*).

10.5 The key challenge in locating the source of wastewater contamination is the difficulty of tracing and viewing and even accessing the underground pipe network. Investigation crews use a range of techniques to locate and detect seepages and cross contamination, however, the available techniques are not highly sensitive or accurate. Current approaches typically include:

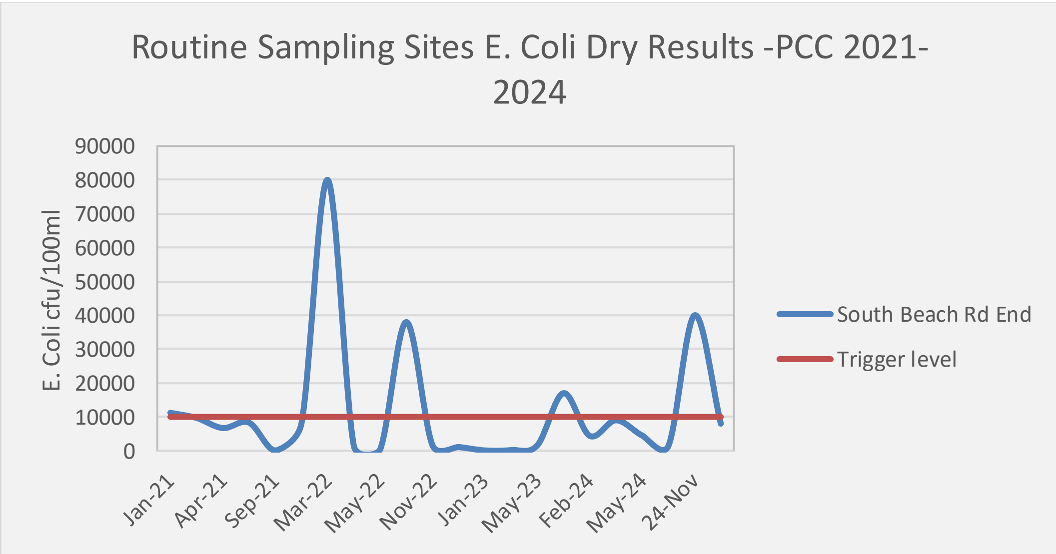
- Closed circuit television (CCTV) where a robot mounted camera is physically inserted into a pipeline through a manhole access chamber and the video feed is viewed by an operator who controls the camera speed and viewing angle and recorded for future viewing and analysis.
- Smoke testing - this technique is generally used to show a direct cross connection between stormwater and wastewater, and may also show a significant fault, particularly for shallow pipelines.
- Dye testing – the insertion of non-toxic dye is used to visually verify connectivity between a wastewater source and the stormwater network or a watercourse. This is an effective technique, however, is labour intensive and generally used as a final verification method.
- Visual indicator checking – a suitably experienced inspector can often identify significant faults from inspection of the visible plumbing and drainage connections. In some cases a visual indicator, such as wire netting, may be

[8] Para 334, M OÇallaghan s42A Hearing Stream Objectives report

inserted into a stormwater manhole to identify toilet paper as an indicator of wastewater contamination.

- Water sampling – as noted above, water quality sampling for *E. coli* or faecal coliform indicator microorganisms is regularly used to indicate whether wastewater contamination is present. The main limitation of this method is that samples are only a grab sample at a point in time, and contamination will come through in flushes correlating to the faecal contaminant source.

10.6 The efficacy of these investigations can be limited due to resource and methodology constraints. Even when significant work has been undertaken, water quality monitoring results can vary significantly over time. In general, Wellington Water's practise has been to filter results from wet weather for assessment of effectiveness of resolving cross connections and significant leaks or seepage, which in my opinion is appropriate for those investigations however does set aside the issue of wet weather overflows and contamination that would contribute to the 95%ile measurements. Examples of water quality monitoring (in dry conditions) before and after work is included below as **Figure 5**. In the case of the South Beach results, the first spike was resolved when a cross connection was found and the following spikes were related to blockage discharges which were located. I understand wet weather results at that site remain high and would require larger scale network renewals and upgrades.



