Cockburn/Colombo

Wastewater Overflow Review

Masterton District Council

12 June 2024

→ **The Power of Commitment**

Project name	Cockburn/Colombo Road Overflow Review						
Document title	Cockburn/Colombo | Wastewater Overflow Review						
Project number	12629672						
File name	12629672_REP Cockburn-Colombo WW Overflows DRAFT 25032024.docx						
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S3	0.1	B Challis	M Kneebone		M Kneebone		
S4	1.0	B Challis	M Kneebone		A Patterson-Horner		25/03/24
S4	1.1	B Challis	M Kneebone		A Patterson-Horner		12/06/24

GHD Limited
Contact: Brittany Challis, Senior Engineer | GHD
Grant Thornton House, Level 1, 215 Lambton Quay
Wellington, Wellington 6011, New Zealand
T +64 4 495 5800 | **F** +64 4 472 0833 | **E** wgtnmail@ghd.com | **ghd.com**

Executive Summary

The problem

The low-lying areas of south Cockburn Street and the west end of Colombo Road have experienced wastewater overflows during extreme wet weather (see Figure 1). This has directly impacted several residential properties, with raw sewage backing up onto the property and the residents being unable to use their toilets, showers or kitchens.

Figure 1 Cockburn/Colombo area of concern for wastewater overflows

Uncontrolled wastewater overflows are usually indicative of catchment-wide issues with both the wastewater and stormwater networks. In the case of the Cockburn Catchment, inflow and infiltration has been identified as a key source of water causing the uncontrolled wastewater overflows, due to the following risk factors:

- Typical stormwater solution is on-site soakage, with no public stormwater connection available
- High levels of infill development, increasing stormwater runoff
- Existing open channels are not actively managed or maintained, and are underutilised for stormwater drainage
- Roads have not been formally designated as overland flow paths
- High groundwater levels, above the level of the wastewater network
- Private wastewater laterals are commonly earthenware, which is susceptible to infiltration
- Rapid flood hazard assessment indicates deep stormwater ponding (up to ~0.5 m) for some properties

- On-site ponding is likely to lead to direct inflows into the wastewater system, including from poor behavioural practices such as diverting downpipes into gully traps because there is no stormwater disposal system available.

The other potential key source of water is from limitations in network capacity. Masterton District Council (MDC) does not have a hydraulic model of the wastewater network and there is no real-time monitoring, so it is not possible to confirm whether there is sufficient capacity in the existing network.

The solution

To date, MDC's responses to address wastewater overflows in the Cockburn/Colombo area can be summarised as follows:

Immediate: Deployment of portaloos.

Short-term: Installation of 21 reflux valves and 13 tanks on private properties.

Long-term: Replacement of the Cockburn Street main sewer in 2007.

Major network-wide project around this time to reduce inflow and infiltration through pipe relining or replacement, joint repairs, CCTV inspections and source detection inspections on private properties.

MDC has an ongoing wastewater network renewal programme.

GHD has identified three focus areas to address the problem of wastewater overflows:

Focus Area 1 – Addressing the source of water

- Investigations to understand the source of water causing the wastewater overflows – inflows, infiltration and surcharge from other parts of the network.

Focus Area 2 – Addressing the capacity/connectivity of the wastewater and stormwater networks

- Development of hydraulic models to understand how the existing stormwater and wastewater networks operate.
- Improved coordination between MDC 3 Waters, Building and Transportation teams in terms of renewals, coordinated network improvements and use of roads as secondary flow paths, including defining specific levels of service.

Focus Area 3 – Developing stormwater Catchment Management Plans

- Development of Catchment Management Plans to address stormwater quality and quantity, asset management, monitoring and compliance to meet the conditions of the recently granted Global Stormwater Discharge Consent.
- Development of policies and strategies for managing stormwater in each subcatchment, including ownership of open channels and planning for growth.

Cockburn pilot scheme

The issues and pathway forward will take significant effort, time and budget to achieve. GHD recommends using the Cockburn catchment as a pilot scheme to focus on implementing investigations and to test any new policies and strategies. Choosing a smaller focus area means that options can be implemented and assessed before being rolled out to a wider area, meaning that budgets can be staged over time and assumptions robustly challenged. Experiences in the Cockburn catchment can also be used to inform engagement with the wider community.

The recommended activities for the Cockburn pilot scheme are outlined in Table 1 below.

Table 1 Recommended activities for the Cockburn pilot scheme

Activity	Description
Strategy on accessing private property	High level strategy on: When, who and how Communications with property residents What will council do with the results etc?
Private property inspections	Undertake property inspections to identify sources of water. Includes: – Tracking downpipe connections – Checking compliance of gully traps and surrounds Requires logistics associated with entry onto private property (under Building Act or Local Government Act), identification of non-compliances, follow up actions, further inspections and enforcement.
Management of open channels	Explore use of the open channel between Cockburn and Kuripuni as the backbone of the stormwater network in this area. Identify ownership, maintenance requirements (who/when/how), legal opinion for waterway as a Public Drain, leading to options for use as stormwater disposal for private properties.
Development of a stormwater bylaw	Currently MDC does not have a stormwater bylaw. Development of a stormwater bylaw to address items above.
Provision of a stormwater network	Construct kerb outlets in Cockburn Street to offer residents a stormwater connection to their boundary. Residents can then connect their downpipes (roof runoff) into the public stormwater system.
Network monitoring	Targeted flow monitoring of the Cockburn catchment, focussed on the downstream trunk main, to understand design flows vs actual flows.
Asset data collection	Manhole surveys to confirm pipe sizes and invert levels in local catchment and of MDC wastewater trunk mains
Wastewater hydraulic model	Using network monitoring and asset data above, develop a hydraulic model of the trunk wastewater network to understand downstream capacity limitations (wet weather and dry conditions). Consider future integration with a stormwater model.
Stormwater hydraulic model	Develop a hydraulic model of the stormwater network in the Cockburn catchment, including overland flow paths.

Contents

Table index

Figure index

Appendices

1. Introduction

The low-lying areas of south Cockburn Street and the west end of Colombo Road have experienced wastewater overflows during extreme wet weather events. This has impacted on a number of residential properties, with raw sewage backing up onto the property and the residents being unable to use their toilets, showers or kitchens. Masterton District Council (MDC) has engaged GHD to provide a holistic review of the long-time wastewater network issue(s) causing these wastewater overflows.

1.1 Purpose of this report

The purpose of this report is to summarise the findings from the initial data assessment, site visit and discussions with MDC staff. This report also makes recommendations on possible next steps for MDC to continue addressing this problem.

1.2 Scope of work

The scope of work is as outlined in GHD's offer of service dated 15 November 2023 and includes the following activities:

– Requesting and reviewing relevant data
– High level catchment analysis of Cockburn Street wastewater catchment
– Spatial mapping using GIS software
– Rapid flood hazard assessment
– Site visit and workshop with key stakeholders
– Review of historic wastewater overflow responses
– This summary report.

A workshop to present to the MDC elected members is also included in the scope and will be held following submission of this report.

The causes of wastewater overflows are often network-scale issues. This report is specifically focussed on the wastewater overflows at the 21 properties identified on Cockburn Street and Colombo Road, and the Cockburn Street wastewater catchment (Cockburn catchment) as shown in Figure 2.

