Wellington Water

Three Waters Catchment Plan to Support Growth and Plan Change 50 – Phase One

Upper Hutt

Document information

The content of this report has been reviewed and prepared with the expert advice of Wellington Water's Chief Advisors.

Quality Assurance

Activity	Title	Name	Signature	Date
Prepared by	Senior Land Development Planner	Emily Greenberg		8/10/20
Reviewed by	Principal Engineer Stormwater Network Engineering	Mohammed Hassan		8/10/20
	Manager Modelling	Nadia Nitsche		14/10/20
Approved by	Manager Land Development	Olena Chan		15/10/20

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This report may only be used and relied on by Wellington Water and Upper Hutt City Council for the purpose agreed.

Cost estimates in this report are preliminary and based on pre-feasibility level concepts. Actual preferred solutions, prices, costs and other variables may be different to those used to prepare the cost estimates and are subject to change as a result of feasibility investigation and design development. Unless otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report.

Executive Summary

This Phase One report provides information for Upper Hutt City Council's development of Plan Change 50, which will result in revised District Plan zoning and provisions to support population growth of approximately 13,000 people over the next 30 years, a major increase on the current population of approximately 43,000 people at year 2017.

The report builds on the evidence presented in the Housing and Business Assessment Report (HBA) completed by Upper Hutt City Council in November 2019. The HBA evaluated housing and business demand over a 30-year period from 2017 – 2047 and compared this demand against land that is currently available or identified as a future growth area, in order to test whether each city can meet projected demand. The assessment also looks at the capacity of three waters (drinking water, wastewater and stormwater), roading and other infrastructure required to service development. The HBA noted that each of the areas identified for growth had constraints in the available and planned networks to provide water supply and wastewater services.

Building on the evidence presented in the HBA, the approach to this study has been to use two phases of investigation to assess the city-wide level of impact on the performance and service delivery upgrades needed to the three waters infrastructure to support Upper Hutt's projected growth scenarios:

- Phase One – assists in understanding long-term growth demands and the potential impacts to three waters infrastructure based on the best information available at the time of writing
- Phase Two - investigations are occurring concurrently and rely on new and updated hydraulic models to refine the Phase One assessment and to explore optimised options and more detailed cost estimates.

The results of the Phase One investigation indicate that significant investment in the existing water supply and wastewater infrastructure as well as new infrastructure will be required to enable the anticipated population increase. The identified upgrades are high-level, pre-feasibility concepts that have not been assessed against alternatives to achieve solutions that are optimised for cost and outcomes.

At this high-level, the following upgrades were identified (and costed) as needed to maintain an adequate network performance at year 2047, to meet the existing shortfall in water supply and wastewater network performance and to service the anticipated population at the year 2047:

- Approximately 8 ML of additional water supply storage volume, over 2 km of water mains, 5 new or upgraded pump stations, and associated upgrades to the bulk water supply network
- Over 9 km of wastewater trunk pipe upgrades, more than 25 ML wastewater storage, 1 new pump station and upgrades to the Seaview Wastewater Treatment Plant (WWTP).

The existing constraints in the stormwater network are relatively unknown at this time and will not be quantified until the hydraulic model is complete. Therefore, for this report only a long list of potential stormwater upgrades are identified based on existing information and best practice using water sensitive design. The long list of potential upgrades are not linked to specific flooding issues. The long list includes the identification of potential locations that would be suitable for the replacement of hard surfacing (carparks) with permeable paving, installation of stormwater storage, and use of rain gardens and wetlands to offset the impact of development related stormwater run-off on waterways.

Thirteen (13) areas are considered for potential urban growth, including existing residential areas where infill is projected to result in additional dwellings and greenfield sites that are currently not provided with reticulated three water services.

The growth areas and their projected future populations were overlain with the infrastructure catchment areas that define the water supply, wastewater and stormwater systems. This catchment planning approach was used to assess the existing performance of the three waters network within each area and to identify what would be needed to service the areas in the future.

Options for new or upgraded assets are based on what is needed to support the projected population at 2047 and to address existing shortfalls. Therefore solutions also include what is needed to address existing backlogs in the level of service.

This report does not provide specific costs for identified pre-feasibility upgrades, which is consistent with the Wellington Water Cost Estimation Manual (Revision D) that is clear that a confidence at the 95 percent level can only be provided for Level One or higher designs. As an alternative, the estimated costs calculated for each option were summed within each growth area. This sum is presented as a cost band, which represents the scale of investment in water supply and wastewater assets needed to support growth in each of the growth areas. The cost bands used are:

Band A, $1 to $5M
Band B, $5M to $10M
Band C, $10M to $30M
Band D, $30M to $60M.

The costs are presented by potential growth areas to inform the development of zoning provisions in Plan Change 50. The costs are allocated according to if the upgrades are specific to servicing the population projections within a growth area, such as an area-specific water supply reservoir, or if the upgrade is needed to service populations in more than one or all growth areas, such as the upgrades to the WWTP which serves all areas. In addition, the costs of some wastewater upgrades that are part of the Hutt Valley Joint Venture would be shared between Upper Hutt and Hutt City and this cost share is reflected in this report as the UHCC portion only.

It is important to note that the identified upgrades address current and future network deficiencies alongside upgrades specifically needed to address the stated growth that PC50 could deliver. In particular some investments needed to upgrade the water supply and wastewater systems include upgrades that would be needed at year 2047 without any population growth. These are upgrades to address existing deficiencies in the required level of service as well as projected deficiencies due to degradation of the network over time.

Specifically for water supply, some reservoirs are currently undersized to meet the required level of service for fire fighting supply. Therefore the identified upgrades needed address existing and future storage needs.

For wastewater, the piped network is anticipated to degrade over time, which will allow more rainwater and groundwater to enter the pipes. Therefore even with no additional connections from new dwellings, the wastewater system will need to accommodate increasing flows over time.

For this Phase One assessment, the investments needed within each growth area to adequately service the potential population at 2047 were not split between existing and projected deficiencies in levels of service and growth alone. This refinement will be added to the scope of the hydraulic modelling runs for the Phase Two report.

The investment needed to upgrade the water supply and wastewater infrastructure to support projected growth at year 2047 in each area is shown in the table below:

Growth Area	Potential Population Growth at year 2047	Investment Cost Band	Cost Range
Akatarawa	2075	D	$30 to $60M
Mangaroa	0	A*	$1 to $5M
Riverstone Terraces	0	N/A	N/A
Trentham-Brentwood	719	A	$1 to $5M
Trentham	2654	C	$10 to $30M
Clouston-Kingsley Heights-Maidstone	915	C	$10 to $30M
Elderslea	425	A	$1 to $5M
Upper Hutt Central – Ebdentown	533	A	$1 to $5M
Wallaceville	332	A	$1 to $5M
Emerald Hill-Birchville	0	A*	$1 to $5M
Maoribank	233	B	$5 to $10M
Te Marua	659	D	$30 to $60M
Totara Park	174	A	$1 to $5M
Pinehaven-Blue Mountains	1510	D	$30 to $60M
Silverstream-Heretaunga	2595	D	$30 to $60M

'* = Even though there is no projected population growth, modelled pipe degradation over time results in the need for wastewater storage to prevent overflows.

In general, the Phase One assessment calculates that servicing all potential growth areas for the projected 2047 population would require an investment of over $90M in the local and bulk water network and approximately $160M in the wastewater network. Estimated costs have not been calculated for stormwater services.

The investment needed for upgrading the Seaview WWTP and additional storage at the Silverstream detention tank includes an estimate of Upper Hutt's approximate 30 percent share for these Hutt Valley Joint Venture assets. The cost bands do not include Hutt City's approximate 70 percent share of the cost that would be needed to upgrade these assets.

The next steps rely on the completion of hydraulic models for each for the three water networks to identify optimised solutions that can include more detailed investigations, trigger points associated with associated growth timelines and construction cost estimates. This will provide better estimates to inform the development of Plan Change 50, including where Plan Change 50 should enable development with revised zoning provisions. In addition further steps will include use of this report to inform asset planning, programming and investment for UHCC's three water assets.

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Abbreviations

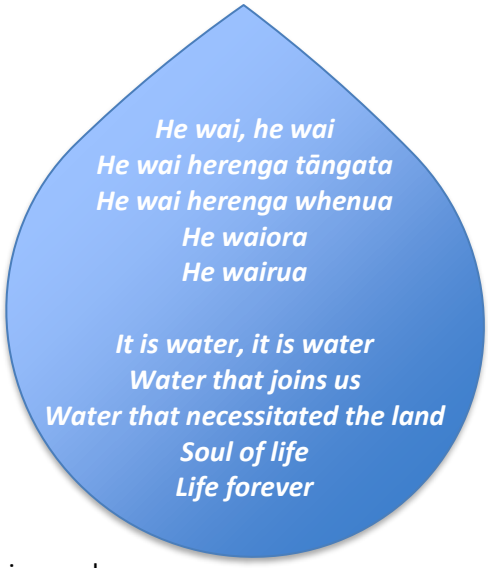
Abbreviation	Description
ARI	Annual recurrence interval
CBD	Central business district
cfu/100mL	Colony forming unit per 100 millilitre
E. coli	Escherichia coli
FMP	Floodplain management plans
ForecastID	The population forecast service provided by, .id – the populations experts, to Upper Hutt City Council up to the end of 2019
GWRC	Greater Wellington Regional Council
HBA	Housing and Business Development Capacity Assessment (a requirement under the NPS-UDC)
I&I	Inflow and infiltration
l/s	Litre per second
ML	Megalitre (equal to 1,000 cubic metres)
NPS-FM	National Policy Statement for Freshwater Management 2014 (amended 2017)
NPS-UDC	National Policy Statement for Urban Development Capacity 2016
PRV	Pressure reducing value
RMA	Resource Management Act 1991
Regional Plan	Natural Resources Plan for the Wellington Region
RSWS	Regional Standard for Water Services. May 2019. Wellington Water.
SH2	State Highway 2
SLUR	Selected land use register
UHCC	Upper Hutt City Council
WSA	Water Storage Area
WTP	Water treatment plant
WWL or Wellington Water	Wellington Water Ltd
WWTP	Wastewater treatment plant

1. Introduction

Wellington Water was created in 2014 to manage the water supply, wastewater and stormwater services for GWRC, Upper Hutt, Hutt, Porirua and Wellington city councils. The management of South Wairarapa District Council's services was added in 2019.

Wellington Water does not own any drinking water, stormwater, wastewater or bulk water assets. Nor do we set policies or control rates or user charges. These functions remain with our client councils.

The company philosophy is to manage the three water services to achieve three outcomes - safe and healthy water, respectful of the environment and resilient networks that support our economy. We assess service performance and recommended investments across 12 service goals.



2. Purpose

The purpose of this Phase One report is to assess the implications for forecast population growth over the next 30 years in Upper Hutt, based on available network information. The assessment has been carried out based on today's expected level of service and identifies the potential scale of investment that would be needed to provide acceptable water supply, wastewater and stormwater services.

The solutions and associated costs address existing deficiencies in the levels of service as well as upgrades needed to support the projected population growth.

3. Strategic Context of this report

This three waters catchment plan was designed to assess the implications of Upper Hutt City Council's urban planning for growth and specifically the Upper Hutt Plan Change 50 (Plan Change 50). This plan also responds to the deficiencies in the available capacity for new housing identified in the 2019 Wellington Housing and Business Development Capacity Assessment (HBA). The anticipated 30-year growth for Upper Hutt is 13,000 more urban residents in up to 5,600 new dwellings. This represents an average annual growth rate of 0.9 percent - from an estimated base of just over 43,000 people in the year 2017 to over 56,000 people in the year 2047.

This catchment plan report provides information from the first phase of a two-phase project to inform future growth by providing:

- a holistic view of three waters infrastructure needed to support urban growth as considered in the 2019 Wellington Housing and Business Development Capacity Assessment (HBA) and the development of Plan Change 50 to the Upper Hutt District Plan, including the need to manage adverse effects on the water quality of the receiving environment
- a baseline report with maps that describe the growth areas and the existing three waters networks, along with descriptions of known constraints to the existing networks
- a baseline report with maps that describe important features associated with environmental conditions, cultural sites, and other matters that could impact on the selection or cost of potential network upgrades
- a list of potential upgrades at the pre-feasibility level needed to support predicted urban growth and rectify existing constraints. All identified upgrades focus on the trunk infrastructure and catchment-scale solutions
- estimated costs at a high-level, summed within catchment areas and presented within costing bands that indicate the level of investment needing to provide three waters services
- initial guidance for developers who are planning any future changes in land-use and for the preparation and processing of private plan changes
- guidance on infrastructure needs for Upper Hutt City Council to enable growth and meet the requirements of the National Policy Statement for Urban Development Capacity 2016 (NPS-UDC), as detailed in the HBA. The requirements in the amended NPS, the National Policy Statement for Urban Development (NPS-UD), which was gazetted following the drafting of this catchment plan, will be used to inform the catchment plan generated for the second phase of this assessment.
- information that can be used to meet the requirements of the National Policy Statement for Freshwater Management (NPS-FM).

The Phase Two investigation will rely on more detailed investigations that use hydraulic modelling to investigate options needed to service this growth as well as refinements to the areas that will be enabled for growth based in part on the results of Phase One, the requirements of the new NPS-UD and Upper Hutt's ongoing development of Plan Change 50. Results of the Phase Two report will contain a list of potential optimised solutions to inform the development of Council's Long Term Plan, Infrastructure Strategy and Development Contributions Policy.

4. Integrated Catchment Planning

Integrated catchment planning provides a way for Wellington Water to describe the existing performance of the three waters networks and to assess what is needed to meet the needs of a growing population and the agreed levels of service.

It is an approach to manage water resources and land use on a catchment basis that considers network infrastructure planning in an integrated manner with urban and environmental planning.

Catchment planning requires the three waters networks to be assessed as whole systems and in relation to their surrounding environment that defines their catchment. For this report, the environment includes predicted urban growth, documented community expectations, ecology, geology and constraints such as sites with outstanding or significant natural or cultural values, contaminated sites and seismic hazards.

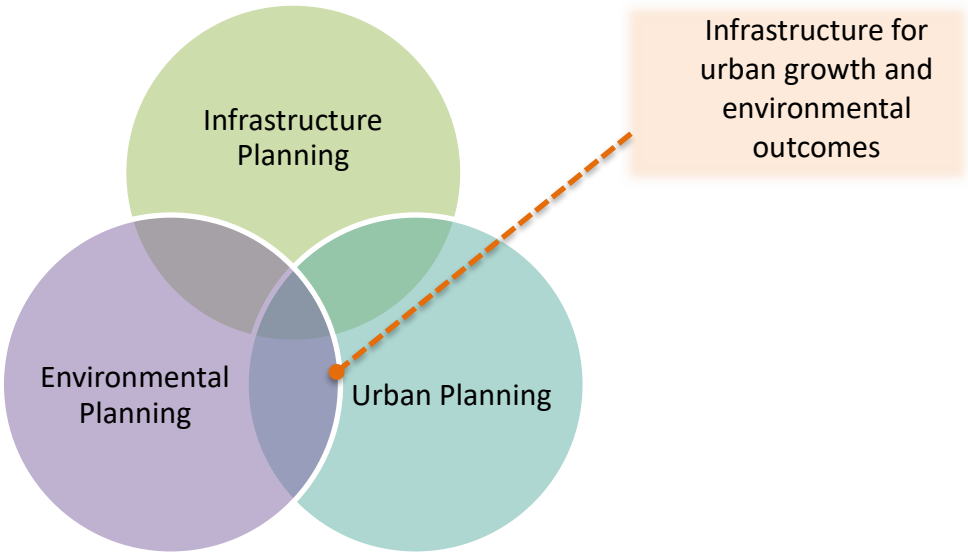


Figure 1. Venn diagram describing integrated catchment planning.

In this report, areas and boundaries are different between the catchment that is the city of Upper Hutt, the catchments for each growth area and the discrete catchments for each of the three water networks that serve the urban area.