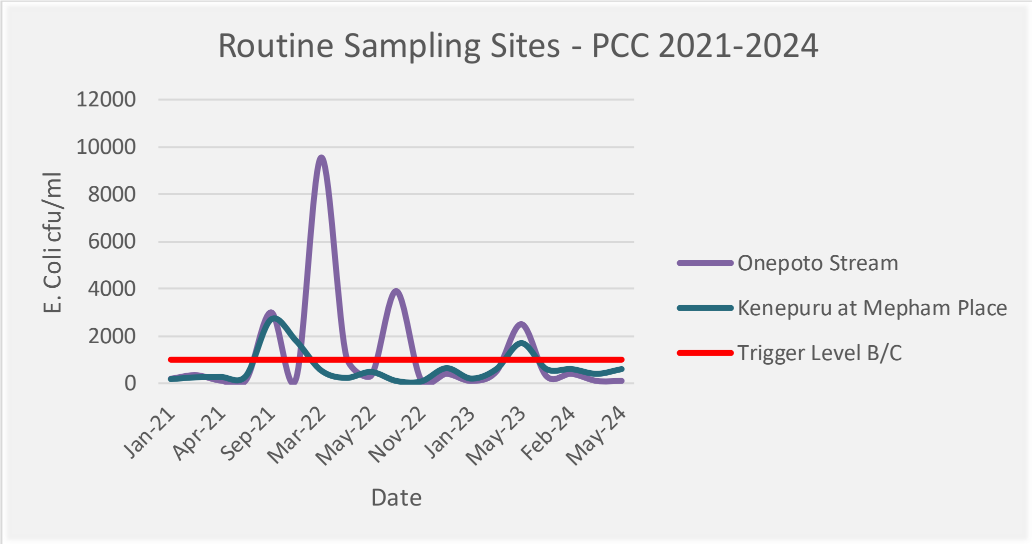


Figure 5: Water quality sampling results from Porirua catchments
Investigation and fault finding work in several dry weather wastewater

10.7 Pressure testing, such is undertaken when new drains are constructed, has been used in the past in Hutt City, however in my experience is expensive and the correlation of faults to environmental impacts is very hard to prove. One of the challenges in managing faults is that the burden of proof from fault to causation needs to be sufficiently high to warrant expensive repair or renewals.

Cross connections from wastewater to stormwater networks

10.8 Cross connections are a significant issue for stormwater contamination and the *E.coli* target attribute state. These are generally created when there has been a plumbing mistake that has not been detected by self-inspection by the plumber. Typically Wellington Water and Council building inspectors will not inspect or independently test new connections within the property boundary.

10.9 Wellington Water investigations occasionally detect these cross connections from public reports of pollution and water quality investigations. Some of these connections found may have been present for years, and are elusive because of the intermittent contaminant loading that grab sample tests of water quality can very easily miss detecting. Records or reporting on the cross connections found is not historically held, however data since the establishment of the Wellington Water Drainage Investigation Team is summarised in **Table 1** below, including other faults identified. This shows about a dozen cross connections have been located each year. The majority of these are from relatively new properties which have had a plumbing mistake made, although some have been present for over 10 years and have taken a long time to locate due to the intermittent nature of the contamination[9]. The process to locate and find these cross connections can be long and

[9] https://www.stuff.co.nz/national/118627305/wastewater-spilling-into-harbour-for-at-least-a-decade

challenging, and requires significant effort to investigate and locate. Note that the data in Table 1 will be biased towards areas with higher levels of faults as the investigations are targeted at the higher areas of water quality pollution, so should not be taken as representative of the respective cities.