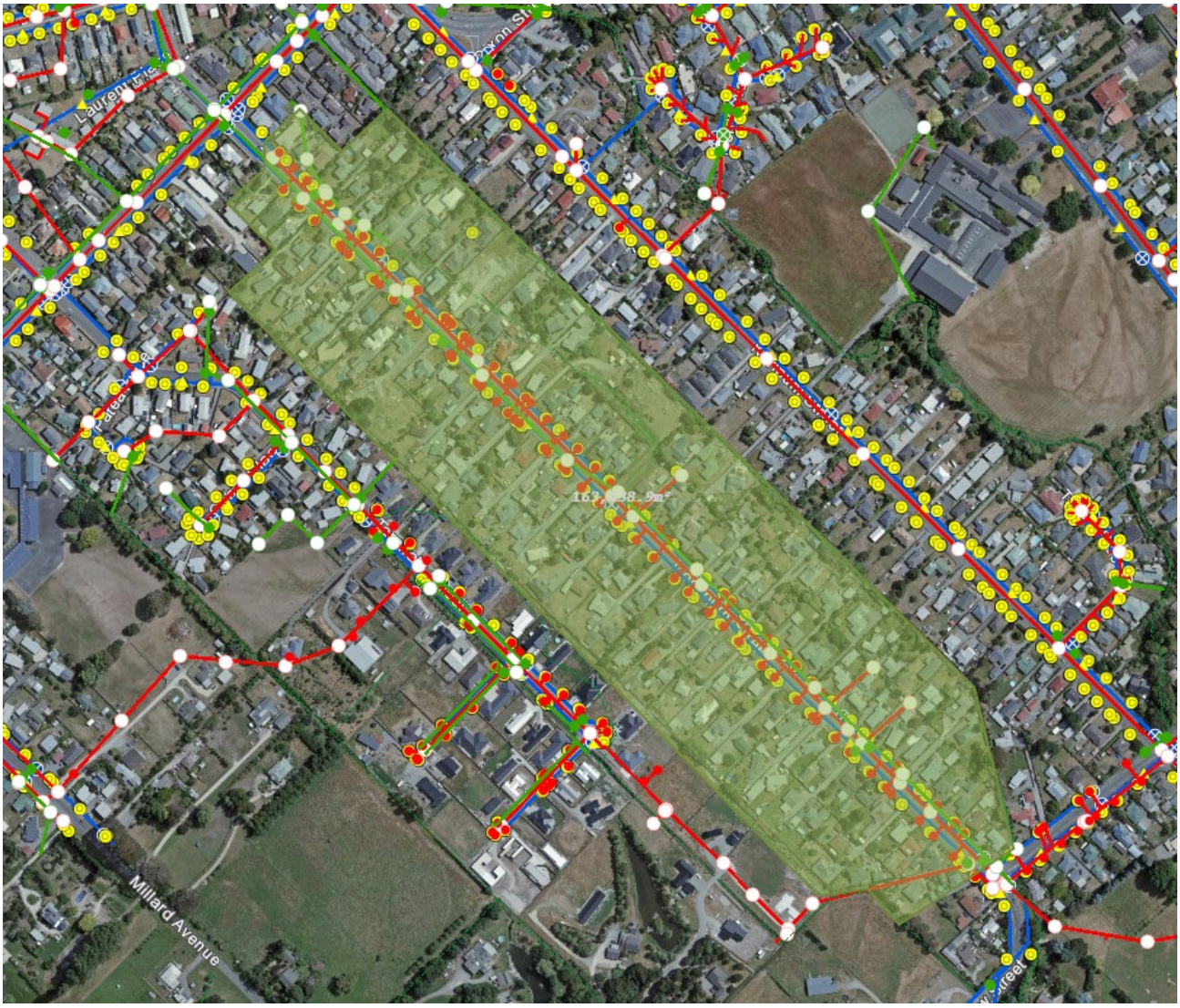


Figure 2 Cockburn Street wastewater catchment

1.3 Limitations

This report: has been prepared by GHD for Masterton District Council and may only be used and relied on by Masterton District Council for the purpose agreed between GHD and Masterton District Council as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Masterton District Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared the high level preliminary cost estimates set out in section 5 of this report ("Cost Estimate") using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD.

The Cost Estimate has been prepared for the purpose of comparison only and must not be used for any other purpose.

The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the [works/project] can or will be undertaken at a cost which is the same or less than the Cost Estimate.

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

GHD has prepared this report on the basis of information provided by Masterton District Council and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

2. Problem definition

This project has been kicked off due to the following issue:

Raw sewage backs up and overflows onto private properties on Cockburn Street and Colombo Road. When this happens residents are unable to use their showers, toilets or kitchens.

The sewage entering people's houses is a symptom of a much wider problem. Uncontrolled wastewater overflows are usually indicative of catchment-wide issues with both the wastewater and stormwater networks. Although seemingly unrelated to stormwater, wastewater overflows are often caused by rainfall runoff being inadequately managed, leading to entry of stormwater into the wastewater network.

Although not a major focus of this report, wastewater overflows in private properties are also an indication that there may be uncontrolled overflows happening elsewhere in the network which could be entering freshwater and have significant negative ecological effects.

2.1 Source of water

When the capacity of a pipe network is exceeded, the water will overflow at the lowest point, in this case, the houses on Cockburn Street and Colombo Road. To investigate wastewater overflows, it is important to understand the source of water. In essence, the capacity of the network is exceeded either because the pipes are too small for the design flows, or because the actual flows are much higher than the design flows.

There are four high level options for the source of water:

1. Blockage in the downstream wastewater network
2. Pipe flows are too high because of wastewater – i.e. too many houses connected along Cockburn St
3. Pipe flows are too high because of stormwater inflow and groundwater infiltration into the Cockburn wastewater network
4. Major limitations in the capacity of the downstream wastewater network

These are discussed in more detail below.

2.1.1 Pipe blockage

The Cockburn/Colombo wastewater overflows have been a recurring long-term problem during extreme wet weather events. They are unlikely to be due to a pipe blockage, as this would present as an acute problem, causing continuous overflows until the blockage is fixed.

A pipe blockage is therefore not considered to be the main cause of these wastewater overflows.

2.1.2 Excess wastewater flows

GHD has undertaken a high-level catchment analysis of the flows in the Cockburn catchment defined in Figure 2. We have calculated design flows based on the existing number of houses (Table 2). There is some uncertainty on whether the Cockburn St pipe is 150 mm diameter or 225 mm diameter, for the purposes of assessing capacity we have taken a conservative approach and assumed the smaller size.

Table 2 Catchment analysis for existing Cockburn catchment

Existing development flows		Assumptions
Number of dwellings	143	2017 aerial imagery
ADWF loading (L/p/d)	250	
People/dwelling (Kuripuni)	2.5	
Wet weather peaking factor (SWI)	5	
Average dry weather flow (ADWF)	1.0 l/s	
Peak dry weather flow (PDWF)	2.6 l/s	
Peak wet weather flow (PWWF)	**5.2 l/s**	Assumed SWI of 5
Pipe size	150 mm	Nominal diameter, assumed
Pipe material	PVC	Based on Beca report
Pipe grade	0.62%	Pipe grade provided by MDC
Pipe flow capacity	**12.1 l/s**	Assumed 80% flow depth to allow for airflow/odour management

This analysis shows that there should be sufficient capacity in the network for the design flows.

In addition, wastewater overflows have only been observed during and after extreme wet weather. This indicates that the problem is exacerbated due to rainfall runoff entering the network. If the pipe was too small for the wastewater flows (from sinks, showers, toilets etc), then you would expect to see overflows even without rain.

Excess wastewater flows are therefore not considered to be the main cause of these wastewater overflows.

It should be noted that the peak wet weather flow in the table above is a theoretical value. A common design assumption is that the peak wet weather flow is five times the average dry weather flow. This is referred to as a wet weather peaking factor of 5.

In reality, given the network is experiencing wet weather overflows, the peaking factor is likely to be significantly higher than this due to stormwater inflow and groundwater infiltration, which is described in more detail below. Anecdotally, this peaking factor has been measured to be up to 20 in Masterton.

Discussions with MDC have indicated that there is a piped connection from South Street to Cockburn Street at the northern end, which operates as an overflow when the South Road sewer is surcharging. This type of network interconnection is important to confirm as part of identifying the source of water.

2.1.3 Inflow and Infiltration

Inflow – stormwater that enters the wastewater network directly, eg from roof downpipe cross-connections, stormwater runoff into gully traps, cross-connections from sumps to wastewater pipe.