For stormwater, the geographical catchment area is defined by discrete hydrological boundaries. These boundaries include the area of land that catches all of the rain that flows to a common waterbody.

For wastewater, the geographical catchment area is defined by the pipe network. In Upper Hutt the wastewater catchment is described as one system. In reality the Upper Hutt wastewater network is one part of the larger Hutt Valley network, which services both Upper and Lower Hutt.

For water supply, the catchment is the reticulated network (pipes, pumps and reservoirs) that serves Upper Hutt as well as the bulk water supply that feeds these reservoirs. This system is managed as 12 discrete water storage areas (WSAs).

5. Key Drivers

The main driver for this catchment plan is the development of Plan Change 50 for the Upper Hutt District Plan to enable projected population growth.

Other key drivers include regulatory and non-regulatory requirements and plans associated with urban planning or environmental management, such as Service Planning, which includes asset management to assess, maintain and upgrade the three water systems, and the financial planning included in Council-led Long Term Plans and Infrastructure Strategies as shown in Figure 2.

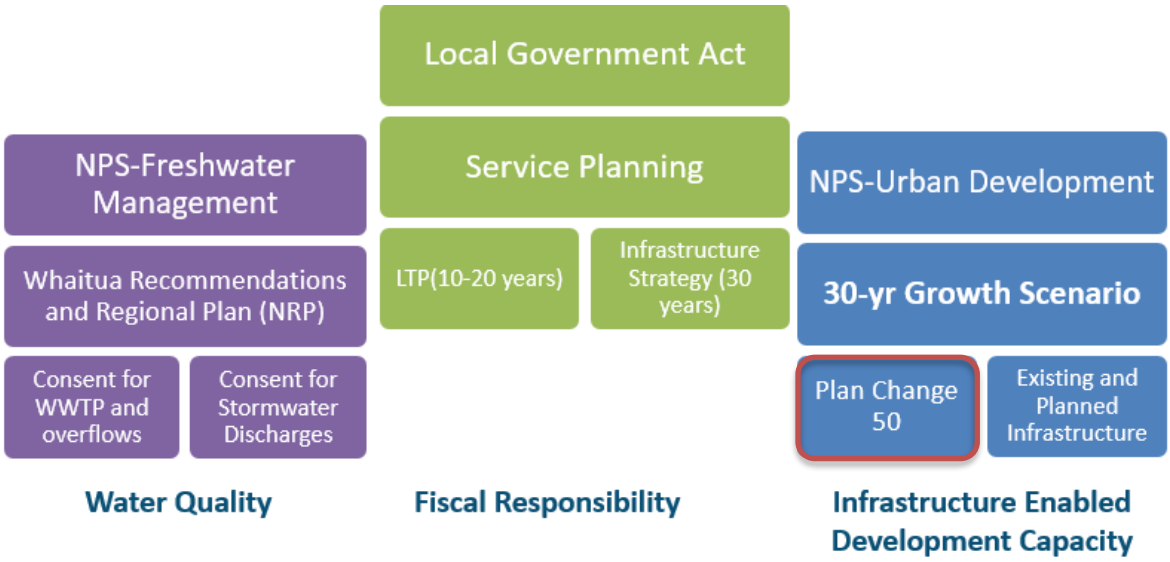


Figure 2. **Key drivers and outcomes of integrated catchment planning. The development of Plan Change 50 is highlighted as the main driver.**

6. Project Scope

This project is the first phase of a two-phase project. Phase One is limited to an assessment of existing information to inform the initial development of Plan Change 50. Phase Two will be completed once detailed hydraulic models are available for each of the three water networks.

6.1 Phase One

The scope for Phase One was limited to:

1. identification of existing and future constraints in the performance of the water supply, wastewater networks and stormwater systems based on previous investigations and future population projections within 13 potential growth areas identified for the development of Plan Change 50
2. assessment of pre-feasibility stage options to upgrade the networks to meet the desired level of service for existing and future populations
3. presentation of cost bands that illustrate the scale of investment needed for pre-feasibility level infrastructure upgrades within each of the 13 potential growth areas.

No indicative or detailed design was carried out as part of this Phase One study. All solutions were based on a high-level desk top exercise only, without detailed or physical investigation work (e.g. no site visits, physical investigation work, or optimisation with the use of hydraulic modelling were used).

Phase Two will rely on the completion of hydraulic models for each of the three water networks to identify likely optimised solutions that can include more detailed investigations and construction cost estimates with an increased level of confidence appropriate for the level of analysis completed (see Table 1).

Table 1. Scope and timing of Phase One and Phase Two.

Information	Phase One	Phase Two
Planning and Policy	Plan Change 50 Predicted populations	
Hydraulic Models	Wastewater	Wastewater Water supply Stormwater
Level of Service	Wastewater overflows Reservoir storage	WW and SW water quality* Sustainable water use*
Environmental	District and Regional Plan layers	Whaitua limits**
Optimisation of Investment		Hydraulic model testing
Timing	June 2019 – Sept 2020	Sept 2020 – June 2021

*= Wellington Water's Statement of Intent 2020-23 identifies that planning for growth can be an opportunity to improve environmental outcomes and to use water more efficiently.

**= Please see Appendix C, section 14.1 for more information on the Whaitua process in the Hutt Valley.

Details on the Level of Service assessed for each of the three waters and the assumptions and exclusions used in these assessments are detailed in Appendix A.

6.2 Renewals, Backlogs and Growth

Assessing the infrastructure needs to cater for growth can result in the identification of projects that address a mix of renewals, backlogs (shortfall in existing level of service) and greater capacity to cater for growth. Conversely an assessment focusing on renewals can identify projects to support growth or desired levels of service. This overlap among renewals, backlogs and growth was noted in the Draft 2019 NZ Productivity Commission report on local government funding and financing, which stated on page 228 that, "*many of the assets are ageing and require extensive investment, including so they can meet new higher environmental standards. Yet this need for renewal is also an opportunity for relocation and redesign*."

Growth as a driver for infrastructure upgrades brings the opportunity to increase the performance of multiple service goals, which without growth as a driver, Council might not have the opportunity to address:

- **Backlog** – shortfalls in existing level of service (upgrades can also provide increased capacity needed for growth)
- **Renewal** – end-of-life assets (replacements can improve level of service shortfalls, such as replacing leaky wastewater pipes or increasing seismic resilience, both of which are needed to support growth)
- **Growth** – new capacity (can be combined to address demand, levels of service and renewal requirements).

Because infrastructure upgrades can address a mix of these three service goals, it is often difficult to separate out the component that is specific only to growth. For this report, the component specific only to growth has not been identified. The Phase Two assessment will address these components in a more comprehensive manner.

6.3 Cost estimates and cost bands

The estimated cost of infrastructure upgrades identified for this report reflect that the upgrades are conceptual and have not been tested or optimised through the use of calibrated/validated hydraulic models.

Therefore the estimated costs are summed across solutions for both water supply and wastewater and then presented as cost bands. These cost bands can be used to understand and compare the scale of investment associated with providing water supply and wastewater infrastructure across each of the 13 growth areas.

For this Phase One report, the performance of the stormwater network against the desired outcomes of flood prevention and healthy urban waters is not fully assessed, and therefore potential solutions that needed to upgrade the stormwater system to support future growth have not been costed or included in the cost bands.

Presenting the estimates in cost bands illustrates the scale of infrastructure upgrades needed, rather than describing the cost of specific upgrades. The cost bands represent the sum of cost estimates for

each pre-feasibility level infrastructure upgrade identified as needed to provide an adequate level of service for the projected growth.

A simplified method was used to estimate the cost of each option based, in part, on the Wellington Water Costing Estimation Manual (Revision D) (2019). Costs were calculated using a base cost that includes costs for physical works associated with construction, council, legal and consultant fees and land purchase. This base cost is then subject to a contingency of 40 percent and a funding risk of 60 percent. On top of this a Wellington Water management fee of eight percent was added to make up the total cost.

Additional notes on costing are:

- The costs are based on year-2019 unit rates, and do not make allowance for inflation.
- The costs are limited to capital expenditure for construction, generally referred to as Capex. Additional costs for operational expenditure, including on-going maintenance and operation (Opex) are not included. Opex can include items such as, operation and maintenance, condition assessment and performance monitoring
- Upgrades to wastewater assets that are part of the Hutt Valley Joint Venture, such as the Seaview Wastewater Treatment Plant (WWTP) and the Silverstream storage tank were costed to Upper Hutt at 30 percent of the total cost. The UHCC contribution to the joint venture wastewater projects can vary depending on population but in this report is assumed as 30 percent.
- The costs of upgrading network assets that service more than one growth area (system-wide upgrades) are allocated proportionally based on the projected population increase in each growth area
- The upgrades were identified based on providing adequate service to the projected population and costs are not separated for any existing deficiencies in level of service.

The overall cost estimate of all water supply and wastewater upgrades were summed for each growth area in cost bands, as follows:

Band A, $1 to $5M
Band B, $5M to $10M
Band C, $10M to $30M
Band D, $30M to $60M.

The percent of the cost by water supply and wastewater is illustrated within each cost band.

The cost bands do not include projects that are in the LTP 2018-2028, such as over $18M of flood protection works on Pinehaven Stream[1] and approximately $32M for a storage tank[2] for treated effluent at the Seaview WWTP.

[1] Page 269, Upper Hutt City Council 2018 -2028
[2] Page 268, Upper Hutt City Council 2018 -2028

7. Infrastructure Planning

7.1 Three waters strategic direction

Wellington Water's strategic direction acknowledges that the performance in each of the 12 service goals is variable across the region and will require decades of investment to meet the desired levels of service. Therefore, the achievement of the strategic outcomes is a long term endeavour that will require regular adjustment as policy, standards and levels of service change over time.

In the short to medium term, Wellington Water has identified five key challenges for managing and planning investment as shown in Figure 3.

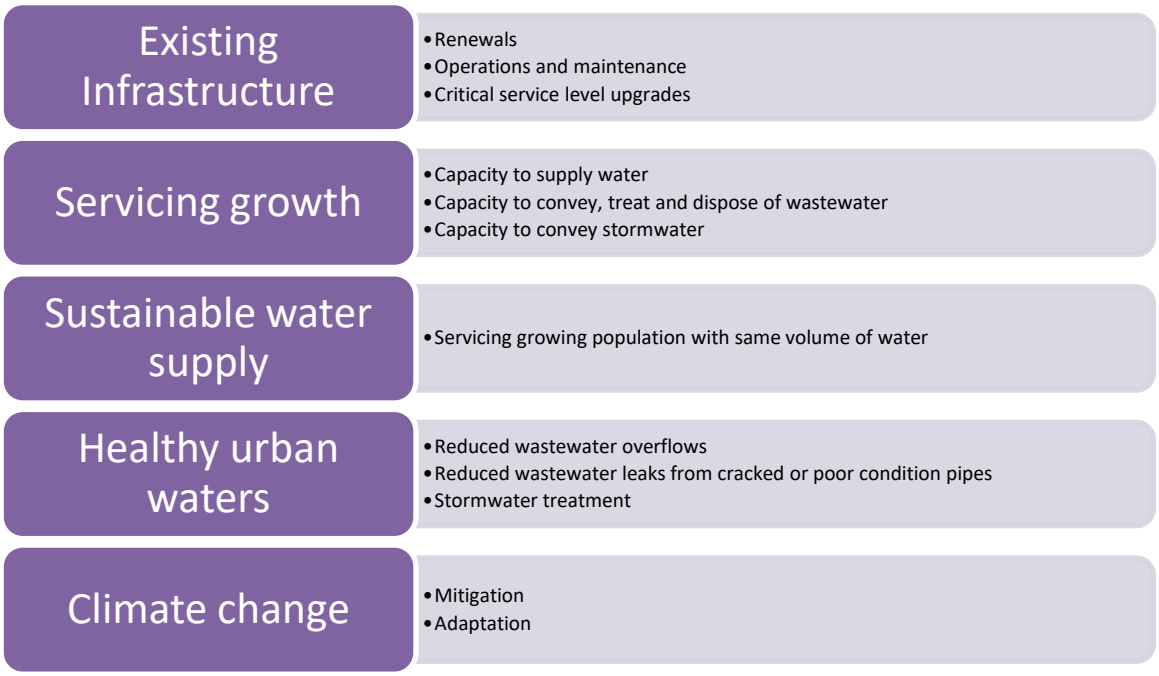


Figure 3. Wellington Water's five key challenges.

A significant level of investment is needed over the next 30 years to accommodate projected growth and respond to current deficiencies in the performance of the existing networks.

7.2 The three water networks

The urban areas of Upper Hutt are serviced by reticulated networks, which are designed to provide for the effective supply of drinking water and the collection and disposal of wastewater. Stormwater is managed through a combination of a reticulated network of pipes and a network of overland flow paths and watercourses.

Wellington Water uses a variety of data, maps, observations and tools to help describe and assess three water networks. Hydraulic modelling uses mathematical methods to analyse hydraulic flow. Hydraulic models are used to understand the network performance and to verify and assess concept options.

To ensure that the model represents reality, model results are verified against observed rainfall events or calibrated against monitored and gauged data.

The availability of hydraulic models for the three waters networks servicing Upper Hutt is discussed in the sub-sections below.

7.2.1 Water supply network

The water supply network receives treated water from the GWRC's bulk water network, with water being supplied from the Te Marua Water Treatment Plant (WTP) under normal operating conditions. The bulk network feeds reservoirs, from which the water is distributed via a pressurised pipe network to consumers at their point of connection (boundary toby or manifold), then via privately owned service pipes to consumer's taps.

7.2.1.1 Bulk network

The bulk water supplied to the four cities in the metropolitan Wellington region comes from three sources:

- The headwaters of Te Awa Kairangi/Hutt River, abstracted from an intake at Kaitoke weir, treated at the Te Marua Water Treatment Plan (WTP) and stored in the Macaskill Lakes for use during summer.
- The Wainuiomata and Orongorongo catchments, abstracted from river intakes and treated at the Wainuiomata WTP.
- The Hutt Valley artesian system, primarily extracted and treated at the Waterloo WTP although there is a standby treatment plant at Gear Island, Petone.

The alkalinity of the water leaving the water treatment plants is adjusted to reduce the natural corrosive potential on pipelines and household plumbing fittings. Chlorine is added to disinfect the water and protect water quality in the distribution system, and fluoride is added for dental health.

The bulk water supply for Upper Hutt is sourced from the headwaters of Te Awa Kairangi/Hutt River and is managed in a coordinated way to also serve Hutt City, Porirua and Wellington City. The water supply system relies on river flows, with lake storage that is used when river conditions are unsuitable, though water can be supplied from the Waiwhetu aquifer via the Waterloo WTP in Lower Hutt, if required.

The availability of water is not unlimited and at the current level of use, a new water supply source for the region would be required in approximately 2040. Using the available water more efficiently is a priority for Wellington Water, in part, because it will be difficult to get consent to extract additional water from our rivers and aquifers under the new provisions in the Regional Plan.

7.2.1.2 Upper Hutt water supply network

The bulk water is treated and delivered to 16 local reservoirs. Each reservoir is positioned at an elevation that can provide adequate water pressure for drinking water, domestic and commercial use, fire-fighting and emergency storage (Table 2 and Figure 4).

Table 2. Reservoirs in Upper Hutt

Reservoir	Volume (ML)
Emerald Hill Reservoir	1.1
Cruickshank Reservoir 1	2.3
Cruickshank Reservoir 2	9.1
Chatsworth Reservoir	0.1
Trentham Reservoir 1	2.3
Trentham Reservoir 2	9.1
Maidstone Reservoir	0.2
Mount Marua Reservoir	0.4
Pinehaven Reservoir (1)	0.7
Pinehaven Reservoir (2)	1.0
Plateau Road Reservoir	0.5
Riverstone Lower Reservoir	0.7
Riverstone Upper Reservoir (1)	0.4
Riverstone Upper Reservoir (2)	0.4
Sylvan Heights Reservoir	0.1
Timberlea Reservoir	6.1

The reservoirs service 10 discrete water supply areas (see Figure 5). The water supply areas describe "catchments" that are specific to how drinking water is distributed and managed and are not necessarily consistent with the "catchments" that describe the projected growth areas assessed in this report.