Table 1 Summary of faults located by Wellington Water Drainage Investigation Team between January 2021 and February 2025

	WCC	HCC	UHCC	PCC
Houses inspected	1166	973	17	978
House found with major fault	103	46	1	117
House found with minor and moderate fault	445	282	8	215
Cross connection found sewer to stormwater	17	12	2	20
Cross connection found stormwater to sewer	0	2	0	1

Condition of wastewater network

10.10 The condition of the wastewater network is closely related to the degree of contamination likely from wet weather overflows and/or seepage contamination into stormwater. Poor condition pipes will have more faults, such as displaced joints, cracks, holes or other faults which will compromise the ability of the pipe to fully contain the wastewater it is conveying, and will also present faults which allow the ingress or infiltration of groundwater or stormwater that contribute to the probability of wastewater overflow in wet weather conditions. Therefore poor condition pipes will present a pathway for wastewater to directly escape the pipe into the environment and/or a contribution to wastewater contamination from overflows.

10.11 Wellington Water uses the industry standard publication "New Zealand Gravity Pipeline Inspection Manual, Edition 4" for condition grading. Some of the grading is extrapolated from the physical inspections, which is reflected in the confidence grade assigned.

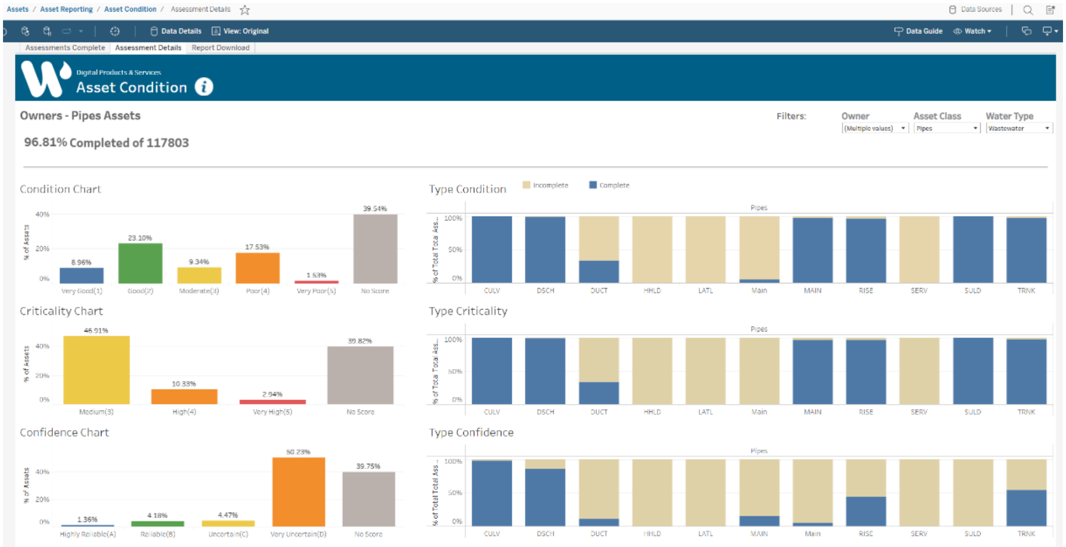


Figure 6: Condition grades of wastewater pipes in the Wellington region wastewater network

10.12 From the dashboard presented in **Figure 6** it can be seen that there is a significant (40%) portion of the assets which do not have a condition grade currently assigned. Assuming the ungraded pipes have a similar condition profile to the graded pipes, then of the 2,658,000 metres of public wastewater network there will be about 810,000 metres in poor (Grade 4) or very poor (Grade 5) condition, about 400,000 metres in moderate (Grade 3) condition and about 1,360,000 metres in good (Grade 2) or very good (Grade 1) condition.

10.13 Unit rates to replace pipe are quite variable depending on ground conditions, accessibility, traffic management requirements, size and other factors including market pricing at the time. A range of contract values have been provided by WWL to GWRC advisers for their economic analysis and they estimated the likely costs in evidence from Mr David Walker. The time required to implement large scale renewals would be significant, noting that the current rate of renewal is quite low, so resources to implement large scale renewals would need to be established, in addition to the funding.

10.14 The key issue in meeting future target attribute states would be the correlation of structural condition grade. The condition grading is focussed on structural condition, which reflects the probability of the pipe with regard to collapse, rather than a water-tightness grading. For example, some of the older earthenware pipes had mortar joints which are well known to become ineffective at holding a watertight seal with age. While the grading may reflect the overall profile there is insufficient data to understand the direct correlation and would assume that at least the poor and very poor condition pipes would require replacement to fully contain wastewater, and likely the moderate condition pipes would also require replacement or extensive repairs.