Infiltration – stormwater and groundwater that seeps into the wastewater network through cracked pipes, open joints or leaks in structures like manholes. Infiltration is significantly worse when the groundwater level is above the level of the pipe. In this scenario, cracked pipes can act like filter drains, slowly drawing down the groundwater until the level drops below the pipe.

Figure 3 shows some common sources of inflow and infiltration.

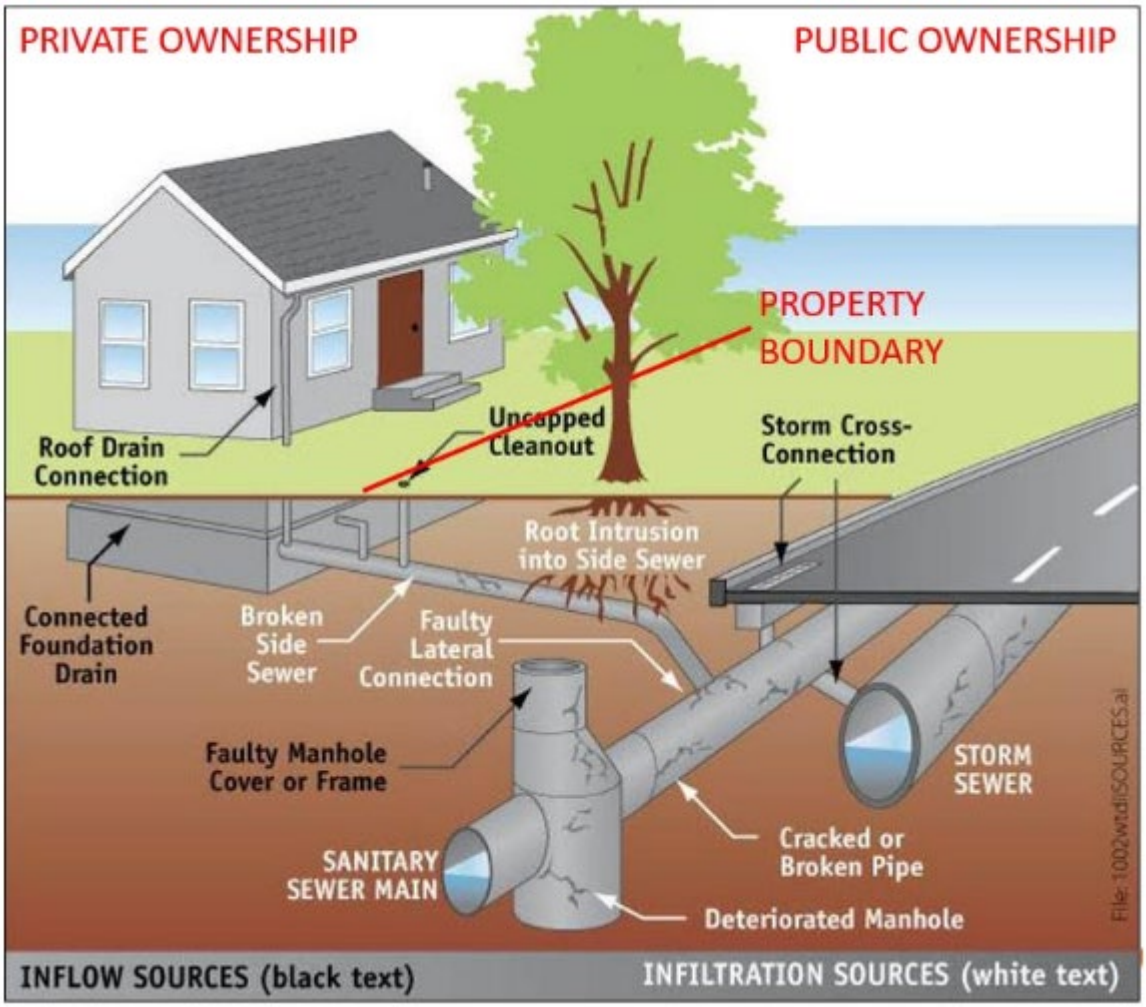


Figure 3 Sources of inflow and infiltration[1]

For the Cockburn catchment, the inflow and infiltration picture is as follows:

2.1.3.1 Infill development with no stormwater connections

Masterton does not typically provide a reticulated stormwater network for residential houses to connect to. The typical solution available to residents is for stormwater to be managed directly on their own site. This generally takes the form of on-site soak pits, where stormwater runoff from house roofs and paved areas is piped into a rock-filled hole and then water slowly soaks into the ground. This may have been appropriate when lots were larger, with more grassed areas for on-site soakage. Current housing trends and population growth are leading to more infill development, where the original lots are subdivided into two or more smaller lots.

A clear example of this is shown in Figure 4. This example is from Kuripuni Street, but the same type of infill development is happening on Cockburn Street.

[1] Beca (30 July 2021) *Inflow and Infiltration Management Strategy Report*, Prepared for Central Hawke's Bay District Council

Figure 4 Example of infill development on Kuripuni Street

From a stormwater point of view, this results in less area available for on-site mitigation, as well as an increase in roof and paved areas which in turn increases stormwater runoff. The increased number of dwellings also increases the wastewater flow.

Discussions with MDC have indicated that the stormwater solution for infill development is soak pits, as there are no alternative disposal options readily available.

2.1.3.2 Open channels/watercourses

Masterton has a large network of open channels which are noted as 'watercourses' on the Wairarapa Maps GIS. The open channels in the Cockburn/Colombo area can be seen in Figure 5. There are two stormwater channels shown between Cockburn Street and Kuripuni Street, however one of these appears to have been built over much of its length. Although it is clear from aerial photographs that the channel has been piped in large sections, this is not shown on the GIS which indicates that private property owners may have piped sections as part of development work

The ownership of these channels are in private property/private ownership, and therefore access for stormwater disposal is not available for a significant number of properties in the Cockburn catchment. Due to the private ownership, it is also unlikely that there is any formal, ongoing maintenance programme to clear the channel and to maintain flow capacity. Aerial photographs indicate that private development has encroached very close to or over the channels in many locations. Currently MDC has no rules in place to maintain overland flow paths that drain into open channels.

This open channel still provides an opportunity for the Cockburn St catchment as a means of stormwater disposal, as it could form the backbone of a stormwater network to service houses in this area. However, this would require MDC to ensure that maintenance is occurring and to provide protection of the channel from further development.

There are also opportunities for ecological and cultural benefits from active management of the watercourse which could be explored further by MDC.

Figure 5 Stormwater network and watercourses in and around the Cockburn catchment (Wairarapa Maps GIS)

2.1.3.3 Roads as overland flow paths

A common approach for dealing with property runoff in New Zealand is to build a primary system (to collect runoff from roof gutters, property yard sumps into a formal network of pipes to convey stormwater to the receiving environment) to manage runoff from small to medium storm events, often up to a 10% AEP event (1 in 10 year storm).

For larger events, the open waterways and roads are used as overland flow paths to form the secondary system. For stormwater that exceeds the capacity of the primary system, properties are typically designed to drain towards the road, which provides an open flow path to convey stormwater, minimising hazards and damage to property.

This is not currently the case for Cockburn Street. The primary system for property runoff is soak pits. The building code requires that soak pits are designed for a 10% AEP (1 in 10 year) storm, with a duration of 1 hour. Where storms are larger than this design storm, overflows could be piped to the road. In Cockburn Street very few kerb outlets are visible and properties at the southern end are significantly below the level of the road, so there is not the option for gravity drainage to the road. In addition, the roads have not been formally classified as overland flow paths.

2.1.3.4 High groundwater

Where groundwater levels are high, or the upper soil layers are saturated from rainfall or soak pits, high rates of infiltration into the wastewater network can occur. This can be into both private laterals and public mains. MDC has

indicated that private lateral connections constructed of earthenware pipes are still common, and these are extremely susceptible to infiltration through cracks and open joints – especially where on site soakage of stormwater occurs as the primary means of disposal.