Two of the greenfield sites – Gillespies Block and the Pinehaven/Silverstream Southern Growth Area (see Appendix B, section 13.4) are located outside of existing WSAs and a new zone would likely be formed to supply them.

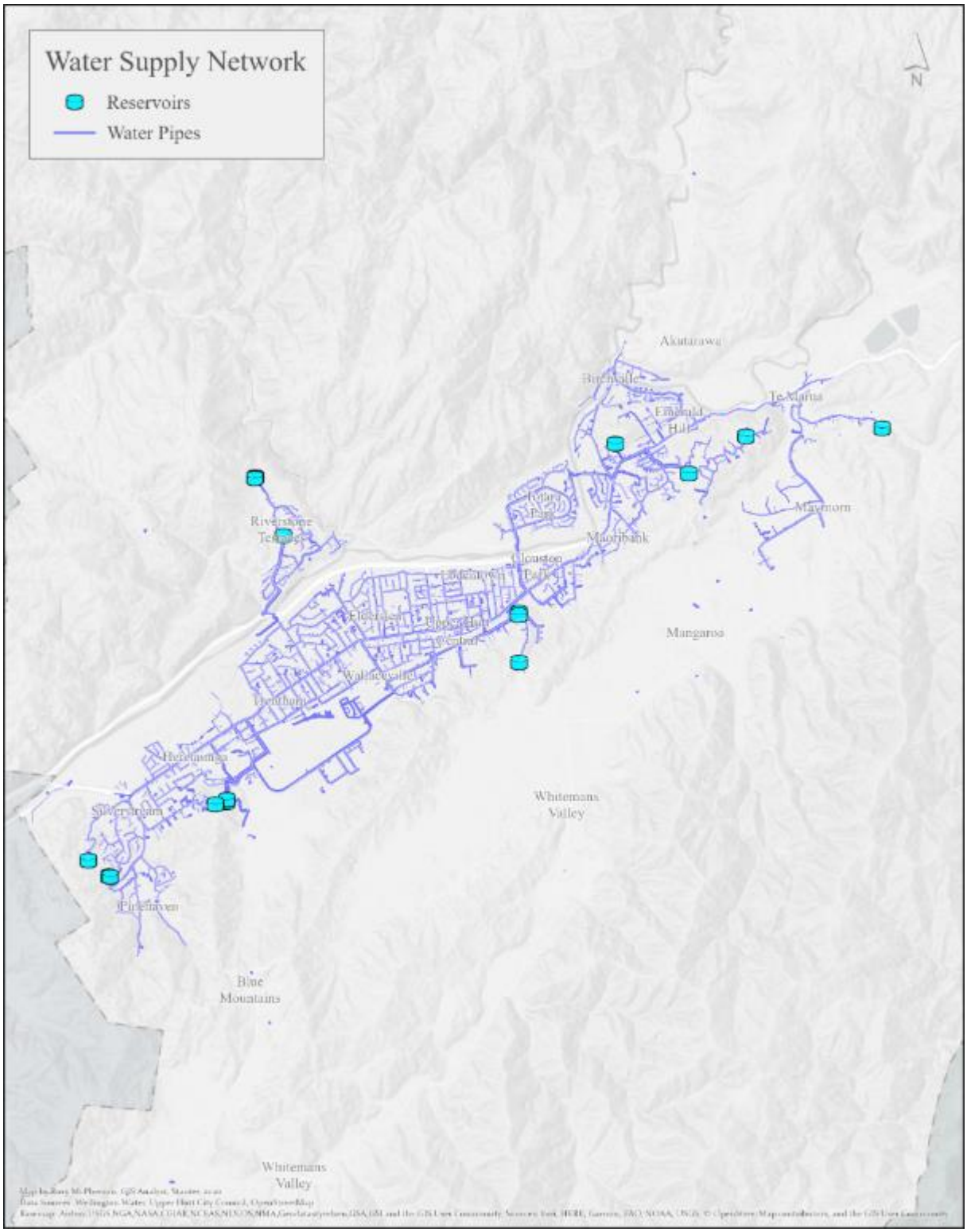


Figure 4. Water supply network in Upper Hutt.

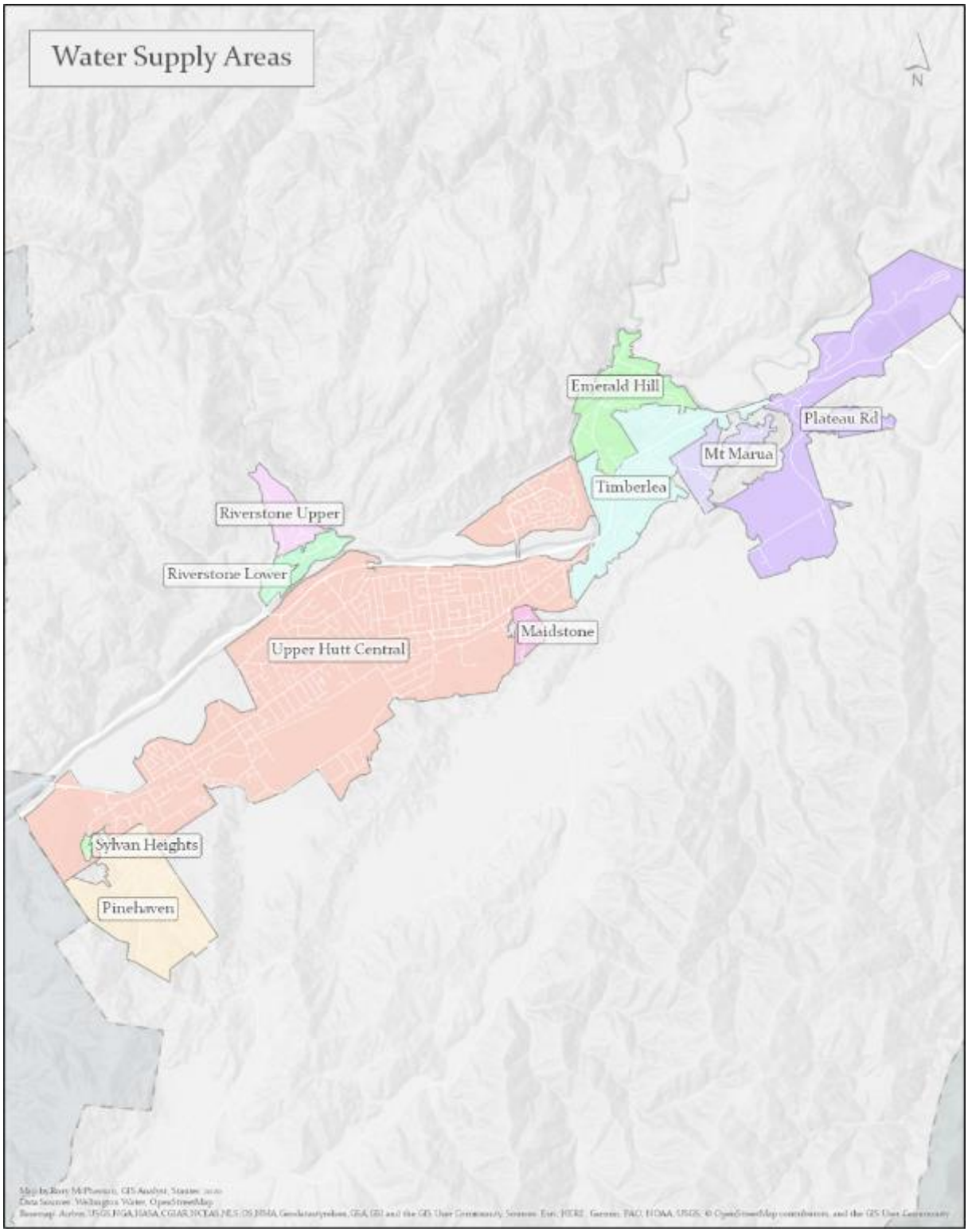


Figure 5. Illustration of the 10 discrete water supply areas in Upper Hutt.

7.2.1.3 Water use

Residential customers in Upper Hutt are not metered other than a small number for representative consumption assessment purposes. Water use can therefore only be estimated based on the meters that are installed at the system, at a zone level and on some extraordinary users, such as commercial users which are required to be metered.

Leaks in the network are monitored at the system and zone level based on usage trends and analysis of night flows, however the lack of metering at each property limits the ability to identify and accurately determine the extent of leaks.

Water conservation and leakage management are essential to minimising waste and deferring capital expenditure for source development. It is also essential to demonstrating efficient use of the resource from a regulatory perspective.

Regionally, average summer demand is typically greater than that in winter and can vary widely. Water use on peak days can be almost 50 percent more than an average 'winter' day. Dry spring and summer conditions can lead to potentially serious water shortage concerns. In such years, lake storage can be depleted rapidly because the same set of climate conditions that restrict supply also increase demand. The extra demand during spring and summer arises mainly from discretionary outdoor water use – particularly for garden watering.

Peak daily flows have occasionally come close to the supply capacity of treatment and bulk distribution assets. Dry conditions and persistently high demand over several weeks, typically in mid-late summer, require the use of stored water at the Te Marua WTP, depleting reserves and increasing the likelihood of a water shortage.

7.2.2 Wastewater network

The Upper Hutt wastewater system consists of a network of gravity sewers, pump stations and rising mains that transport wastewater from the urban areas of Upper Hutt to the Seaview Wastewater Treatment Plant (WWTP) in Lower Hutt (Figure 6).

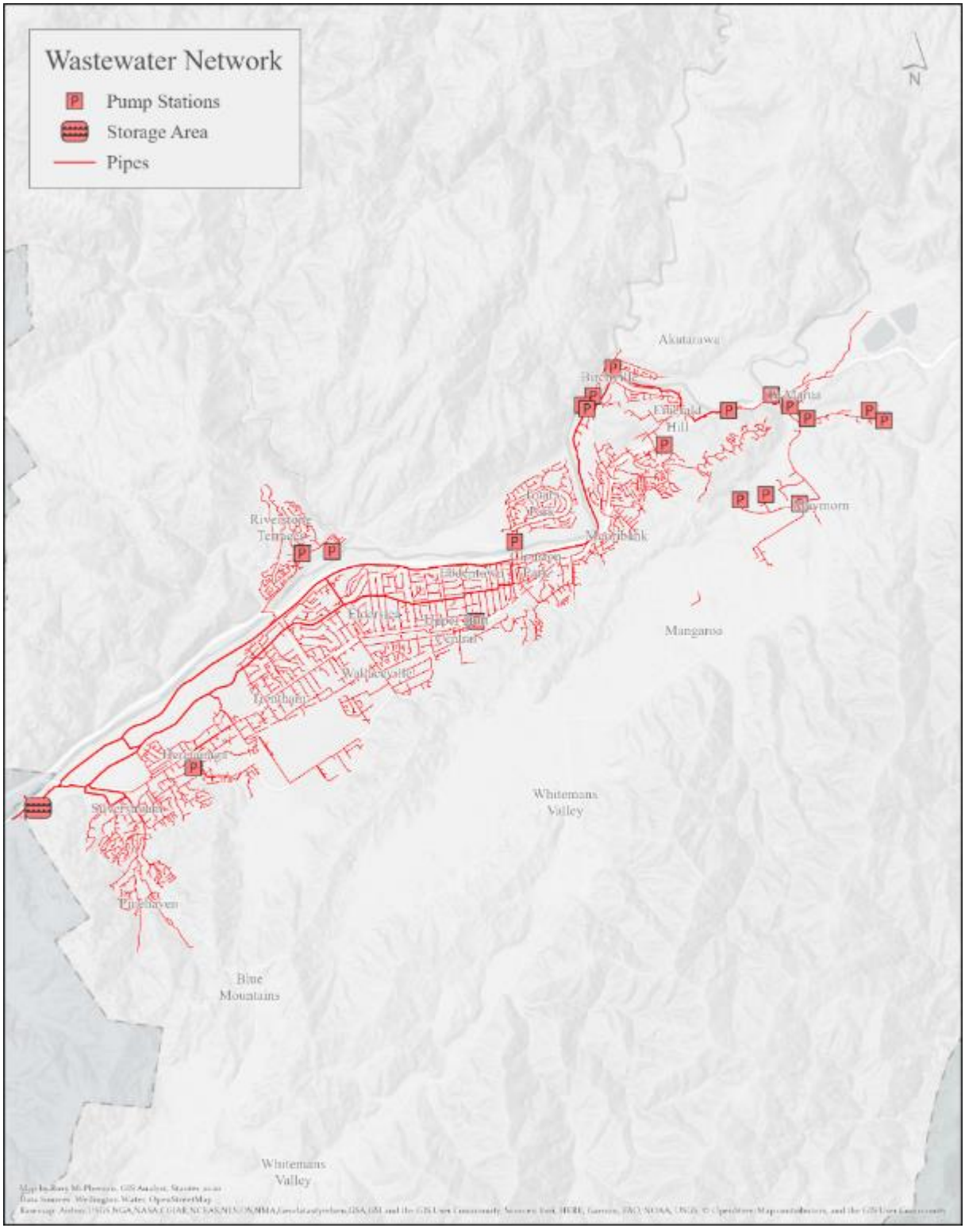


Figure 6. The existing wastewater network in Upper Hutt.

The Upper Hutt and Lower Hutt wastewater system work as one network (Figure 7). Most of the larger assets, including trunk mains, pumping stations, storage tanks and the WWTP are operated under the Hutt Valley Joint Venture, of which Upper Hutt holds a share of approximately 30 percent. Managing the collection and disposal of bulk wastewater in the Hutt Valley on behalf of both Hutt City Council and Upper Hutt City Council is a function of Hutt City Council under the Hutt Valley Drainage Act 1967.