Impact of blockages

10.15 I noted above that there are several hundred blockages across the Wellington wastewater network each year. In terms of impact on target attribute states these are generally located and resolved relatively quickly. From time to time there will be some blockages which are not visible to the public or our own monitoring instruments and the routine water quality monitoring is important to identify those potential blockages and undertake investigations to locate and fix.

Pilot scale testing to confirm extent of works

10.16 The scale of the work anticipated to meet the proposed standards would warrant pilot scale testing as part of the investigations to efficiently meet the standards. At this stage Wellington Water and to the best of my knowledge other Councils in New Zealand have not undertaken works to achieve the scale of change from current performance to the proposed standards.

10.17 Pilot scale testing would normally be recommended to achieve a better understanding prior to full scale implementation, given the high uncertainties involved and the duty on the public network operator to use public money prudently. The tight timescales proposed would make this challenging and likely lead to inefficiency as lessons will be learnt during implementation. The current and likely future funding cycles also have significant lead times.

Wet weather overflow reduction

10.18 PC1 requires that the frequency of wet weather overflow events are progressively reduced to meet or exceed the containment standard of no more than 2 per year (Policy WH.P19 and P.P18).[10] I acknowledge that matter will be considered further in Hearing Stream 4 however the contribution of these wet weather overflows is material to the wastewater loads affecting the 95%ile *E.coli* in particular.

10.19 Achieving this would require major changes to the condition and capacity of the public and/or private networks. In general, the interventions that have been scoped in recent technical studies have relied on a combination of peak flow storage, increased capacity at critical locations in the network and increased capacity at treatment plants and their respective outfalls. Reducing overflows through elimination of inflow & infiltration has had varying but generally limited success in my experience.

10.20 As an example, Wellington Water completed a study in 2019[11] to quantify the works required to reduce wet weather overflows in the Porirua wastewater network to a more acceptable level and also take account of the significant growth forecast at the time to the year 2057. The methodology for the study was based around a similar containment standard to the proposed Plan Change 1, namely 2 overflows a year at constructed overflow locations, however set a higher standard of 1 overflow a year at surcharging manholes, what we refer to as uncontrolled overflow points. A specialised modelling software "Optimizer" was used to link a hydraulic model and cost data to identify the least cost option for network solutions. In this case the preferred master plan strategy identified:

a Fiver storage locations across the city, gravity sewer, pump station and rising main pipe upgrades, I&I reduction work in one suburb and an upgrade to the wastewater treatment plant capacity to 1,500L/s,

b A prioritised work programme based on reducing volume and frequency of wet weather overflows,

c A high level cost estimate of $477M, in 2019 cost basis.

10.21 Separate cost estimates were undertaken for the catchment assuming no change to current population, which calculated that 60% of the preferred master plan would be required to improve the network for the target level of service alone, the marginal 40% being required to cater for projected population growth.

10.22 In terms of cost estimate, it should be noted that several of the projects identified in the Network Improvement Plan have since been commenced and costs have been approximately double than were estimated in the study. In particular, the City Centre storage tank for 7 million litres of off-line storage now has a budget of $97M, when the 2019 estimate was for $47.2M. Some of that was due to increased structural design requirements, and for relatively substantial pipework requirements to suit the available site. Market conditions and inflation were also higher than in 2019.

10.23 In terms of time required to deliver these works, I note that those large infrastructure projects generally have a project lifecycle of five to seven years. For example, the City Centre storage tank investigation work commenced in 2019, with optioneering and concept design in 2020, consenting and detailed design completed in 2022, construction commencing in early 2023 and commissioning planned for mid 2026. Delivery of large programmes of such projects would require similar time frames for each project, potentially longer if land acquisition was complicated, making the proposed 2040 target very challenging from deliverability perspective, funding notwithstanding.