Groundwater monitoring at three bores along Cockburn Street indicates that the groundwater table is 0.6 – 1.2 m below ground level. Wastewater pipes are typically laid with a minimum cover of 0.9 m, so this means that the groundwater level is likely to be higher than the pipes, enabling groundwater to flow into any cracks or open joints. This has also been confirmed by MDC staff working in the Cockburn area.

The wastewater pipe along Cockburn Street was replaced in 2007. However, the laterals were only replaced as far as the property boundaries, so there is still significant scope for infiltration through the private laterals.

MDC has an ongoing renewal and upgrade programme for wastewater assets, which includes both full replacement and pipe rehabilitation through relining. Pipe relining is a cheaper option than construction of a new pipe and can be a successful technique for increasing asset life and fixing watertightness issues to reduce infiltration. However it offers no opportunity to upsize pipes to provide capacity for future growth so needs to be considered alongside long term asset management planning.

2.1.3.5 Surface water ponding

GHD carried out a Rapid Flood Hazard assessment (Appendix A) which identifies surface water ponding up to approx. 0.5 m deep within private property along Cockburn Street. Figure 6 shows some of the locations of this deep ponding close to houses. It also indicates that the open channel between Cockburn Street and Kuripuni Street appears to be underutilised for stormwater conveyance, as limited water depth is shown in the model along the channel. Noting that the rapid flood hazard maps are only an indication as to where ponding is likely to occur, it was not derived from a detailed hydraulic model.

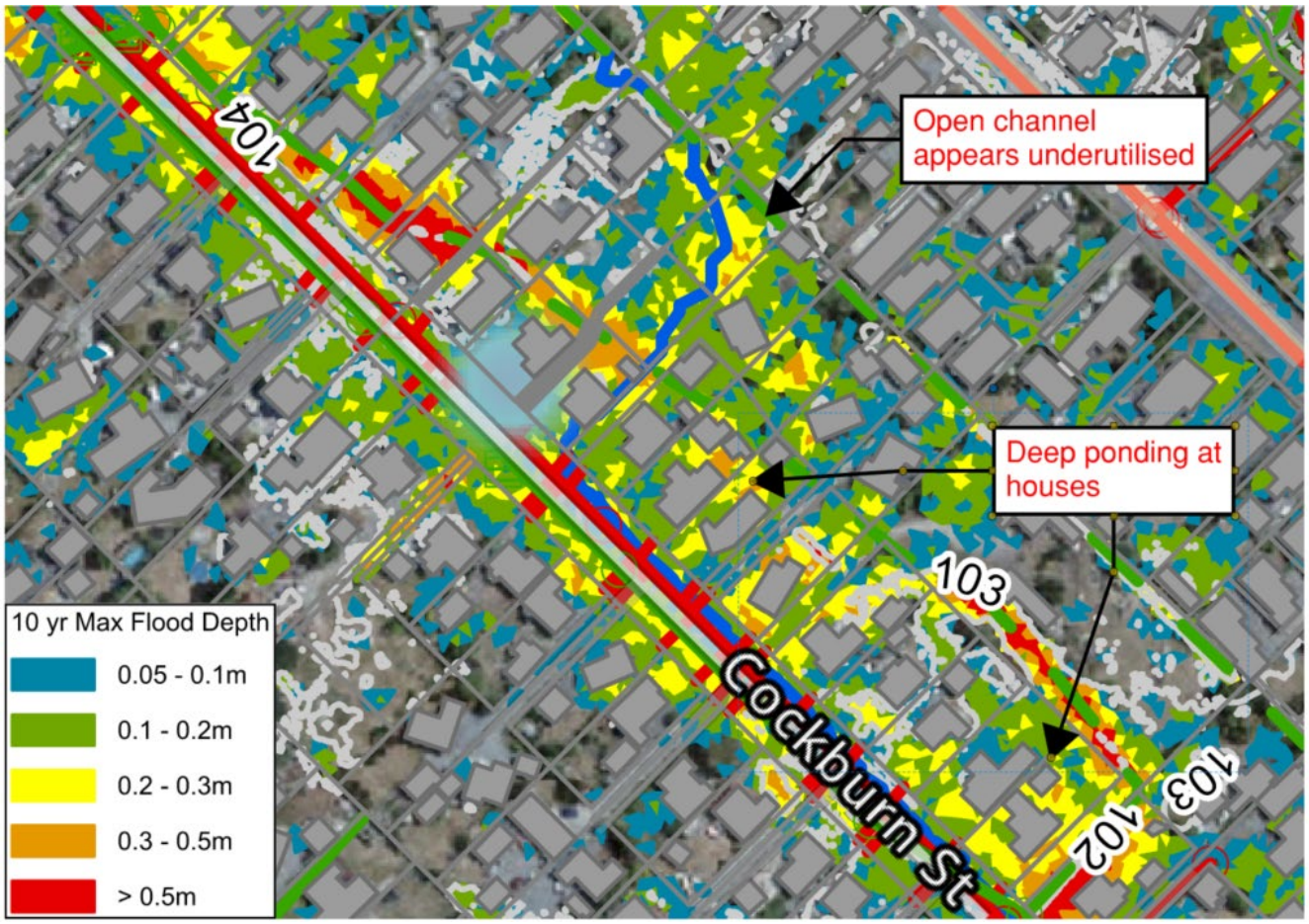


Figure 6 Rapid flood hazard assessment showing ponding at houses on Cockburn Street (extract from Appendix A)

There is a 525/600 mm stormwater pipe along Cockburn Street which provides a drainage solution for the road and for the connected open channel. There are no stormwater lateral connections to this main, and as mentioned above the servicing solution for private properties is on-site soakage. Where no public stormwater disposal solution exists, residents will find alternative methods to manage the negative effects of stormwater ponding on their property. A common method is to adjust roof downpipes so that they drain into gully traps, which are directly connected to the wastewater network. Cross-connections to the wastewater network also occur, where a stormwater pipe that should connect to a soak pit is instead connected directly into the wastewater network. These solutions may seem to work to reduce ponding on a property during smaller rain events. However, it would only take 5-10 house roofs discharging to the wastewater network to overwhelm a standard 150 mm diameter public wastewater main.

In addition to intentional cross-connections, there are likely scenarios where ponding occurs close to houses which can be the cause of direct stormwater inflow into the wastewater network through gully traps.

The properties that have cross-connections from stormwater into the wastewater network are not necessarily the properties experiencing the negative impacts of wastewater overflows. It may be properties further upstream who are contributing stormwater flows, which overwhelm the wastewater network, causing it to overflow at its lowest point which is in properties at the Cockburn/Colombo corner.

Where no stormwater disposal system is available, poor behavioural practices will continue to occur, as residents have no alternatives to fix the ponding issues on their properties.

2.1.4 Limitations in network capacity

The wider Masterton wastewater network drains to three trunk main routes which connect to the Homebush Wastewater Treatment Plant (WWTP).

The Masterton GIS shows the Cockburn Street wastewater main as DN150, discussions with MDC staff indicated there is some uncertainty on this and it may be DN225. Downstream of Cockburn Street, the Masterton GIS shows there is a DN150 main along Colombo Road, as well as a DN225 main which cuts across a field to connect to one of the trunk mains at the corner of Kuripuni Street and Makoura Road. The readily available GIS information does not include pipe invert levels, and there are multiple interconnections in the wastewater network, so the direction of flow in this area is not immediately clear..

As mentioned above, wastewater overflows have not been recorded during dry periods. This has led to the natural assumption that the wastewater network is sized correctly for the catchment it serves. However, this cannot be confirmed as there is no real time monitoring of the wastewater network, nor does MDC have a hydraulic model.

In the absence of any model or monitoring, it will be difficult for MDC to actively manage the future growth of Masterton. This is apparent in nearby Taranaki Street, where development is constrained as a result of capacity limitations in the wastewater network during large rain events. This is an example where MDC needs to understand the interconnectivity of the wastewater and stormwater systems and the impact on the expected level of service. The significant infill development in the Cockburn catchment will be exacerbating the existing issues, but the effects cannot be quantified.