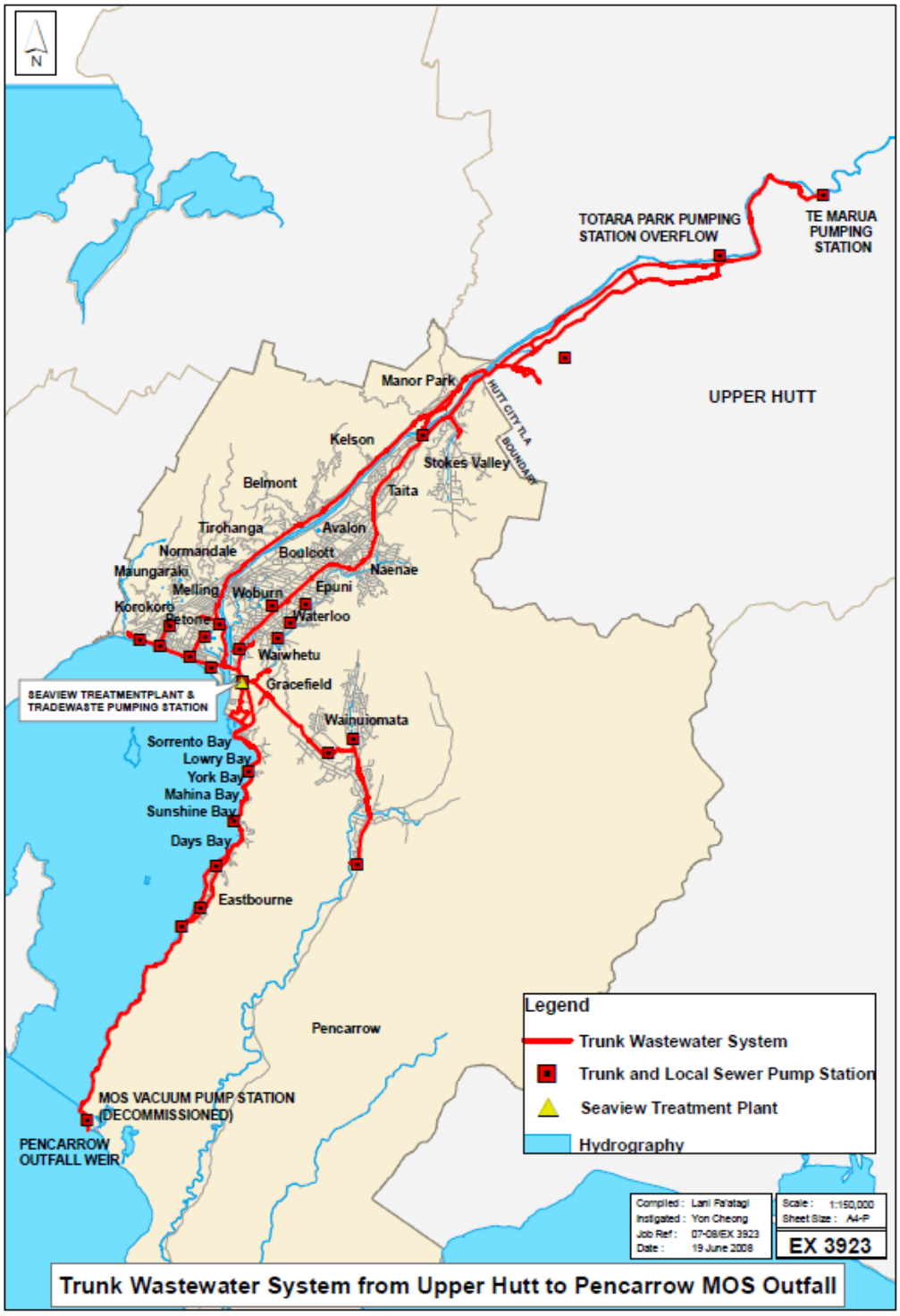


Figure 7. The Hutt Valley Joint Venture wastewater network includes main trunks and major assets within Upper Hutt and Hutt City councils

The Seaview WWTP began operating in October 2001 and was formally commissioned in March 2002. The Seaview WWTP provides secondary biological treatment with ultra-violet (UV) disinfection.

Treated wastewater from the Seaview WWTP is discharged at the Pencarrow Outfall at Bluff Point approximately 500 m southeast of Pencarrow Head (Figure 8).

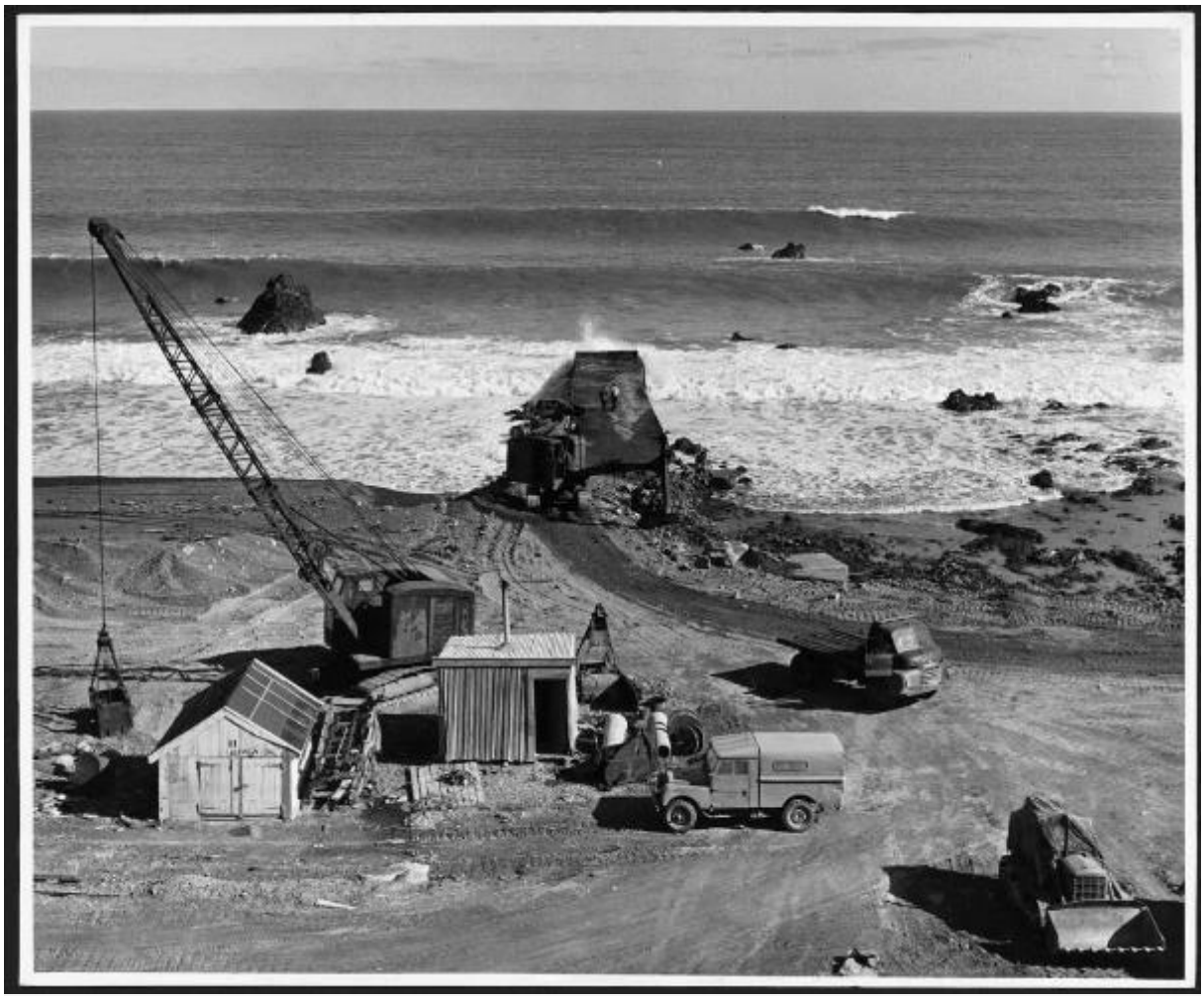


Figure 8. Sewerage outlet at Pencarrow. Dominion post (Newspaper):[3]

The treated wastewater is transported a relatively long distance via an 18 km long pipe. The pipeline was constructed over the period July 1956 to October 1959 and was commissioned in 1962. The pipeline consists of approximately 4,000 pipe sections of pre-stressed concrete rubber ring jointed construction.

A secondary outfall pipe is used to discharge treated wastewater from the Seaview WWTP to the Waiwhetū Stream when the main outfall pipeline is at capacity or needs to be shut down for maintenance.

[3] Sourced from: Photographic negatives and prints of the Evening Post and Dominion newspapers. Ref: EP-Municipal-Sewerage-01. Alexander Turnbull Library, Wellington, New Zealand./records/23173849

As noted in Appendix A, there are four locations in the Upper Hutt wastewater network where partially treated or untreated wastewater is known to overflow to freshwater locations during wet weather events.

- Silverstream storage tank outlet to the Hutt River of partially treated (screened) wastewater. The discharge of screened wastewater at this location is largely a result of how the downstream Hutt City network is operated. In particular, during wet weather and when the network receives increased flow from I&I, the wastewater flow is restricted from entering the downstream Hutt City network by closing down valves in the sewer pipes. As a result, wastewater that cannot pass into the downstream network is discharged into Te Awa Kairangi/Hutt River under a resource consent for emergency discharges.

  In 2016/17 there were 10 events where a total of 243,480 m^3 was discharged to Te Awa Kairangi/Hutt River from the overflow downstream of the Silverstream storage. In 2017/18 there were eight events which spilled 214,927 m^3. This location is the largest regional overflow of wastewater and is well above any generally accepted standard.

- Ashington Road Pump Station (PS 604) (located in the Silverstream sub-catchment upstream of the GWRC Hutt River opposite Manor Park Golf Club monitoring location);

- Weir Grove Manhole (located within the Heretaunga sub-catchment upstream of the Wellington Water Coates Grove stormwater monitoring location), which is monitored in Hulls Creek; and

- Lila Gillies Lane Pump Station (located within the Riverstone Terraces catchment upstream of the GWRC Hutt River at Poets Park monitoring location).

7.2.3 Stormwater network

Stormwater services are essential to the protection of public health impacts and property damage from flooding, ponded water and damp ground. Prior to the Canterbury Earthquakes, flooding was the most costly natural hazard in New Zealand and continues to be a significant source of impact on our communities.

Stormwater pipe networks historically were designed to carry away only the low to medium intensity rainfall events. When the storm intensity exceeds this pipe design capacity then water flows overland and low lying residences and businesses can be at risk of flooding. Increased urban development can result in increased flood risks when more water runs off the land instead of soaking into undeveloped areas and where overland flow paths are altered or restricted.

As stormwater picks up sediment and contaminants, such as petrochemicals, zinc, copper and lead, it can result in harmful water quality where it discharges to streams or coastal waters. Litter, such as plastics and rubbish from streets and properties, can also end up in waterways after being carried there in stormwater. Stormwater from greenfield development in particular can result in excessive discharges of sediment during large scale earthworks and home construction phases.

The Regional Plan and the NPS-FM has introduced new and more stringent provisions for the protection of water quality. In particular, the Regional Plan has new consenting requirements for discharges from the council stormwater network, including the requirement for the development of Stormwater Management Strategies. These strategic documents will link stormwater asset management and land use planning with water quality outcomes. Stormwater management strategies will be used to describe how sub-catchments within a stormwater network will be managed, through time to meet water quality objectives. Specifically, the requirement and use of

stormwater management strategies are referred to in Rules R48A, R50 and R51 of the decision version of the Regional Plan.

Upper Hutt is serviced by a piped network that includes approximately 11 km of open drains, six pump stations and two detention dams (at Heretaunga and Emerald Hill) (Figure 9). Most of the residential properties in the Upper Hutt catchment drain to the piped stormwater network.

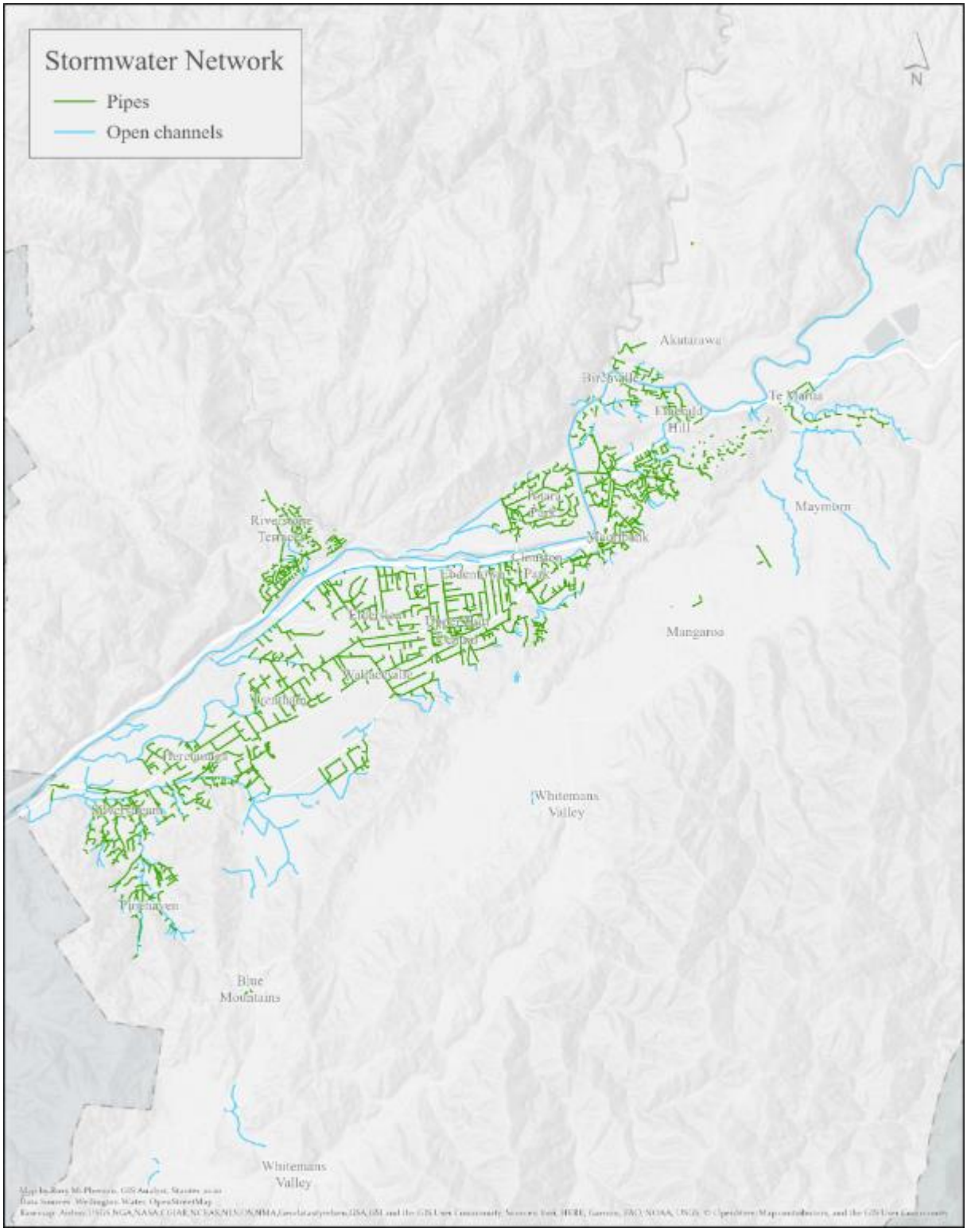


Figure 9. Stormwater network of pipes and open channels in Upper Hutt.

For this assessment three critical pipelines within the existing stormwater network were assessed and are described by the main streets that they are associated with - Fergusson Drive, Gibbons Street and Montgomery Crescent.

- The Fergusson Drive stormwater pipeline is associated with the Trentham and Wallaceville growth areas.
- The Gibbons Street stormwater pipeline drains the Upper Hutt CBD area that includes part of the Maidstone area of the Clouston-Kingsley Heights-Maidstone growth area and portions of Elderslea and Upper Hutt Central-Ebdentown.
- The Montgomery Crescent piped stormwater network drains the Clouston-Kingsley Heights portion of the Clouston-Kingsley Heights-Maidstone growth area

Currently UHCC requires primary stormwater systems to be constructed to a 1 in 25 year ARI standard.

There are three consented locations where the wastewater network overflows into the Upper Hutt stormwater network (see section 7.2.2 above).

7.2.3.1 Flooding from rivers and major streams

Protection from river flooding in the Wellington region, including from the Te Awa Kairangi /Hutt River in Upper Hutt, is managed primarily by GWRC and typically is not managed as part of Wellington Water's stormwater services.

An exception is Wellington Water's project management of a major flood improvement project for Pinehaven Stream. Pinehaven Stream flows to Hulls Creek and then to Te Awa Kairangi/Hutt River at the downstream end Upper Hutt. The stream has a long history of regular flooding events, with the largest recorded event occurring in 1976. Smaller flooding events occur every 1 to 2 years typically. While some upgrades were completed following the 1976 storm, residential dwellings remain at risk of internal flooding with the current level of service well below the UHCC minimum service level.

The flood protection project for Pinehaven Stream is funded by GWRC and UHCC and includes stream widening, upgrades and replacement of stream crossings and the upgrade of several control structures and minor culverts. The works will minimise the impact of flooding on people's lives by increasing the capacity of the stream to cope with 1 in 25 year storm flows and by providing overland flow paths for protection of dwellings up to a 1 in 100 year event including climate change effects. It is important to note that these works are being designed for the current catchment and do not facilitate increased flows from future growth as it is anticipated that future growth will be hydraulically neutral.