10.24 A similar study was completed in 2024 for the Hutt Valley wastewater network. For that particular study, a 2070 population projection was used. Several containment standards were considered, and climate change projections were also taken into account. The Optimizer software was not used, with the options for the different containment standards developed by engineering judgement, and assuming relatively minimal inflow and infiltration effectiveness, based on the authors experience and judgement. Figure 7 below shows the relative cost increases for the higher containment standards, with the proposed Plan Change 1 standard estimated at a capital cost of $980M. No analysis was done for the cost without population growth, however noting the longer time scale and the nature of some significant network pipeline upgrades required I would expect the proportion to be less than the 60% calculated for Porirua. The 18km outfall pipeline from Seaview was not included in this cost estimate as that was treated as a renewal cost, however there may be consenting drivers to replace that pipeline due to its limited capacity and it has a standalone cost estimate of $678M prepared in 2022 based on the preferred harbour alignment. No allowance for treatment plant renewal or upgrading was included in the above study, with the exception of storage allowance at Seaview based on existing outfall capacity.

10.25 A more comprehensive but high level approach was taken for a strategic study of the Karori wastewater catchment in 2022[12]. A 30 year time horizon was used, and a combination of information sources was compiled. In the case of Karori, a total cost of $275M was estimated. This estimate included a significant cost for replacement of the ageing outfall, in addition to treatment and also an allowance for improvements for dry weather contamination. From the table below it can be seen that $95M of the cost has been ascribed to "level of service" investment for wet weather overflow reduction, although the outfall replacement is arguably a level of service improvement as it was assumed that a larger outfall pipe would be required to avoid intermittent treated wastewater discharge to the Karori Stream in wet weather flow conditions. The connected wastewater population of Karori is approximately 13,000 at present.

Table 2: Cost estimates for improvements to wastewater system issues for Wainuiomata

Table 0-2: Cost allocation of PBC projects

Project	Level 0 Estimate	Renewals		LoS		Growth	
Wet weather network improvements	$66M	$66M	100%	-	-	-	-
Dry weather network improvements	$28M	$21M	75%	$7M	25%	-	-
Network storage	$96M	-	-	$73M	76%	$23M	24%
WWTP treatment upgrade	$20M	-	-	$15M	76%	$5M	24%
Outfall replacement	$65M	$50M	76%	-	-	$15M	24%
Total	**$275M**	**$137M**	**50%**	**$95M**	**35%**	**$43M**	**15%**

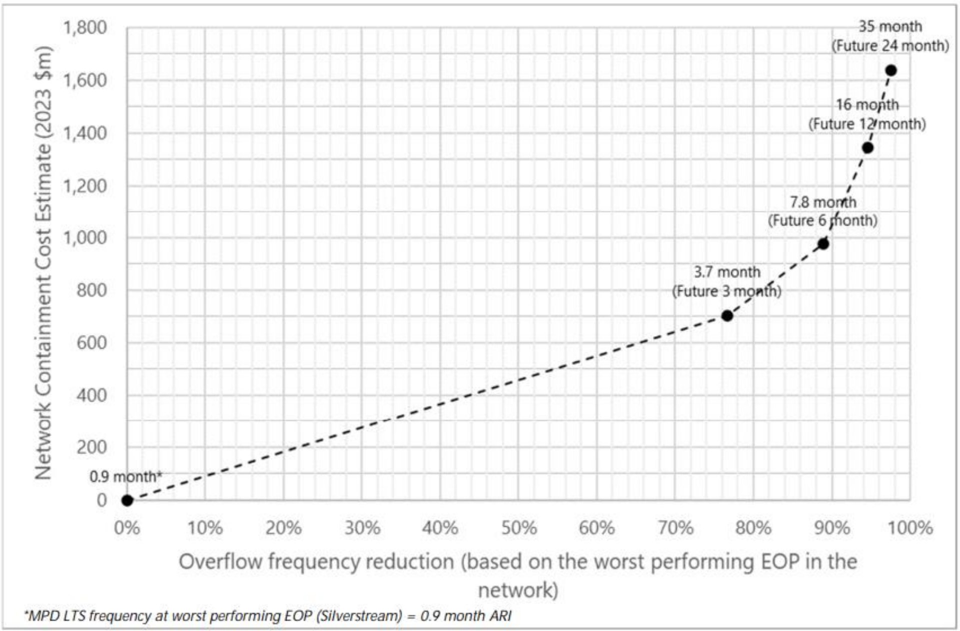


Figure 7: Cost curve for improvements to wet weather overflow containment standards for Hutt Valley