A hydraulic model is required to understand the design flows in the network and whether the trunk mains are appropriately sized. A model, alongside physical and automated monitoring, will allow MDC to understand the impacts of wet weather events, assess future growth scenarios, understand the level of service provided and the risk of overflows entering the receiving environment. This understanding enables informed investment decisions, for example: is it acceptable to reline a pipe to resolve infiltration, or is upsizing also required to address capacity issues?

MDC has indicated work on developing an asset management system which will assist with reviewing and analysing data from real-time monitoring once installed on site has commenced.

2.2 Historic wastewater overflow responses

The responses MDC have taken to date to address wastewater overflows fit into three categories:

– Immediate response – deployment of portaloos
– Short-term – installation of reflux valves/wastewater tanks
– Long-term – actions to address I&I

2.2.1 Immediate response

The immediate response to residents loss of service due to wastewater overflows is to deploy portaloos. GHD understands that a system is in place for quickly contacting residents and distributing portaloos during heavy rainfall events. It should be noted that while portaloos provide an alternative to a functioning toilet, residents may still be unable to shower, wash dishes or do laundry. In this event, households are invited to evacuate and offered short term alternative accommodation.

2.2.2 Short-term

As a short-term measure, MDC has installed, 21 reflux valves and 13 tanks (see Figure 7). It can be seen from the map below that the installation of reflux valves and tanks aligns with the locations of recorded faults (overflows).

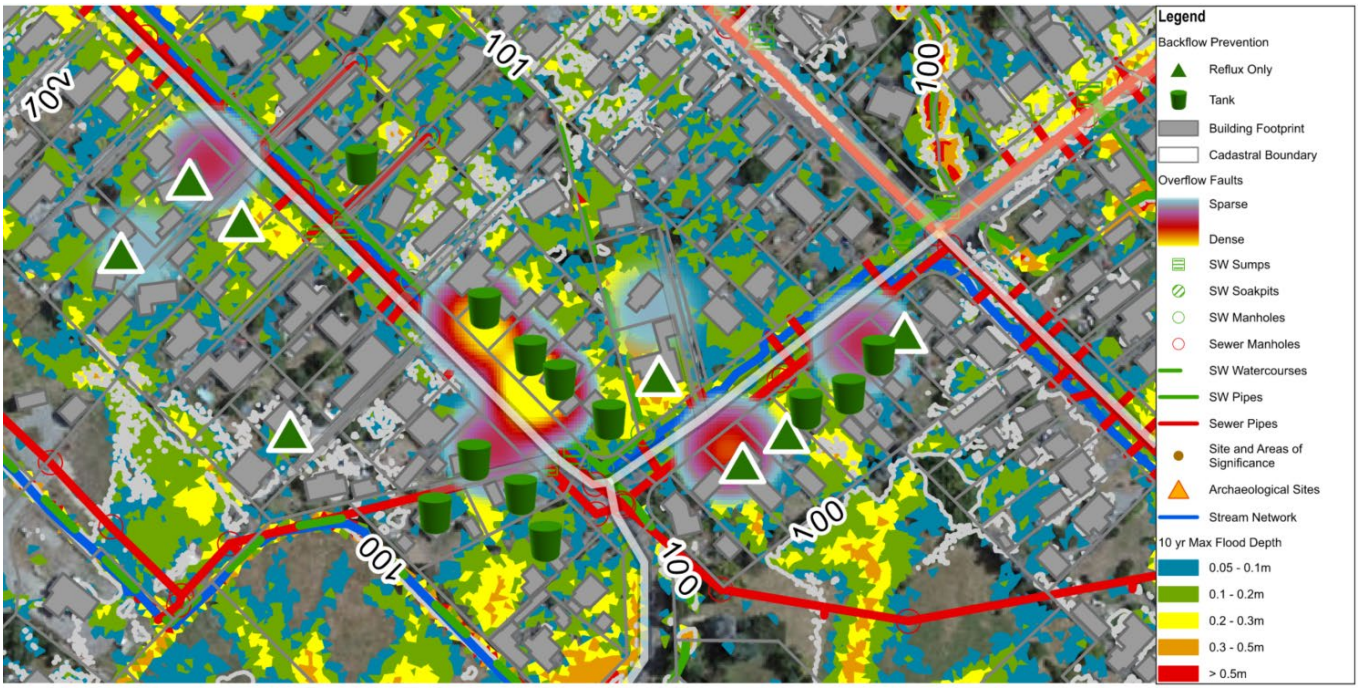


Figure 7 Reflux valves and tanks installed at Cockburn/Colombo St (extract from Appendix A, tank at 129 Makoura Road not shown)

The reflux valves prevent water flowing the 'wrong way' up the pipe, so that an overwhelmed wastewater network does not 'push flow' up the wastewater laterals and into houses.

The tanks provide a temporary wastewater service to the houses during the period of network surcharge. When the pipe network is surcharged, the reflux valve prevents backflow and the wastewater from sinks and toilets drains into the tank. When it stops raining and the pipe network has capacity again the house will empty into the public network. Contents of the storage tank are then pumped out. The laterals of these properties were also lined to reduce infiltration, which could quickly fill up the storage tank.

The reflux valves and tanks are expected to reduce wastewater backups and overflows for these properties, which will provide short-term relief for residents. However, they are a 'band-aid' to address a symptom of the problem, and do not address any of the inflow, infiltration and network capacity issues described above.

If stormwater management is not addressed at a catchment level, ponding on these properties could lead to direct stormwater inflows into gully traps which will overwhelm the on-site tanks (where installed) and customers will continue to experience loss of wastewater services, and potentially have wastewater backing up into their houses again.

The tanks and valves are not a complete solution to the problem. They are only part of the solution, aimed at quickly providing an improved level of service to the residents most affected by wastewater overflows. Residents may have an expectation that all of the problems have been solved with the tanks and valves, so clear communication with residents is required on future stages of work to avoid reputational risks for MDC.

2.2.3 Long-term

Infiltration and inflow is a challenge that all wastewater network operators face. Historically, a number of different projects have been undertaken in Masterton to address this challenge, including pipe renewal and rehabilitation, joint repairs, private property inspections and CCTV inspections. Since 2007, MDC has an ongoing wastewater network renewal and upgrade programme. It appears that specific inflow and infiltration investigation and planning work was often triggered by significant surcharging and overflows, for example during a storm in July 2006, and by the Homebush WWTP consent application.

Table 3 Summary of major wastewater network upgrades and I&I work undertaken in Masterton

Year	Description
1991	170 joint repairs.
1994	CCTV inspections. Joint and manhole repairs.
1997	Lansdowne wastewater catchment – rehabilitation of mains and some laterals using urethane grouting system. Flow monitoring to develop peaking factors.
1997	Waipoua siphon upgraded.
2004	Major investigation resulting in Technical Memorandum 4, which included flow monitoring in six catchments, analysis of GWI, RDII and DI, spot monitoring in 40 subcatchments. Indicated ground water infiltration is the primary I&I problem for Masterton, as high volume.
2005/06	CCTV inspections, manhole inspections, manhole measurements. Source detection in three catchments: inspections undertaken for 2362 properties, which found 451 faults across 344 properties. MDC indicated response to requests for repair was relatively good. Cockburn St main was noted as having heavy surcharging.
2006	July 2006 storm caused widespread flooding and wastewater overflows, resulting in evacuations and deployment of over 180 portaloos
2007	CCTV inspections and cleaning
2007	Cockburn Street sewer was replaced, including: • 860 m DN225 PVC pipe, trench and lay • Three DN150 PVC branch sewers, approx. 50 m long each • 103 lateral connections, mostly by pipe bursting • 16 new manholes • Three groundwater piezometers
2005	Groundwater monitoring from 1995 – 2005 at Cockburn Street indicated the following: • 141 Cockburn Street: 0.9 – 1.2 m bgl • 85 Cockburn Street: 0.9 – 1.2 m bgl • 7 Cockburn Street: 0.6 – 1.0 m bgl (It should be noted that anecdotal evidence indicates that groundwater is up to surface level during winter in the Cockburn area.)
2009	Homebush WWTP consent application

Year	Description
2010	Masterton Sewerage I&I Reduction Management Plan prepared *Note: There are gaps in the data that GHD has obtained, which require backfilling to understand the full picture of I&I reduction work undertaken, in accordance with this plan or otherwise. This is likely to be the same data that would be required to build a hydraulic model.*
2017	Council resolved to take over sewer laterals from property boundary to public main
2022	Record rainfall in February, requiring portaloos to be dispatched and an emergency discharge from Homebush WWTP.
2023/24	New wastewater pump station at Colombo Road bridge across Waipoua River (to replace siphon).