8. Results

For this Phase One report, the pre-feasibility solutions needed to support projected growth (as detailed in Appendix B, section 13.4) were identified at the trunk main or catchment-scale. This includes concept-level network upgrades, needed to service growth in one or more suburbs or currently undeveloped areas, such as a shared reservoir, rather than smaller-scale solutions specific to a localised constraint in the network. A few identified upgrades are at a larger system-wide scale, such as the downstream storage options identified for the wastewater network.

The solutions are based on rectifying identified constraints in the network performance for future growth as well as rectifying existing constraints. For example, if there is deficit in reservoir storage for the existing population, the calculated additional needed reservoir volume includes the existing deficit as well as the projected need. In other words, the identified solutions to enable growth, will also bring the existing network up to the appropriate level of service.

8.1 Water supply performance and needed upgrades

8.1.1 Existing water supply system performance

The performance of the current water supply network was summarised from existing information (Wilson, 2019). This includes the results from a hydraulic model calibrated in 2015. The model is considered to be outdated for a number reasons. For example the source data used for the hydraulic model is missing a significant number of dwellings. The hydraulic model for Upper Hutt is currently being updated and will be ready to inform the system performance of the network for Phase Two.

Table 3. Existing network and storage constraints within the Upper Hutt water supply.

Water Storage Area	Minimum Pressure Requirements	Storage Requirements		Storage Surplus / Shortfall
		Operational	Seismic	
Timberlea	*			+2.90 ML
Upper Hutt Central				+0.64 ML
Mount Marua				+0.10 ML
Riverstone Upper	*			+0.32 ML
Sylvan Heights				+0.00 ML
Maidstone				-0.12 ML
Riverstone Lower				-0.17 ML
Pinehaven				-0.25 ML
Emerald Hill	*			-0.57 ML
Plateau Road	*			-0.77 ML

	= Requirement met.
	= Requirement not met.
*	=Minimum pressure requirements may not be met for high elevation properties located near reservoirs. These areas are unlikely to be affected by an increase in dwellings and demand.

8.1.2 Potential upgrades to address existing constraints and service growth

Where the results of this desktop assessment indicate additional storage volume would be required, further investigations would be needed to confirm the actual capacity and reservoir location. Those details would depend on the projected populations being enabled through Plan Change 50 and zoning provisions in the UHCC District Plan.

For this report, a reservoir that would service more than one growth area is generally considered a 'system-wide' upgrade. For these assets the costs for the upgrade are shared proportionally among each relevant growth area based on projected population increase.

High-level investment needed to support growth (detailed in Appendix B, section 13.4) in the water supply network would include approximately 8 ML of additional storage volume, over 11 km of mains, 5 new or upgraded pump stations, a pressure reducing valve (PRV) and associated upgrades to the bulk water network, as described in Table 4 and Figure 10.

Table 4. Pre-feasibility water supply options needed to service projected growth.

Growth Area	Develop-ment	Existing WSA/ constraint	Pre-feasibility Option
Clouston-Kingsley Heights-Maidstone	Primarily greenfield – Kingsley Heights	Maidstone Existing Maidstone reservoir requires seismic strengthening.	A new reservoir 1.0 ML or 1.5 ML (Sensitivity Scenario) at approx. 210 m elevation to replace the Maidstone Reservoir to service the existing population and the new development area of Kingsley Heights. Over 1.5 km of 150 mm diameter main, upgrade of pump station and PRV needed.
Akatarawa	Greenfield - Gillespies	New WSA needed	New connection to the bulk supply would need to cross the Te Awa Kairangi /Hutt River. Assumed that it would be via a new road bridge that is outside the scope of this assessment. New reservoir at approx. 190 m elevation of 1.5 ML to 2.9 ML (Sensitivity Scenario), associated pump station, mains and PRV.
Silverstream -Heretaunga	Infill and greenfield site – Southern Growth Area	Pinehaven and Sylvan Heights WSAs for infill. New WSA needed for Southern Growth Area.	Two new reservoirs (1.3 ML and 1.4 ML), two pump stations, mains and upgraded bulk water pump station.
Pinehaven-Blue Mountains	Primarily greenfield – Southern Growth Area	Pinehaven WSA for infill/ Pinehaven No 1 reservoir is nearing the	Replace Pinehaven No 1 (0.7ML) with a larger 1ML reservoir to service existing and infill population.

		end of its lifecycle. New WSA for greenfield site	
Mangaroa	Greenfield – MacLaren and Old School	Plateau Road	See option for Te Marua growth area.
Te Marua	Infill and Greenfield- Gabites Block	Plateau Road Existing storage deficit	Upgrade of pump station and new reservoir 1.4 ML or 1.7 ML (Sensitivity Scenario). Approximately 2.8 km of 200 mm diameter main and a new 200 mm bulk branch main.
Maoribank	Infill and Greenfield site – Brown Owl School	Timberlea No existing constraints	No upgrades needed.
Silverstream -Heretaunga	Greenfield site – St Patricks Estate	Upper Hutt for Greenfield – St Patricks Estate Minimum pressure likely to be insufficient	Upgrade and extend approximately 330 m of 100 mm to 150 mm main.
Trentham-Brentwood	Infill	Upper Hutt	No upgrades needed.
Trentham	Infill and Greenfield sties – Defence Land and Wallaceville	Upper Hutt	No upgrades needed.
Elderslea	Infill	Upper Hutt	No upgrades needed.
Upper Hutt Central – Ebdentown	Infill	Upper Hutt	No upgrades needed.
Wallaceville	Infill	Upper Hutt	Upgrade approximately 260 m of 150 mm main
Totara Park	Greenfield – Cannon Point	Upper Hutt	No upgrades needed.

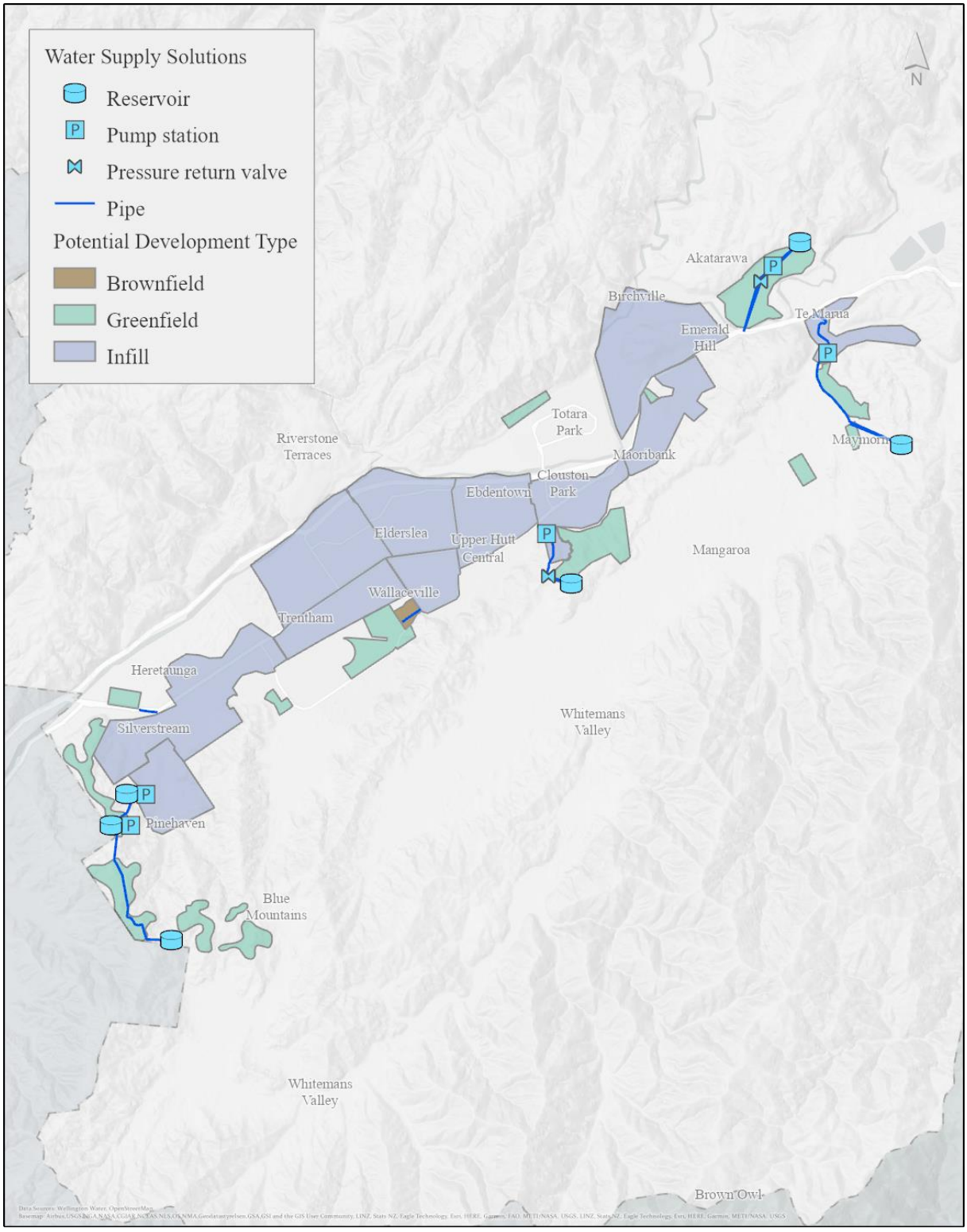


Figure 10. Pre-feasibility solutions for the water supply network to support potential growth at year 2047.

8.1.3 Environmental limitations and interactions

The drinking water supplied to Upper Hutt is sourced from the headwaters of Te Awa Kairangi/Hutt River. Consent conditions limit the amount of water that can be extracted from the river, especially when the river flows are low, without adversely affecting the available aquatic habitat and water quality of the river downstream from where the water is taken.

To avoid the requirement for a new regional supply source, which would be very costly as well as having environmental impact, region-wide reductions in water use and water loss are needed so that the reservoirs required to service the anticipated population growth can be filled from the existing water sources.

In terms of the Upper Hutt water network, urban growth will increase the amount of water required from Te Awa Kairangi/Hutt River at the Te Marua WTP, and increase the headloss within the Te Marua to Karori bulk water main. Without bulk network upgrades, this may compromise water supply to downstream areas within Wellington City.

A programme of works including source management, regional demand management and efficient transfer of water is critical to providing a growing population with a safe and sustainable water supply.

In addition to the environmental considerations associated with water abstraction, the main points of interaction that the water supply network has with the environment are:

- Energy consumption by water pump stations
- The volume of water used directly impacts on the volume of water discharged into the wastewater network
- Construction of reservoirs at appropriate elevations may be in sensitive locations.

8.1.4 Potential planning provisions

Integrated development of district plans, policies and bylaws with water supply planning can help reduce the future cost of water supply. The investment needed to provide water supply services to a growing population could be reduced by:

- Zoning that considers the suitability of housing at elevations or distances from existing or planned reservoirs that affect the ability to provide sufficient supply or pressure.
- Planning provisions that consider the need and the ability to locate a reservoir (and access to) in a protected site.
- Policies and bylaws regarding water use and loss. Demand management to reduce water use from the regional bulk water supply and water loss is needed to avoid the cost of investigating and obtaining an additional water source in the near future.
- Communication, education and behavioural change.

8.2 Wastewater performance and needed upgrades

8.2.1 Existing wastewater performance

This section describes the results of the Phase One assessment and also the results from a recent investigation of potential water quality impacts from the wastewater network.

The existing hydraulic wastewater model was used to assess the performance of the network against the level of service of preventing overflows during the 1-year ARI rain event (see Figure 11).

The hydraulic model results for the existing Upper Hutt population highlight the following:

1. Pinehaven – A lack of pipe capacity in the Pinehaven area results in several overflows during a 1-year ARI. This lack of capacity is mainly associated with the sewer that takes flow to the trunk sewer. The result shows the majority of pipes in this catchment are greater than 80 percent full (indicating a lack of capacity), with local network pipes generally having adequate capacity (being 50 percent full or less).

2. Silverstream – The model predicts the majority of the pipes in this catchment, including the trunk sewer lack capacity. The majority of the pipes are greater than 50 percent full at the modelled 1-year ARI.

3. Trentham – There is lack of capacity in the existing pipe network that takes flow from Rimutaka Prison to the trunk sewer - the model predicts the pipes are greater than 80 percent full during a 1-year ARI.

4. Trentham-Brentwood – The majority of pipes are 50 percent full or less with some pipes that lack capacity being over 80 percent full.

5. Pump Station capacity – The majority of the pump stations in the catchment lack capacity. This results in surcharging in the upstream pipe network or overflows where the flow is constricted at a pump station.

6. The remainder of the catchments show lack of capacity at some branches which discharges to the trunk sewer.

Other than the major overflow location downstream of the Silverstream storage tank, overflows of untreated wastewater can occur at manholes (and gully traps) and at constructed outfalls, which in Upper Hutt, refers to the engineered outlets at pump stations. The hydraulic model was used to predict locations and volumes of wastewater overflows at manholes and constructed outfalls with the existing and future population (Figure 11 and 12 and Table 5).

Overflows predicted from the 2017 base model have not been verified. It is recommended that the overflow locations be reviewed during the Phase Two assessment, including by checking customer complaint records as part of the verification process.

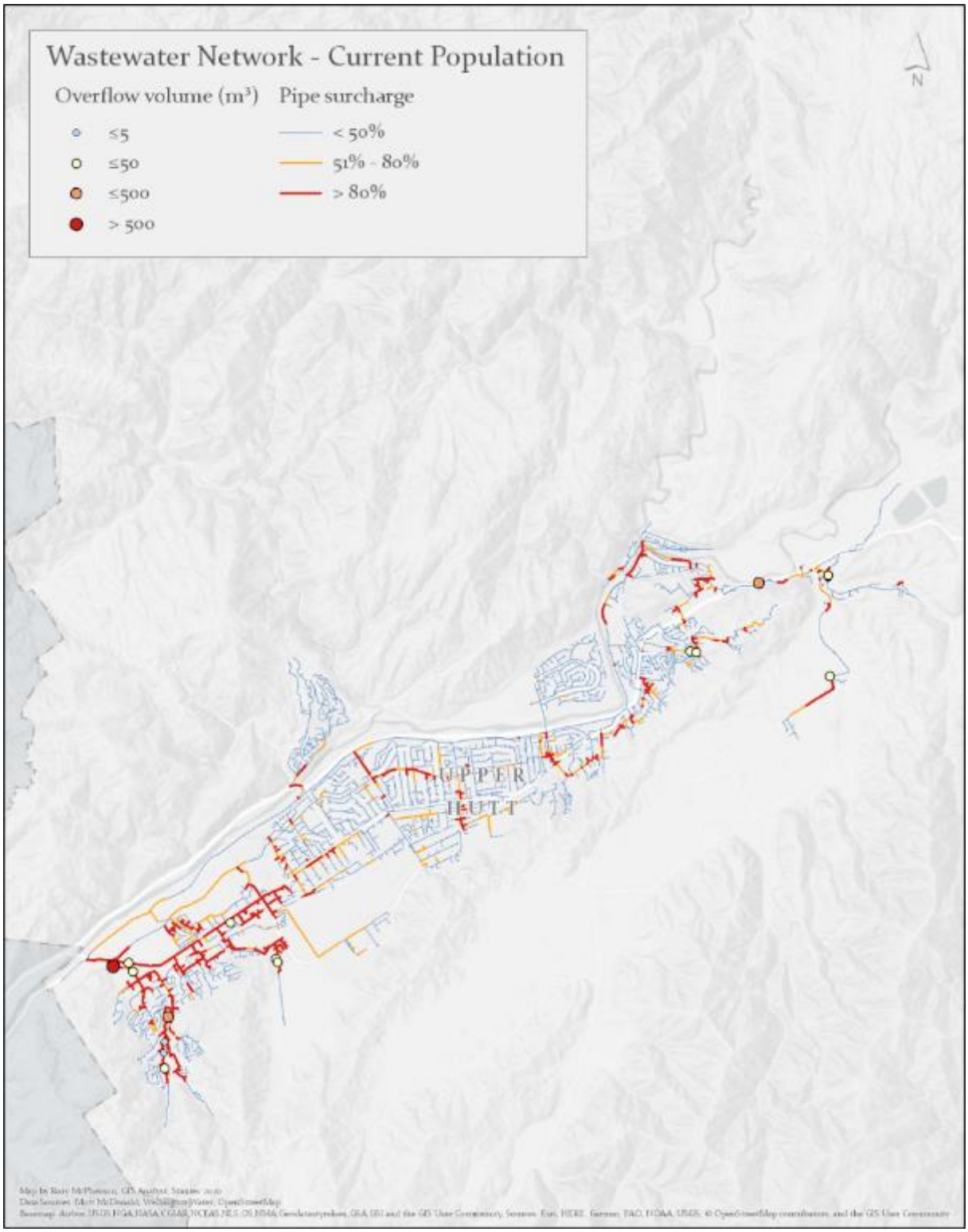


Figure 11. Predicted locations of wastewater overflows with the current population.