10.26 The Moa Point catchment had a similar study prepared in 2023[13]. That study identified thirty projects to improve capacity for growth and to meet the 6 month overflow containment standard at constructed locations, and 1 year standard at uncontrolled discharge locations. The time horizon adopted was to 2048, and no allowance for climate change was included. No upgrades to the treatment plant were assessed and no assessment was made for the existing population alone.

10.27 Overall, the assessed wastewater network upgrades for reducing wet weather overflow have generally been made as part of an assessment for growth capacity upgrades, so the direct costs are difficult to assess. A total of $2.3 billion of investment in wastewater upgrades have been identified, of which approximately half is likely to be directly related to improvements in capacity for the proposed wet weather overflow containment standards. Refer **Table 3** for a summary of the work.

Table 3: Cost estimates for improvements to wastewater system issues for Wellington wastewater catchments

Catchment	Current population	Future population (year)	Total upgrades assessed ($M)	Upgrades for wet weather containment only ($M)
Porirua	92,000	121,500	477M	273M
Hutt Valley	160,000	220,000	980M	NA
Karori	13,000	16,000	275M	88M
Moa Point	163,600	217,900	629M	NA
Total	**429,100**	**575,400**	**2,284M**	**NA**

11 Changes to the public network to achieve reductions in *E. coli*

11.1 A number of PC1 provisions for wastewater discharges refer to making commensurate reductions of *E. coli* or enterococci (rules WH.R14 and P.R13, and Schedule 32). While these provisions are not directly included in Hearing Stream 2, I understand that they are part of the regulatory framework that is intended to ensure that the *E. coli* TAS and CWO targets are met, and I note the changes proposed to these in evidence from Ms O'Çallaghan, Mr Walker and Dr Greer.

11.2 Table 9.2 in PC1 provides four different statistics in relation to the TAS for *E.coli*. These are:

a Median;

b %>260/100mL;

c %>540/100mL; and

d 95th %ile.

11.3 *E. coli* is a microbiological water quality indicator in freshwater and coastal waters, used to provide an indication of the level of health risk to recreational users. Wellington Water has been monitoring *E. coli* levels and reporting on water quality in the Wellington region for some time.

11.4 Wellington Water's approach to sampling to check for faults in the wastewater network has been undertaken by our Drainage Investigation team in recent years. This includes an initial response to water quality results that exceed the current thresholds using "sanitary surveys", where crews open manholes upstream of the high water quality sample, undertake visual observations, further water quality sampling and zero in on the likely fault. CCTV and smoke and dye testing may also be used, based on the investigation crews assessment of the likely fault. In some regards this work could be compared to looking for needles in haystack, due to the limitations of investigation tools noted above.

11.5 Where the field investigations fail to reduce the levels of contaminants in water sampling to the required levels then the cases are considered to be more widespread and wider capital projects are expected to resolve the issues. They then refer the investigation to the Network Engineering team, who undertake further investigation, generally commissioning further CCTV and identifying mains that are in poor condition. This work is reliant on renewal funding, and generally proceeds at a much slower pace.

11.6 In 2017, Wellington Water commissioned a water quality assessment looking at *E.coli* levels in the Wellington Region, using data from 71 routine monitoring sites that had been established as a surveillance network for wastewater contamination. Table 4 below sets out the findings from that report in relation to *E.coli* statistic %>540/100mL by City Council area and between all weather conditions and dry weather only, when wet weather overflows were not expected to be influencing results.

Table 4: Percentage of sites exceeding the 540/100mL NPS-FM criteria.