Information in this table has been compiled from the following sources:

– (Dec 2022) *Masterton Sewer Overflow Briefing*
– Beca (Dec 2007) *Masterton Sewerage Reticulation Planning Report* (Draft)

At a holistic level, the short-term actions already undertaken are reasonable based on the available information. However, as mentioned above, it is only a matter of time before short-term fixes such as reflux valves and tanks start to become ineffective, and problems recur. Over the longer term there appears to have been a stop-start approach, with investments made following significant issues, then tailing off once the urgency has passed.

A long-term, integrated strategy with a broad focus is required. The issues span across wastewater, stormwater, groundwater, management of open channels, private and public infrastructure, network condition, and hydraulic understanding.

Considerable effort will be required to effectively understand and address the problem. This will require ongoing, long-term funding, which will need to be identified through MDC's 30 year Infrastructure Strategy, 10 year Long Term Plans, Three Waters Asset Management Plans and MDC's legislative requirements. In addition to addressing existing issues, the integrated strategy will need to think to the future, so that when population growth happens, Masterton has the infrastructure ready to support it.

2.3 Summary of problem

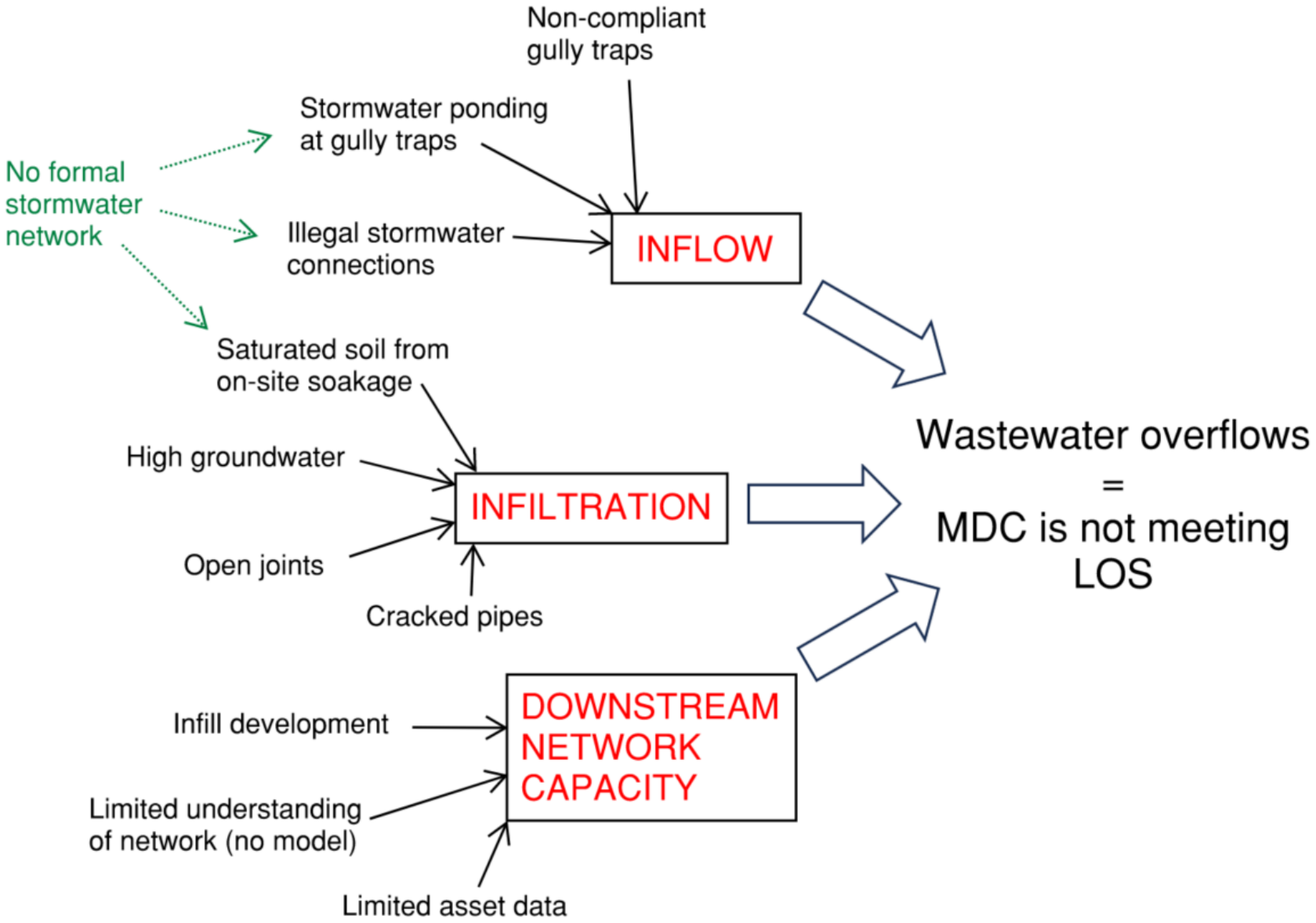


Figure 8 Summary of wastewater overflow problem

3. Objectives

GHD has defined eight key objectives, grouped into three focus areas, to address the problem defined in Section 3.

Inflow and infiltration into the wastewater network is a key part of the problem, informing the first two objectives:

Objective 1 – Reduce direct inflows into the wastewater network

Objective 2 – Reduce infiltration into the wastewater network

We have defined addressing the sources of water into the wastewater network as **Focus Area 1**.

The wastewater network cannot however be considered in isolation, as management of stormwater has a direct influence on inflow and infiltration into the wastewater network.

As mentioned above, surface water ponding can flow into gully traps, and saturated soils can lead to more infiltration. In addition, when residents are experiencing ponding on their properties, it can encourage behaviours such as diverting downpipes into gully traps.

This leads to the next two objectives:

Objective 3 – Reduce on property flooding/ponding

Objective 4 – Provide a stormwater disposal solution for private properties

Rapid flood hazard modelling is an approach that can be used to quickly identify high risk areas for flooding. A more detailed understanding of stormwater runoff and flows is required to assess the capacity of the existing network (pipes and open drains) and identify areas where improvements can be made to the stormwater network to provide additional options for stormwater disposal.

Objective 5 – Understand capacity constraints in the wastewater network

The five objectives outlined above address inflow and infiltration into the wastewater network. The other possible cause of wastewater overflows is limitations in the downstream network capacity.

The information held by MDC on their wastewater network assets is limited or stored in different locations so not readily available. For example, the public GIS does not contain invert level information for the pipe network.

A hydraulic model, informed by robust asset data, is required to identify any capacity constraints in the wastewater network and collection of invert level information is crucial to developing a model and can be used to backfill any missing data gaps in the asset database.

Objective 6 – Understand capacity constraints in the stormwater network

The next thing to consider is the community's experience.

Clearly, residents being unable to use their sinks or toilets and experiencing wastewater backing up into their houses is unacceptable. To understand what is acceptable, MDC must define and agree with the community what the target level of service for the stormwater and wastewater networks should be.