For the 2017 existing conditions scenario, the model predicts a total of 18 overflows of untreated wastewater (Table 5). The majority of these are in the Silverstream and Pinehaven growth areas. The model predicts the cause of overflow is the lack of capacity in the local system.

Overflows in Te Marua and Maoribank are caused by lack of capacity in the pump rates at Maymorn Valley Pump Station and Main Street Pump Station.

Table 5. Predicted wastewater overflow volumes in years 2017 and 2047, 1-year ARI.

Scenario	No. of Overflows	Total Overflow Volume (ML)
Existing System, 2017 Population	18	928
Existing System, 2047 Population	39	7,868
Scenario 1	39	7,854
Scenario 2	27	4,126
Scenario 3	40	7,969

In 2019, Wellington Water completed a separate investigation on the potential contribution of *E.coli* from its wastewater network to the rivers and streams of Upper Hutt, and how this potential source of contamination could be reduced (WWL, 2019c). This report also compiled summary information on pipe condition grades, given that structurally poor pipes are more likely to leak during dry weather and contribute *E.coli* and other contaminants to the environment. The information below is summarised from this report.

As noted in the Appendix C, section 14.1 on water quality, the Mangaroa River at Te Marua and the Hutt River opposite Manor Park Golf Club sites, failed to achieve an attribute state of C or above (2014-2019 data).

The Hutt River opposite Manor Park Golf Club site is located at the bottom of the Upper Hutt catchment, downstream of all Wellington Water wastewater infrastructure. The data indicate that whilst the surrounding catchments have the potential to contribute *E. coli*, including the Akatarawa and Whakatikei River catchments, *E. coli* is discharged to Te Awa Kairangi/Hutt River from multiple sources along its stretch between the Te Marua Intake and Manor Park. The assessment (WWL, 2019c) identified no clear correlation with flow or spatial contribution (due to high variability).

Overflow from events, likely rainfall related, impact water quality at the furthermost downstream Te Awa Kairangi/Hutt River monitoring location, resulting in an elevated 95th percentile value above the national target. The 95th percentile value may be lowered, by reducing the frequency and duration of overflows in the suburbs of Heretaunga and Pinehaven, and the main Silverstream storage tank.

The results suggest that the overflows in the Heretaunga and Pinehaven sub-catchments are of sufficient regularity and quantity to be considered dry-weather or baseline (as represented by the 10th percentile values). This indicates that

- The level of service for the wastewater network, which is based on managing overflows during rain events rather than preventing leaks during dry weather, may not be sufficient for achieving the desired water quality of our urban waters.

8.2.2 Potential upgrades to address existing constraints and service growth

The identification of options to prevent overflows was limited to increasing conveyance through pipe duplication and the use of storage. For Phase Two, solutions to optimise performance of the network as a whole, including management of flows between Upper Hutt and the lower network will also be assessed using a comprehensive hydraulic model.

In regards to the major overflows that occur downstream of the Silversteam storage tank, there is an opportunity to reduce the frequency and volume of these overflows through advanced controls based on flow monitoring that would optimise the capacity of the main trunk sewer.

In addition, Wellington Water is seeking resource consent to relocate the secondary discharge of treated wastewater from the Seaview WWTP from the Waiwhetū Stream to the Hutt River. This application is currently on hold. At the same time, a 10ML storage tank is proposed for construction at the Seaview WWTP to store treated wastewater and limit the volume and occurrence of this secondary discharge.

The assessment limitations of this Phase One study and the physical limitations of how the wastewater network is operated, resulted in the sensitivity scenario areas being grouped into 3 scenarios, and the use of a 2017 hydraulic model to assess the existing and future network performance (Mott MacDonald, 2020).

The existing system has significant overflows (see section 8.2.1 above) and population growth (detailed in Appendix B, section 13.4) without investment will make these overflows worse. Even without population growth, parts of the network are predicted to degrade over time resulting in more overflows. The current renewal programme for the public network and the (lack of) inspection and maintenance of private laterals are insufficient to prevent this.

The results of hydraulic modelling indicate in 2047 the overflows from the existing wastewater network would approximately double in number and significantly increase the volume of overflows during wet weather events (Table 5, in section 8.2.1 above, and Figure 12 below). This is a result of increased flows from connecting an additional 13,000 people to the network as well as the assumed deterioration of the network over time (which is a modelling assumption).

The main reason for the increased number and volume of overflows in the year 2047 is the predicted increase in I&I during storm events. The 2015 model calibration shows the catchment suffers from I&I and therefore the Ground Infiltration Model was applied to the model and in accordance with the Regional Wastewater Modelling Specification, an adjustment is applied to the model to account for future deterioration.

The 2047 model predicts a significant increase in flow due to increased I&I. This large increase in I&I masks the contribution that growth has on wastewater flow.

At this time, it is not possible to assess the impact of growth on the network due to the large inflow and infiltration entering the system. For Phase Two, a series of sensitivity assessments will be conducted that varies the level of I&I as a way to separate out the impact on the network that is specific to growth.

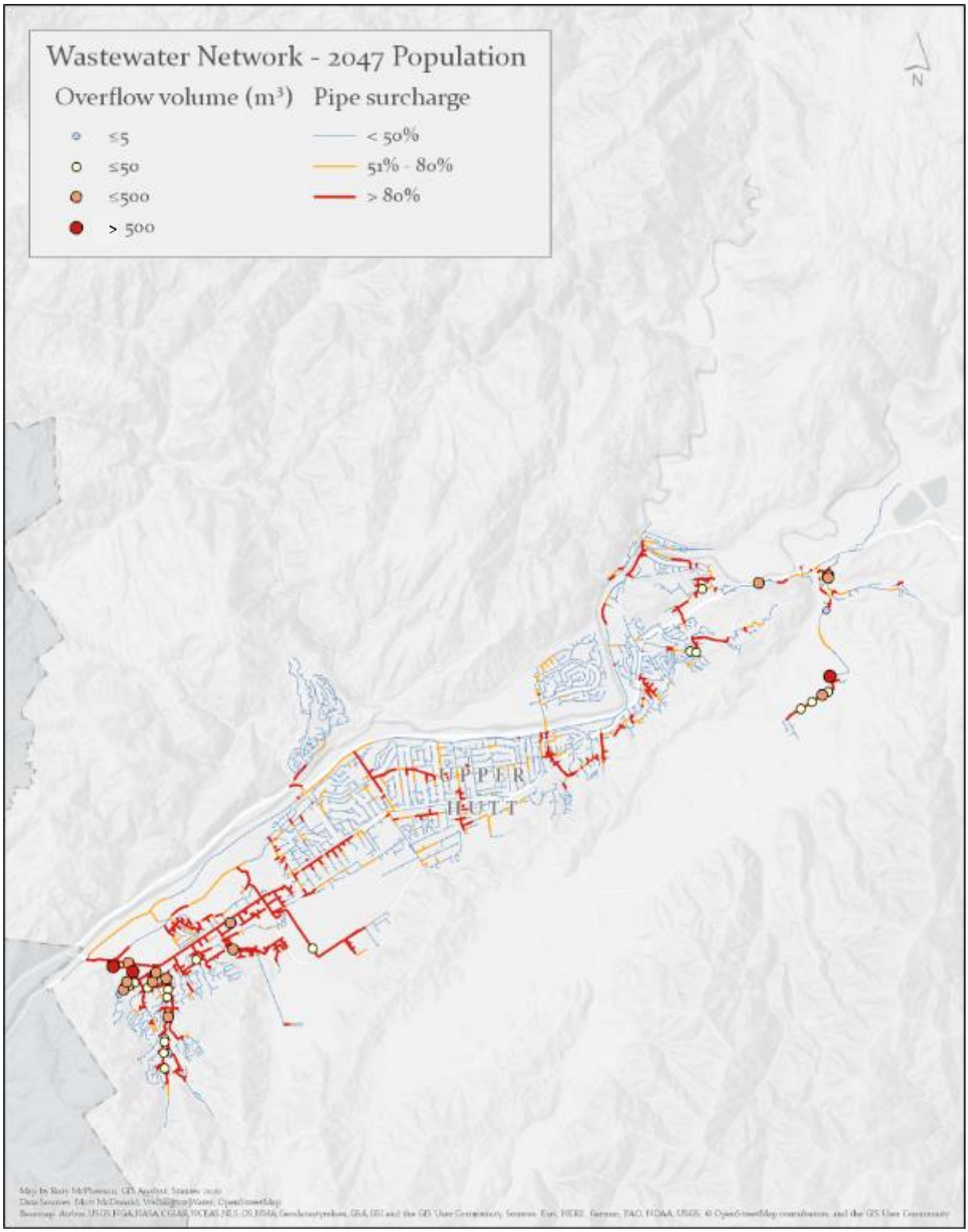


Figure 12. Predicted locations of wastewater overflows with the 2047 population

Without investment in the wastewater network to accommodate predicted urban growth, the frequency and volume of wastewater being released into the environment without treatment will significantly increase leading to increased impacts on the receiving environment. The volume would be approximately 8.5 times greater. This is due largely to a lack of capacity in the 375 mm diameter sewer which gravitates to the Silverstream tank.

For the 2047 scenario, the predicted overflows at Te Marua and Emerald Hill are due to lack of capacity in the pumps and lack of adequate storage at the pump stations.

For Mangaroa catchment, population growth is not been predicted in 2047 (detailed in Appendix B, section 13.4). The base model predicts surcharging in the system but no overflow. However, the model results for 2047 shows overflow at two locations, with total spill volume of 56 m^3. These overflows are caused by catchment deterioration rather than growth.

The base model for the Mangaroa catchment shows total foul flow is 0.81 l/s and 4.3 l/s for runoff surfaces. The 2047 model shows total foul flow is 0.74 l/s and 4.94 l/s for runoff surfaces. This is an increase of 14 percent in runoff due to catchment deterioration. The reduction in foul flow in 2047 is based on the assumption that water saving devices will be fitted to residential properties by 2047 as per the modelling specification.

For the Trentham catchment, which has the largest projected growth of 1,070 dwellings, the model predicts total foul flow is approximately 42 l/s and total runoff is 90 l/s with the current population. For the 2047 population, the model predicts total foul flow of 52 l/s and total wet weather (runoff) is 131 l/s. This represents a 25 percent increase in foul flow but 46% increase in wet weather runoff due to catchment deterioration.

Pre-feasibility solutions to prevent any overflows of 2 m^3 or more during a 1-year ARI wet weather event with the predicted population growth include increasing pipe capacity of specific trunk mains, pump capacity and storage. . This is a conservative approach as it does not account for over predication by the model.

System-wide upgrades that had estimated costs apportioned among all growth areas include a 25ML storage tank at the downstream end of the wastewater catchment, which is upstream of the existing 10ML storage tank at Silverstream, as well as upgrades in the capacity and treatment of the Seaview WWTP. These system-wide upgrades and the other upgrades needed are shown in Table 6 and Figure 13.

Table 6. Wastewater upgrades needed to service population at 2047.

Upgrade option	Length (m)	Diameter (mm)	Volume (m^3)	Cost sharing notes
Pipe Duplication				
Pinehaven/Blue Mountains	3,834	450		
Silverstream-Heretaunga	585	500		
Silverstream-Heretaunga	540	750		
Silverstream-Heretaunga	252	450		
Silverstream-Heretaunga	660	150		
Silverstream-Heretaunga	197	300		
Silverstream-Heretaunga	197	300		
Trentham/Silverstream-Heretaunga	1840	300		
Maoribank	202	225		

Emerald Hill-Birchville	352	300		
Mangaroa	477	225		
Te Marua	416	225		
Total pipe	**9,136**			
Storage				
SPS8_WEIR			160	
MAYMO1176SM/2			3,000	
In addition to Silverstream tank			25,000	System-wide, Hutt Valley Joint Venture
Total Storage			**28,160**	
Pump Station				
SPS_54MAINRNDT 50 L/sec			160	
Seaview WWTP				
25% upgrade				System-wide, Hutt Valley Joint Venture

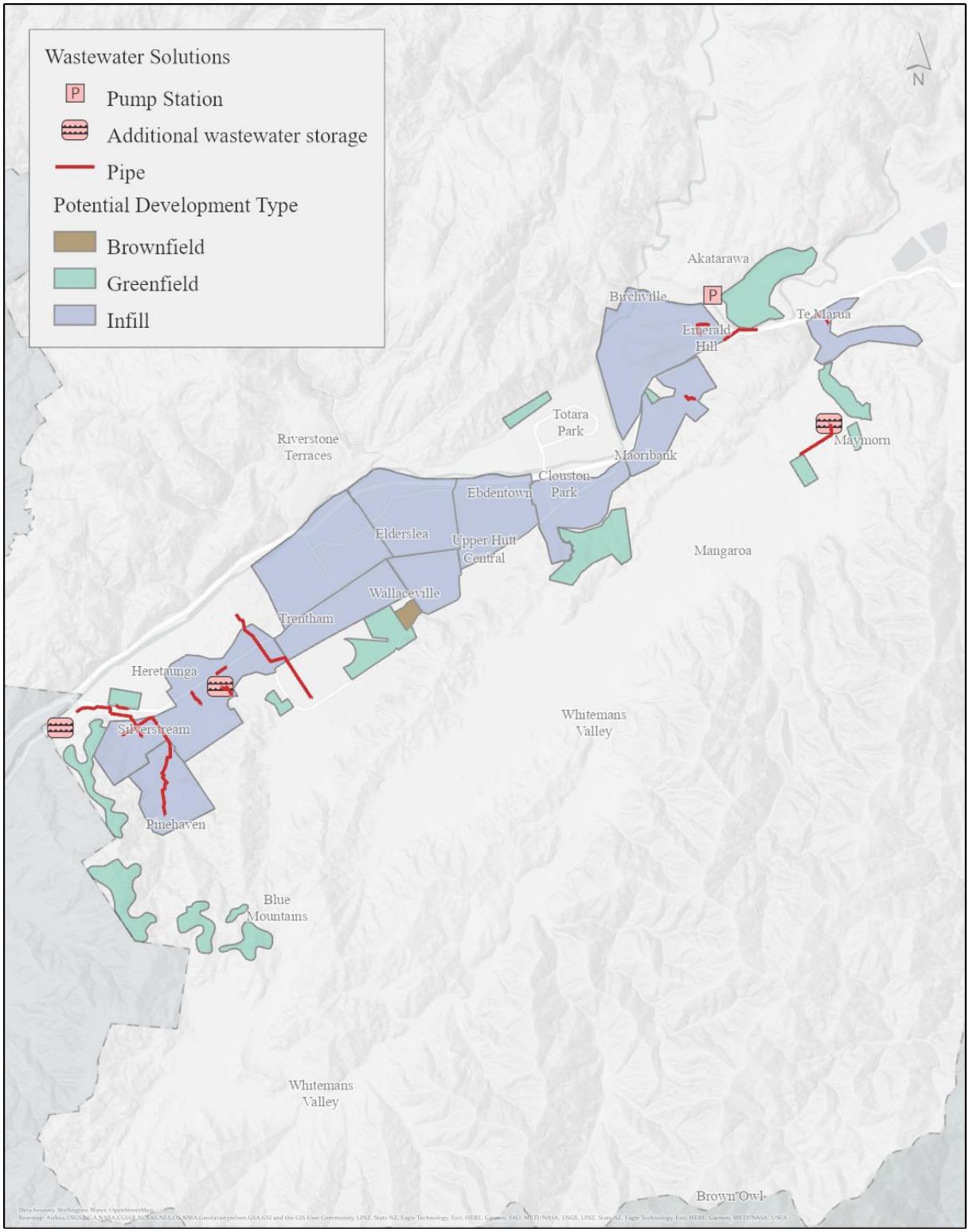


Figure 13. Pre-feasibility solutions for the wastewater network to support growth at year 2047.