Freshwater Sites	Excellent	Good	Fair	Intermittent	Poor	**Swimmable**
Porirua City combined wet and dry	-	-	-	17.0%	83.0%	**0%**
Porirua City dry weather	-	8.3%	8.3%	8.3%	75.0%	**16.6%**
Hutt City combined wet and dry	-	9.1%	9.1%	18.2%	59.1%	**18.2%**
Hutt City dry weather	8.7%	4.3%	30.4%	4.3%	52.2%	**43.4%**
Upper Hutt City combined wet and dry	10.0%	-	20.0%	20.0%	50.0%	**30%**
Upper Hutt City dry weather	30.0%	10.0%	20.0%	-	40.0%	**60%**
Wellington City combined wet and dry	-	-	18.5%	14.8%	66.7%	**18.5%**
Wellington City dry weather	-	7.4%	18.5%	11.1%	63.0%	**25.9%**

11.7 The 540 cfu/100mL was chosen as being the more representative of the four NPS-FM criteria for dry weather water quality, so was used in the 2017 report to illustrate the scale of the issue for the Wellington urban streams. When combining the 71 monitoring sites for the four cities 82% of sites were grade D or E for the 540 cfu/100mL criteria, 89% of sites were D or E for the 260 cfu/100mL criteria, 82% D or E for median and 96% D or E for the 95 percentile criteria.

11.8 The challenge in improving urban streams to meet the NPS-FM criteria is not well understood. The existing streams in the Wellington Water monitoring sites which meet it are largely reserve sites with a small wastewater network (Korokoro Stream, Speedy's Stream and the stream through Heretaunga Park).

11.9 The Wellington Water monitoring locations for *E.coli* were further developed for the Global Stormwater consent and have been in some different locations since 2020, however a review of the 2022-23 Annual Stormwater Monitoring report shows a consistent trend, with only one of the 46 freshwater monitoring sites being better than grade E, that site being upstream of urban areas at the Te Marua site in the Hutt River so effectively a rural location.

11.10 Wellington Water sampling and reactive works have been focussed on avoiding levels of contamination much higher than the proposed Target Attribute States and it is not clear to us whether these states are achievable in an urban setting, let alone whether the source of the *E.coli* is solely or even predominantly from leaking public wastewater infrastructure.

11.11 The wet weather overflows described in the previous section are the most likely contributor to the 95%ile measure. Seepages and/or cross connections are the most likely impact on the median and other measures. As noted above blockages are mostly resolved quickly, however some will be contributing.

11.12 In general, previous monitoring has shown that the water quality in a stream returns to background levels within 2-3 days after a wet weather overflow, noting that other contamination from the urban area is present. From this observation, it is possible that meeting the containment standard of no more than 2 overflows per year may not directly translate to meeting the 95%ile *E.coli* levels (on the basis of 3 days, twice a year for the 3 days being less than 2% of a year.

11.13 I expect the focus on achieving *E.coli* target attribute states for the median and percentage criteria would rely heavily on investigations of point sources such as cross connections, fixing faults on manholes and pipelines and renewal of poor condition pipes both on public and private networks. I expect the focus on achieving the *E.coli* target attribute states for the 95%ile criteria would rely heavily on work to reduce wet weather overflows. As noted above I do not have sufficient understanding of the extent and cost of intervention requirements to meet the proposed standards at this stage.

12 Outline of possible work over the next 10 years

12.1 As a council-controlled organisation, Wellington Water is funded by its client councils. Councils' Long Term Plan ('**LTP**') processes determine the funding or investment for water infrastructure and network improvements.