For stormwater, this requires consideration by the transportation team as well as the three waters team, as roads are typically designed and used as secondary flow paths for the stormwater network. The target level of service informs the design of new infrastructure, the management of existing assets, and actions taken to resolve issues such as wastewater overflows or surface ponding. Consideration by the building services team is also required when setting minimum floor levels for new development.

Objective 7 – Define and achieve a level of service for the wastewater and stormwater networks

We have defined addressing the capacity and connectivity between the public wastewater and stormwater networks as **Focus Area 2**.

The final piece of the puzzle is compliance with resource consents. MDC has recently been granted a global stormwater discharge consent (Stage One) by Greater Wellington Regional Council (GWRC). This is a new consent for MDC and additional work will be required to comply with both current and future (Stage Two) consent conditions.

In addition, the resource consent for the Homebush WWTP includes a condition that the consent holder "*shall continue to work to reduce the influence of the groundwater inflows and stormwater infiltration on wastewater flows entering the treatment plant*."

Objective 8 – Comply with Storwmater Resource Consent conditions

We have defined preparation of stormwater catchment management plans and to address compliance with consent conditions as **Focus Area 3**.

4. Outcomes

The desired outcomes, grouped by Focus Areas, are summarised below.

4.1 Focus Area 1 – Addressing the source of water

Develop and implement strategies to:

– Understand groundwater levels in comparison to the wastewater network
– Manage infiltration through relining (where appropriate) or by replacing wastewater network assets
– Reduce/remove direct inflows via property inspections, in conjunction with predicted flood maps.

4.2 Focus Area 2 – Addressing the capacity/connectivity of the wastewater and stormwater networks

– Based on predicted flood mapping, assess improvements to the stormwater network to provide servicing options for existing and future developments – noting this will likely involve the use of the existing open drainage network within private property and the use of public roads for conveyance and storage of flood waters
– Improve coordination across the MDC 3 Waters, Building and Transportation teams in terms of renewals, coordinated network improvements and use of roads as secondary flow paths
– Define specific levels of service for wastewater and stormwater
– Develop a hydraulic model for the wastewater network – first stage to focus on trunk network downstream of Colombo Road
– Develop a hydraulic model, including secondary flow paths, for the stormwater network – first stage to focus on Cockburn catchment as a pilot study.

4.2.1 Wastewater hydraulic model

GHD recommends that the wastewater hydraulic model is initially focussed on trunk mains, and aims to answer the following questions:

1. What is the network's capacity to convey NZS4404 design flows?

2. What can the network cater for in terms of an I&I peaking factor?
3. How do modelled flows compare to actual flows (through comparison against monitoring data)?
4. What is the network's capacity to convey flows from predicted growth?

Development of the model will require significant asset data collection to backfill level information missing from GIS. The MDC Wastewater AMP states that data collection for inflow/infiltration performance and for future modelling work was started in 2016 and is ongoing, with an estimated cost of $50,000 per year ($ in 2021).

Once the trunk model has been developed, the model can be progressively refined to include more detail on the pipe network for the wider Masterton catchment.

4.3 Focus Area 3 – Developing stormwater Catchment Management Plans

Effective management of stormwater is a key part of the solution to the problem of wastewater overflows. This is typically structured in the form of Catchment Management Plans, which link together the different aspects of stormwater management, as shown in Figure 9.

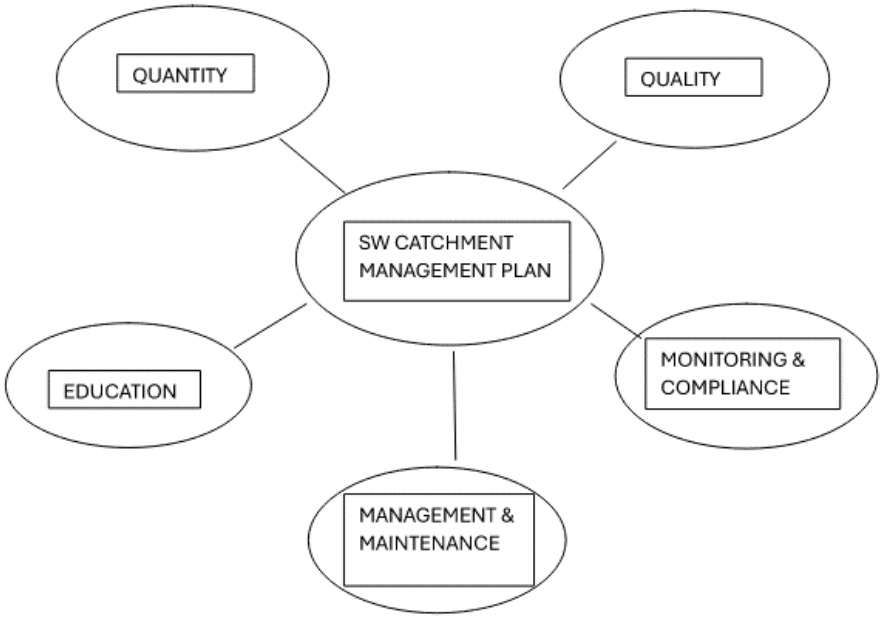


Figure 9 Stormwater Catchment Management Plans schema

Quality – MDC has been granted a Stage 1 global stormwater discharge consent (5 year consent), which has a strong focus on monitoring of water quality to inform what is required for the Stage 2 discharge consent.

Quantity – While the Stage 1 consent focusses on quality, the Stage 2 consent is likely to introduce a stronger focus on stormwater runoff quantity, which is identified as an objective/policy in the Proposed Natural Resources Plan, Regional Policy Statement and National Policy Statement for Freshwater Management. Stormwater quantity will need to be addressed for both existing and proposed developments.

Monitoring and Compliance – A stormwater monitoring plan has been prepared as part of the Stage 1 consent application and will be implemented this year. If there are overflow issues in the wastewater network, then this monitoring is likely to identify elevated levels of E.coli in the receiving environment. To comply with the consent, MDC will need to identify and take action to prevent uncontrolled wastewater overflows. The catchment management plans will include actions required to achieve consent compliance.

Management and Maintenance – There is a clear opportunity to use the open channels throughout Masterton as the backbone of a formal stormwater network, however this will require development of a Management and Maintenance Plan, especially where channels are located in private property.

Education – Underpinning all new strategies and policies will be the education of elected members, council staff, local residents, ratepayers and the wider community. People need to understand why actions are being taken, so that funding is allocated, projects are targeted to achieving the desired outcomes, and community buy-in is achieved as much as possible.

In summary, the desired outcomes of the catchment management plans are as follows:

– Implement the Stormwater Monitoring Plan, and other actions required by the Stage 1 Global Stormwater Discharge Consent conditions
– Develop policies and strategies for managing stormwater from new and existing developments (Stormwater Bylaw), including consideration of quality and quantity
– Address ownership of open channels through private property
– Develop a Management and Maintenance Plan for open channels, especially where they are located in private property
– Assess each subcatchment based on risk factors, including land use, discharge quality and potential flood risk, and rank sub catchments in a priority order for further assessment. Identify subcatchments that are suitable for development (low to no flood risk, available stormwater and wastewater network capacity, appropriate stormwater disposal solutions)

5. Next steps

The issues and pathway forward outlined above will take significant effort, time and budget to achieve. The development of policies and strategies, including on site assessments, will need to be refined over time and education needed prior to enforcement.

As a way of actioning the proposals above, it is recommended that the Cockburn area be used as a pilot study to focus on implementing investigations and to test any new policies and strategies.

Choosing a smaller focus area means that options can be implemented and assessed before being rolled out to a wider area, meaning that budgets can be staged over time and assumptions robustly challenged. Experiences in the Cockburn catchment can also be used to inform engagement with the wider community.

Taking a catchment approach also aligns with future Catchment Management Plans for Stormwater which are expected to be required as part of the future (Stage 2) Global Stormwater Discharge Consent from GWRC.