Regarding the identified need for an upgrade to the WWTP, all of the wastewater from Upper Hutt is conveyed to the Seaview WWTP for treatment and disposal. Therefore the total predicted 30-year urban growth for the Seaview WWTP is approximately 13,000 more people for Upper Hutt plus approximately 25,000 people for Hutt City for a total of 38,000 additional people by the year 2047.

The capacity of the Seaview WWTP will need to be upgraded to accommodate the 30-year projected growth in Upper and Lower Hutt. At a high level, Wellington Water estimates that 38,000 more people will require an approximately 25 percent expansion in the capacity of the WWTP.

At this time there is not enough information to estimate the cost of this upgrade using the method outlined in this report. Instead, the upgrade was costed based on the existing valuation of the plant and an assumption that a 25 percent expansion would have a base cost of 25 percent of this valuation. The final estimate takes into account a contingency cost for such a high level estimate and a recognition that the costs would be shared with Lower Hutt. It was assumed, for this report, that the proportion of cost for Upper Hutt would be 30 percent. In addition, the pre-feasibility cost estimate for this 'system-wide' upgrade was shared proportionally among each of the 13 growth areas assessed based on projected population increases.

Identified needed upgrades associated with Hutt Valley Joint Venture assets were limited to the upgrade of the Seaview WWTP and a 25ML storage tank at Silverstream. For costing purposes, Upper Hutt's financial responsibility for Hutt Valley Joint Venture assets were assumed to be 30 percent.

Table 7. Pre-feasibility options for wastewater needed to service projected growth at year 2047.

Growth Area	Develop-ment	Existing constraint	Pre-feasibility Option
Akatarawa	Greenfield - Gillespies	No existing public reticulation in greenfield site.	Pump station and connection to trunk main as well as contribution to system-wide upgrades (WWTP and storage at Silverstream).
Mangaroa	Greenfield – MacLaren and Old School	No existing public reticulation in greenfield site.	Approximately 500 m of pipe duplication and a 3ML storage tank needed to address network degradation even with no growth. Growth in greenfield sites included as sensitivity test only, in Scenario 2. Growth would need to contribute to system-wide upgrades (WWTP and storage at Silverstream).
Trentham-Brentwood	Infill	Approximately 1 km of surcharging pipes	Growth would need to contribute to system-wide upgrades (WWTP and storage at Silverstream).
Trentham	Infill and Greenfield sites – Defence Land and Wallaceville	Approximately 1.5 km of surcharging pipes	New 160m^3 storage tank needed plus contribution to system-wide upgrades (WWTP and storage at Silverstream).
Clouston-Kingsley	Primarily greenfield –	Approximately 1.3 km of	Contribution to system-wide upgrades (WWTP and storage at Silverstream).

Heights-Maidstone	Kingsley Heights	surcharging pipes	
Elderslea	Infill	Approximately 1.3 km of surcharging pipes	Contribution to system-wide upgrades (WWTP and storage at Silverstream).
Upper Hutt Central – Ebdentown	Infill	approximately 500 m of surcharging pipes	Contribution to system-wide upgrades (WWTP and storage at Silverstream).
Wallaceville	Infill	No existing constraints	Contribution to system-wide upgrades (WWTP and storage at Silverstream).
Maoribank	Infill and Greenfield site – Brown Owl School	2 overflow locations and approximately 1.5 km of surcharging pipes	Approximately 200 m of pipe duplication and contribution to system-wide upgrades (WWTP and storage at Silverstream).
Te Marua	Infill and Greenfield-Gabites Block	2 overflow locations and approximately 500 m of surcharging pipes	Over 400 m of pipe duplication and contribution to system-wide upgrades (WWTP and storage at Silverstream).
Totara Park	Greenfield – Cannon Point	No existing public reticulation in greenfield site	Contribution to system-wide upgrades (WWTP and storage at Silverstream).
Pinehaven-Blue Mountains	Primarily greenfield – Southern Growth Area	4 overflow locations and approximately 3.5 km of surcharging pipes	Over 3.8 km of pipe duplication as well as contribution to system-wide upgrades (WWTP and storage at Silverstream).
Silverstream-Heretaunga	Infill and greenfield sites – Southern Growth Area and St Patricks Estate	1 overflow location and over 11 km of surcharging pipes	Over 4 km of pipe duplication as well as contribution to system-wide upgrades (WWTP and storage at Silverstream).

8.2.1 Environmental limitations and interactions

During heavy rain events, stormwater, groundwater, and even seawater can enter the wastewater network resulting in overloading the capacity of the wastewater networks and overflow to the environment. These overflows are exacerbated by cross connections where stormwater downpipes are incorrectly connected into the wastewater system.

The pipes that make up the wastewater network are aging and prone to leaking and overflowing of untreated wastewater in rain events. It is important to acknowledge that 50 percent of the I&I is generally assumed to be from private laterals which are currently outside of Wellington Water's management. Network capacity constraints and declining condition of public and private pipes, coupled with population growth, and sea level rise may result in increased overflows and contamination of receiving waters, social and cultural offense and risk to public health.

The level of service for the wastewater network, which is currently based on managing overflows during rain events rather than preventing leaks during dry weather, may not be sufficient for achieving the desired water quality in the region's streams, rivers and coastal waters under the NPS-FM.

Wastewater can impact the health of urban waters in a number of ways, as indicated by Figure 14.

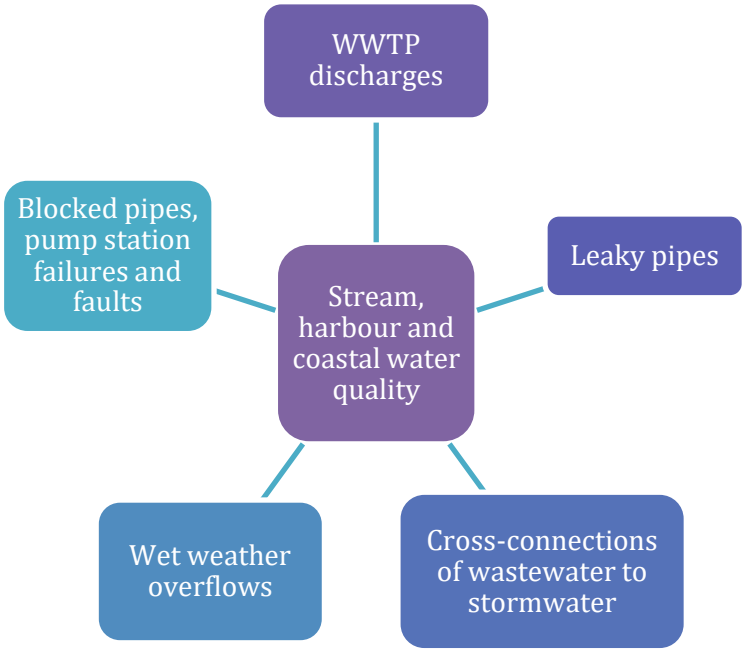


Figure 14. Impacts of wastewater on the health or urban waters.

Wellington Water's approach to managing receiving water impacts has shifted from the past approach of focusing on treatment plant upgrades, to a focus on investing in the overall network. This approach considers the impacts of the whole network and the benefits that can be achieved by reducing overflows, improving capacity, fixing leaking pipes and identifying and addressing leaking laterals, cross-connections and faults on private properties.

It is anticipated that considerable investment in the wastewater network, including investment in the assets which are part of the larger Hutt Valley Joint Venture, will be needed to meet the required national bottom line in the NPS-FM (that streams are suitable for primary contact recreation) and to enable urban growth in Upper Hutt.

A recent report commissioned by Wellington Water addressed the potential impact of dry weather leaks on the health of urban waters in Upper Hutt (WWL, 2019c). The results of this report identified a preliminary cost of $160M to renew or rehabilitate poor condition wastewater pipes and 20 percent of all private wastewater laterals.

For this Phase One assessment, a separate cost estimate was made for renewing all pipes within the potential growth areas that have a condition grade of 4 or 5 for the purpose of reducing dry weather leaks as well as wet weather I&I. This resulted in an estimated cost of over $700M. The difference in cost between the two studies on replacing poor condition pipes reflects that the two assessments did not share similar assumptions, methods or problem statements. Nonetheless, numerous assessments have shown that replacing all poor condition pipes in an effort to reduce I&I would cost at least 3 times (and for this study, over 6 times) the cost of providing increased storage. In addition, the outcome of replacing all poor condition pipes is uncertain as poor condition pipes do not always correlate with the largest incidents of dry weather leaks or wet weather I&I.

8.2.2 Potential planning provisions

Integrated development of district plans, policies and bylaws with wastewater planning can help reduce the future cost of wastewater conveyance, treatment and disposal. The investment needed to provide wastewater services to a growing population could be reduced by:

- Planning provisions that enable housing at locations that affect the ability to provide adequate wastewater services.
- Planning provisions that affect the ability to locate, build, operate and maintain key assets (such as storage tanks).
- Policies and bylaws regarding the wastewater network and private laterals. Currently Upper and Lower Hutt do not have wastewater bylaws that could be used to ensure inspection and maintenance of private laterals.
- Communication, education and behavioural change.

8.3 Stormwater performance and needed upgrades

8.3.1 Existing stormwater system performance

Upper Hutt is generally considered to have a relatively good level of protection from stormwater flooding, given the highly permeable soils under most of the developed area. As development moves up into the hills there is a potential for increased flooding if adequate designs are not used to manage increased run-off.

Given the lack of a hydraulic model for the majority of Upper Hutt, the risk of flooding from a 100-year rainfall event is unquantified. As noted in Appendix A, section 12.1.5, reliable flood modelling is available only for river and stream flooding associated with Te Awa Kairangi/Hutt River, Mangaroa River and the Pinehaven Stream. Flooding from stormwater run-off during an extreme event will be predicted by a hydraulic model that is currently being built and will be available for the Phase two assessment.

Without reliable predictions of stormwater flooding, identification of options to alleviate flooding are conceptual at best. Therefore, a long list of potential stormwater mitigation options was prepared for this report with a focus on treating stormwater to improve water quality across the Upper Hutt catchment as well as supporting anticipated growth. These options were based on a variety of existing information (Connect Water, 2020), including:

- Wellington Water's GIS database of the existing piped and open channel network
- Pipe capacities for pipes within the Upper Hutt stormwater network assigned as part of a stormwater asset valuation undertaken by UHCC in 2007
- The Soakage Testing: Purvis Street, Upper Hutt report produced by Pattle Delamore Partners Limited in 2016
- The Double Ring Infiltration Testing Upper Hutt Site Report produced by Geotechnics Limited in 2017
- Properties at risk from key stormwater infrastructure failure
- An extract of recorded flooding incidents between 1995 and 2019 for the Upper Hutt catchment from the UHCC service requests database
- The mapped Hutt River 100-yr flood extent from GWRC
- The mapped Pinehaven Stream 100-yr flood extent from UHCC
- The mapped Mangaroa River 100-yr flood extent from GWRC
- Modelling results from pre 2000 modelling carried out by various consultants for Upper Hutt City Council
- The Mott MacDonald Upper Hutt Stormwater Drainage Network: System Performance Report produced in 2016
- The Mott MacDonald Upper Hutt Stormwater Option Assessment: Option Analysis Report produced in 2016
- Connect Water preliminary overland flow path mapping exercise

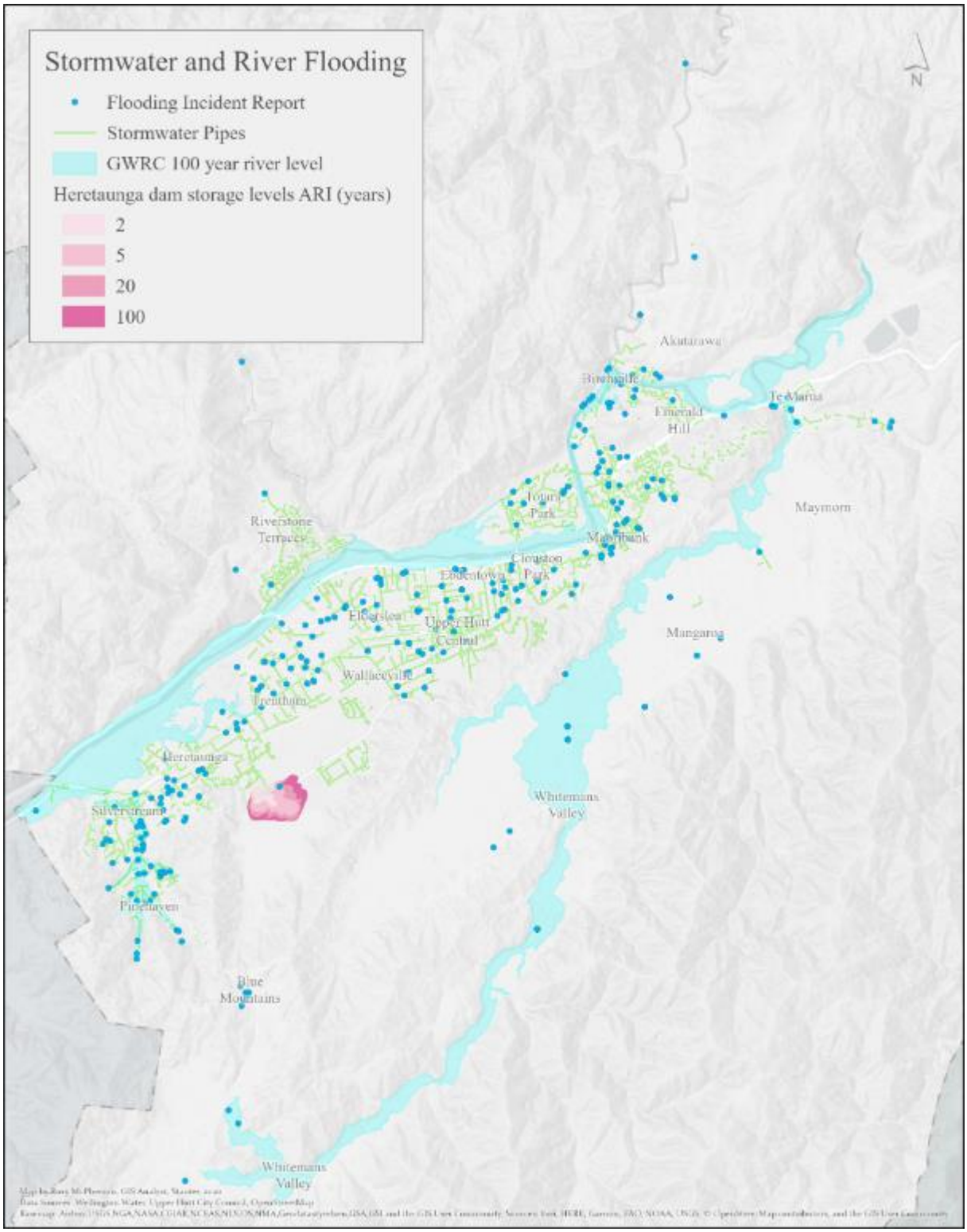


Figure 15 Existing stormwater piped network, 100-yr flood extent for the Hutt River and Pinehaven Stream, Heretaunga Dam capacity and recorded flooding incidents.