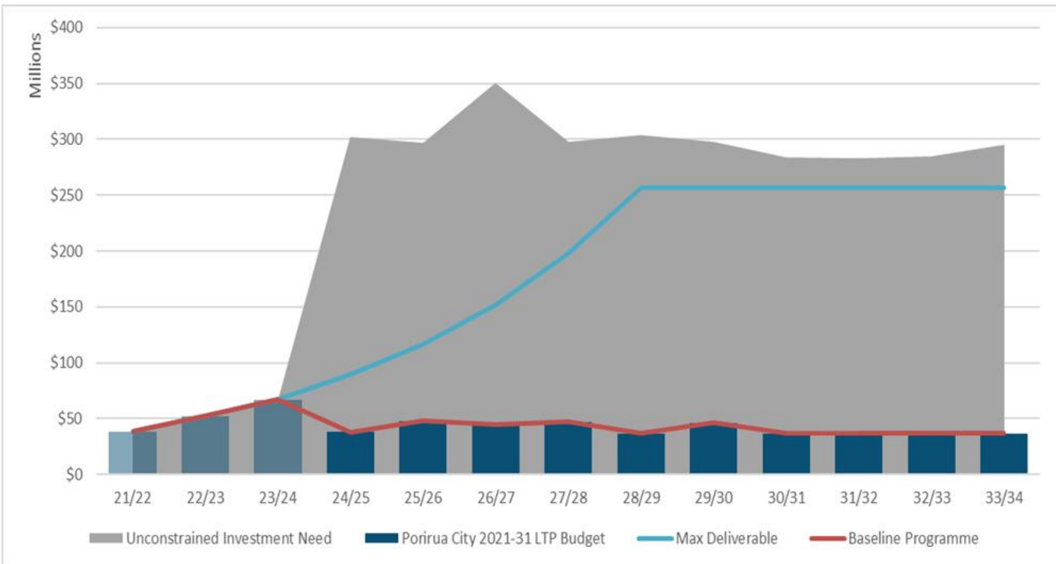


Figure 8: Unconstrained investment example for Porirua City Council 2024-2034

12.2 Wellington Water presented the unconstrained view of investment to our client councils as part of the recent 2024-2034 Long Term Plan deliberations, as seen in the example in **Figure 8**. The constraints of what could reasonably be expected to be resourced and delivered was then overlaid, and the previous approved Long Term Plan investment profile was also shown. This illustrates the scale of the anticipated 3 waters investment. Notably, the assumed target for meeting water quality improvements was 2060, so the full impact of the 2040 date is not reflected in the unconstrained investment estimate. Councils then assessed the funding availability and other competing priorities and proposed, consulted and adopted Long Term Plans accordingly. Of the total $7.6B that WWL recommended, Councils committed to $3.6B of funding. $268M of this was directly related to Improving Environmental Water Quality for wastewater, with renewal funding separate. As Mr Walker notes in his evidence much of this is related to work which will not directly contribute to improving the target attribute states, such as renewal of pump station and treatment plant equipment. The funding also includes growth funding, which again will not directly contribute to *E.coli* improvements.

12.3 However, with the funding committed in this LTP cycle 2024-2034, Wellington Water could feasibly carry out the following:

a Construction of the City Centre wastewater storage tank (7 ML);

b Renewal of some wastewater mains in most critical areas, which are generally focussed on probability of catastrophic failure rather than *E.coli* measurement;

c Continuation of Drainage Investigation work and reactive fault fixing to meet current standards.

d Various projects in sub-catchments to reduce wastewater contamination, not defined at this stage.

13 Work required to meet the TAS and CWO

13.1 As noted above, the scale of the work required by Wellington Water to meet the TAS and CWO is not well understood at this stage. It would clearly require a major uplift in resourcing, monitoring and focus, however I could not quantify that based on current information.

13.2 The Drainage Investigation type of work has been reasonably successful in making progress identifying point sources of contamination in public and private networks. This would need to be scaled up.

13.3 A major uplift of renewals would also need to be undertaken. In recent years the rate of renewals in Wellington has been below asset replacement lives and is not currently funded or resourced to increase markedly, so there would be a real risk that more problems would be identified through investigation work than could be fixed.

13.4 The third and probably largest area of work that would be required would be the improvement in containment standard for wet weather overflows to contribute to meeting the 95%ile E. coli standard and also CWO 95%ile. There would be some benefit from renewal work to meet *E. coli* TAS, however major infrastructure works such a large storage tanks and conveyance pump and pipeline upgrades would still be required. Again, that would require major uplift in resourcing beyond currently funded.

Stephen John Hutchison
14 March 2025