5.1 Cockburn pilot scheme

The Cockburn catchment is an excellent candidate for a pilot scheme. Under dry weather flow conditions it is expected to be a closed catchment which makes hydraulic analysis more straightforward, compared to assessing an entire network catchment area.

There are existing overflows which provide the social and political will to take action. The Cockburn catchment is also a representative catchment for Masterton to investigate the different issues, including high groundwater, stormwater ponding, likely stormwater quality issues due to overflows, and presence of open channels through private property.

Recommended activities for the Cockburn pilot scheme are outlined in Table 4 below.

Table 4 Recommended activities for Cockburn pilot scheme

Activity	Description
Strategy on accessing private property	High level strategy on: – Inspection approach (when, who and how) – Communications with property owners and residents – What actions the council will take following inspections? – Management of private data
Private property inspections	Undertake property inspections to identify sources of water. Includes: – Tracking downpipe connections – Checking compliance of gully traps and surrounds Requires logistics associated with entry onto private property (under Building Act or Local Government Act), identification of non-compliances, follow up actions, further inspections and enforcement.
Management of open channels	Explore use of the open channel between Cockburn and Kuripuni as the backbone of the stormwater network in this area. Identify ownership, maintenance requirements (who/when/how), legal opinion for waterway as a Public Drain, leading to options for use as stormwater disposal for private properties.
Development of a stormwater bylaw	Currently MDC does not have a stormwater bylaw. Development of a stormwater bylaw to address items above.
Provision of a stormwater network	Construct kerb outlets in Cockburn Street to offer residents a stormwater connection to their boundary. Residents can then connect their downpipes (roof runoff) into the public stormwater system.
Network monitoring	Targeted flow monitoring of the Cockburn catchment, focussed on the downstream trunk main, to understand design flows vs actual flows.
Asset data collection	Manhole surveys to confirm pipe sizes and invert levels in local catchment and of MDC wastewater trunk mains
Wastewater hydraulic model	Using network monitoring and asset data above, develop a hydraulic model of the trunk wastewater network to understand downstream capacity limitations (wet weather and dry conditions). Consider future integration with a stormwater model.
Stormwater hydraulic model	Develop a hydraulic model of the stormwater network in the Cockburn catchment, including overland flow paths.

5.2 Road map

In addition to the Cockburn/Colombo pilot scheme, GHD recommends development of a Road Map of what is required across the wider network to achieve the objectives and outcomes identified in Sections 3 and 4.

The road map will include proposals for the rollout of the Cockburn pilot study to the rest of Masterton, as well as identification of plans, strategies and policies that are required or need updating.

6. Conclusion

MDC has commissioned a lot of reports directly or indirectly related to the topic of wastewater overflows over the past three decades. As this report describes, it is a multi-faceted problem, with a multi-faceted set of solutions.

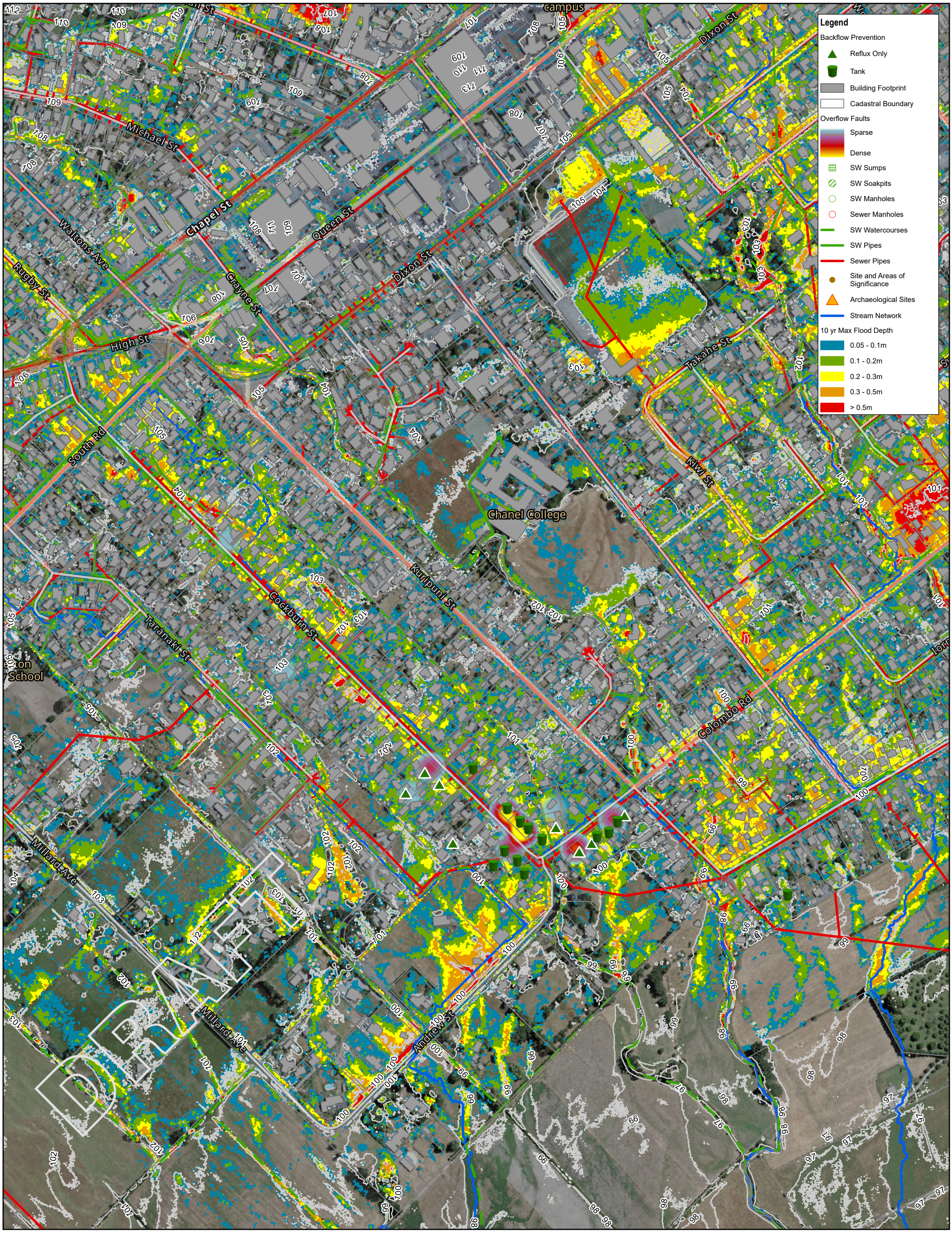
Some historic decisions, such as not protecting open channels from development, have made the current situation more difficult to resolve. Continued inaction or band-aid solutions without an overarching, integrated strategy will only let the problem get worse over time.

Pressure to fix the problem is growing on several fronts. Residents are demanding action to address wastewater overflows and loss of service. Greater Wellington Regional Council has recently granted a Stage 1 Global Stormwater Discharge Consent and will be reviewing the water quality monitoring in anticipation of the Stage 2 consent. Nationally, Three Waters reform will be occurring in some form, with anticipated stronger central government oversight of water quality, growth planning and infrastructure investment.

Wastewater overflows are a network-wide issue, and will require network-wide solutions to fix, across both wastewater and stormwater. We recommend a pilot scheme specific to the Cockburn catchment to enable action to start now, and a road map to plan out the next steps over the 30year infrastructure planning horizon.

Appendix A

Rapid Flood Hazard Assessment



Paper Size ISO A3

0 30 60 90 120

Meters

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

MASTERTON DISTRICT COUNCIL
COCKBURN/COLOMBO ROAD REVIEW

Project No. **12629672**
Revision No. **-**
Date **18/12/2023**

OVERVIEW MAP

FIGURE 1

N:\NZ\Wellington\Projects\51\12629672\GIS\Maps\Working\12629672_WW_Overflow_Review\12629672_WW_Overflow_Review.aprx - GHD-ISOA3-PORTRAIT
Print date: 29 Jan 2024 - 14:52

ghd.com

→ The Power of Commitment