The pipe capacities assessment undertaken as part the UHCC stormwater asset valuation in 2007 indicates several pipes are predicted to have capacity issues in the central area of Upper Hutt within the growth areas of Trentham, Wallaceville, Clouston-Kingsley Heights-Maidstone portions of Elderslea and Upper Hutt Central-Ebdentown.

The assessment identified three pipelines of high importance to servicing growth over the next 30 years due to the size of their contributing catchments and that these pipelines will convey stormwater flows originating from growth areas identified for development in the initial drafting of Plan Change 50. These were assigned the names of the main streets they run under and are briefly discussed below.

- **Fergusson Drive** – The assessment indicated that part of the pipeline running under Lane Street has capacity issues. In addition to this, pipes running under Ward Street, Heretaunga College and Fergusson Drive were predicted to have capacity issues.

- **Gibbons Street** – The stormwater pipeline running under Gibbons Street drains a residential area with some large commercial buildings and associated car parks. The majority of the pipeline is predicted to have capacity issues to its outfall at an open drain just south of SH2.

- **Montgomery Crescent** – The stormwater pipeline running under Montgomery Crescent drains a large industrial area with a significant amount of impervious hardstanding. The assessment indicates there are capacity issues along most of the pipeline.

For more information on each pipeline please refer to the Connect Water (2020) Upper Hutt Catchment Management Plan for Growth (Phase 1) Stormwater Network Assessment report.

The flood extent for Pinehaven Stream is known to impact several existing properties and the works to protect people and property are discussed Appendix A in section 12.1.5.

The flood extent for the Hutt River indicates that flooding would be a major constraint on development of the Gillespies Block greenfield site located in the Akatarawa growth area.

8.3.2 Potential upgrades to address existing constraints and service growth

Future development is assumed to not increase the risk of flooding through the requirement for hydraulic neutrality and the use of designs that avoid flood hazards, such as through location or floor height, and which achieve hydraulic neutrality, such as with on-site detention or soakage. Therefore, upgrades to reduce stormwater flooding and enable future growth are typically upgrades needed to address existing issues and constraints. It is possible, however, that catchment-sized upgrades could also be designed to service the hydraulic neutrality needs of future development.

Without a reliable hydraulic model for the stormwater network (which will be available for the Phase Two assessment) it is difficult to anticipate what upgrades to the existing stormwater network would be required. Therefore, for this Phase One assessment the identification of upgrades was kept quite broad and focuses on “easy wins” that should be investigated further if the opportunity arises (such as a new development proposal) prior to the Phase Two assessment.

Potential upgrades include:

- a length of stormwater pipe on Cruickshank Street to be upgraded to convey the 10 or 25-year flood flow

- potential storage sites, including widening of existing open channels, to manage the volume and peak flow of stormwater within the network

- impervious areas (existing car parks) that could be redesigned with pervious pavements to manage peak flows and provide water quality treatment

- combination of redesigned pervious pavement with underground storage

- rain gardens associated with existing car parks to provide water quality treatment
- potential wetland sites at the bottom of the catchments to provide water quality treatment.

The results of the Phase One assessment (Connect Water, 2020) indicate that discharging stormwater to ground may be possible within a majority of the catchment (as shown in Figure 16). It is therefore proposed that new development should consider stormwater infiltration design prior to discharging into the piped network.

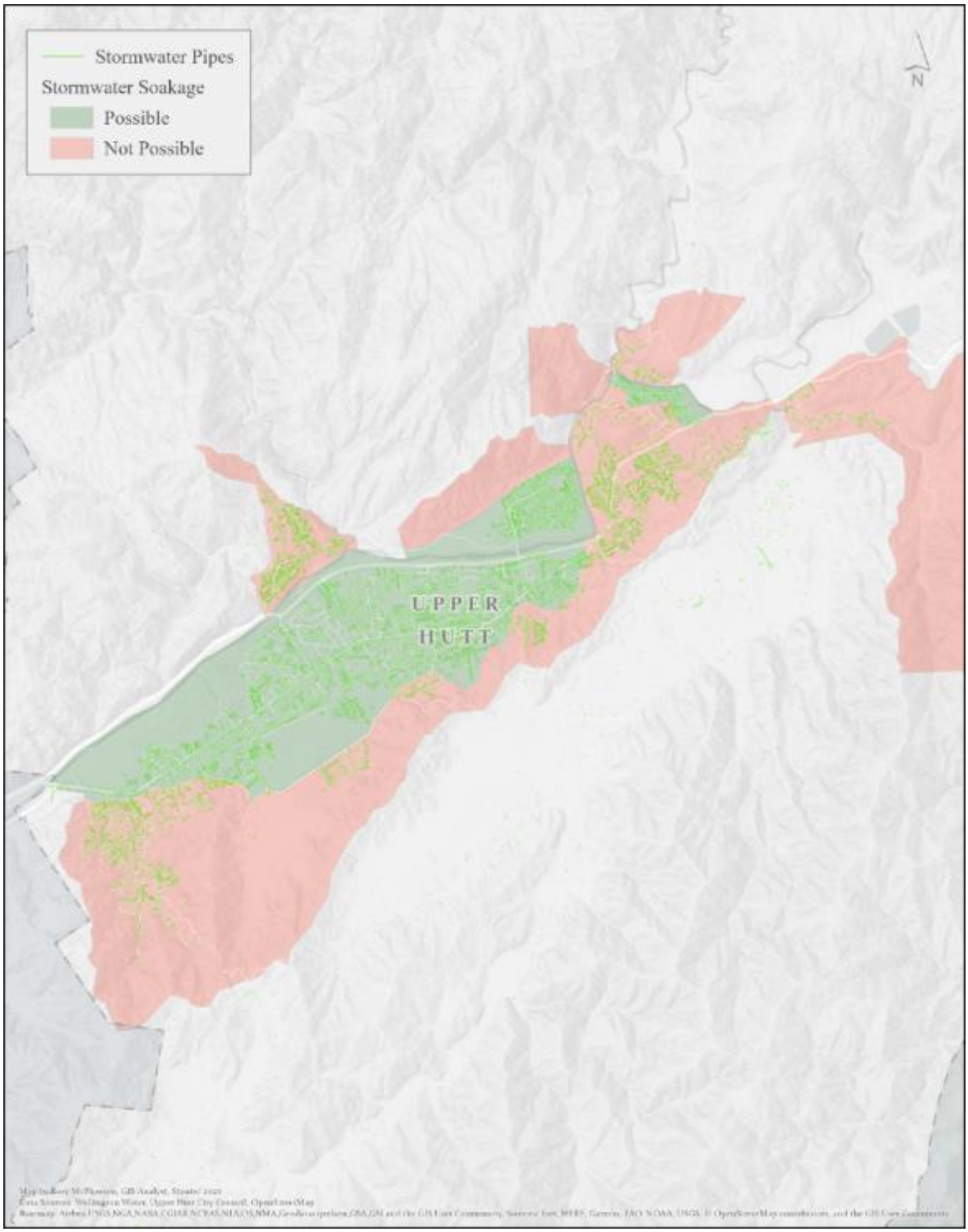


Figure 16. Known locations in Upper Hutt likely to be suitable for on-site soakage of stormwater are indicated in green (Source: UHCC).

The potential locations for wetlands, raingardens and pervious/storage options are illustrated in Figure 17. As mentioned previously, these options have not been costed or refined into a prioritised short list of recommended options, given the preliminary nature of the assessment. Therefore, the locations for potential storage and pervious pavement identified in Figure 17 are indicative only. In addition, design feasibility would be subject to site specific infiltrating testing and groundwater monitoring to ensure groundwater levels would not inhibit the discharge of stormwater to ground at

the site, as well as consultation with private landowners and Upper Hutt's Parks and Reserve departments.

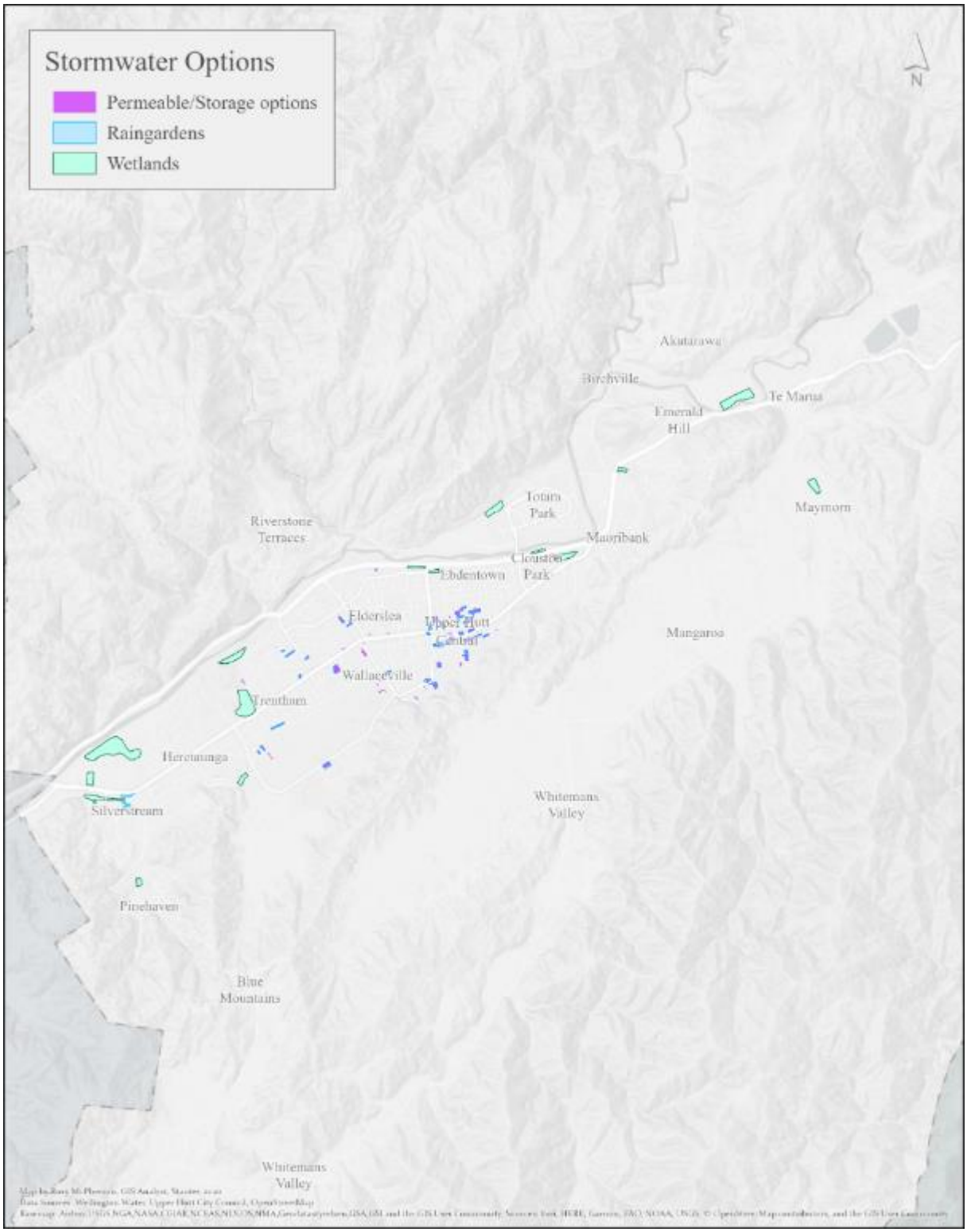


Figure 17. Locations of options pervious pavements/storage areas, wetlands and raingardens.

For infill areas, it can be difficult to find locations that can be used for soakage, detention and treatment given the areas have largely been developed. Therefore, the solutions are likely to be shared across development areas, similar to water supply reservoirs that service more than one development.

Fergusson Drive – the catchment is a mixture of residential and industrial development with a large amount of impervious area. It is proposed that the stormwater runoff from this area is attenuated and discharged at a restricted rate into the network to alleviate the downstream capacity issues. Figure 17 shows some potential areas that could be used for storage and four existing carparks that could potentially be converted into pervious paving[4]. These car parks equate to a total surface area of circa 13,675 m^2.

Gibbons Street –Two large carparks are identified as potential sites for pervious paving – the Brown Street (Council/MetLink) car park and the PAK'nSAVE car park. Two additional areas of open space have been identified for potential underground storage to provide an opportunity to store and infiltrate stormwater. The total surface area for the two identified car parks equates to approximately 23,300 m^2.

Montgomery Crescent – Two sites are identified that would require property purchase to make space for stormwater storage. These are 72 Montgomery Crescent and 75-79 Montgomery Crescent which has been identified as a potential location to increase the capacity of an open drain and provide stormwater storage for part of the Kinglsey Heights greenfield site. A third site on the opposite side of the railway line could attenuate stormwater runoff from the Kingsley Height greenfield site. It is noted that consultation with KiwiRail would be needed to assess the suitability of this site given its proximity to the railway line.

In addition to the proposed storage areas there is an option to upgrade the stormwater network under Cruickshank Road. This would enable the stormwater network to convey flows from part of the proposed Kingsley Heights future growth area. The head of the pipeline running under Montgomery Crescent could be re-routed into this pipe upgrade to alleviate some of its existing capacity issues.

The upgraded stormwater pipe would approximately be 650 m in length and discharge into the open drain adjacent the Rimutaka Rugby Club playing fields. This would require the existing stormwater network pipe run from the McHattie Lane junction to the outfall to be upsized to accommodate the addition flows. The size of the upgrade should be investigated as part of hydraulic modelling exercise to be undertaken in Phase 2.

Given the anticipated need to improve the health of urban waters in Upper Hutt, stormwater treatment will be needed for both the existing developed areas as well as the future developments. The design and use of pervious pavement, rain gardens and wetlands were based on the guidelines in the new Wellington Water technical specification on water sensitive design (WWL, 2019d).

The identification of locations for potential raingardens were limited to the locations identified for pervious paving. The raingardens were sized to treat the stormwater from the carpark and connected roof area.

The identification of locations for potential wetlands was based on existing open areas located in the downstream sections of the catchments. These sites are discussed in Table 8.

For greenfield sites, solutions to achieve hydraulic neutrality and stormwater quality would be internal to the site and the cost borne by the developer. Given that many of the greenfield sites are proposed in hilly terrain, it is possible that a developer may wish to "defer" stormwater treatment to a site further downstream, such as a created wetland, that is outside of the greenfield area. We also

[4] Please note that no discussions have occurred about these options with land owners.

note that for some areas of the Southern Growth Area greenfield sites the requirements for hydraulic neutrality are defined in the UHCC District Plan.

Table 8. Long list of potential wetland sites

Name/Location	Growth area	Feasibility	Reasoning
Brown Owl	Brown Owl School greenfield site	Low	High earthquake risk, significant sloping, and a SLUR site adjacent to the area reduces feasibility, however a retention dam present could be used for a wetland
Maoribank 1&2	Kingsley Heights greenfield site Clouston Park - Kingsley Heights/Maoribank	Low	Area is used as rugby field, and also has significant sloping therefore reducing feasibility
Tulsa Park	Cannon Point greenfield site	High	Located adjacent to a greenfield development making it a suitable location, however feasibility may be lessened by the nearby fault band
Riverbank Park 1&2	Central, Clouston Park	Medium	There is a playground nearby and so placing a wetland adjacent could reduce public amenity. Second area is not near playground so may be more feasible
Moehau Park	Wallaceville/Trentham/Elderslea	Medium	Location is near fault band and is within SLUR site, as well as the area being used for dog training club, reducing feasibility
Trentham Memorial Park	Trentham	Medium	Area used for sports fields, so less feasible
Heretaunga Park	St Patricks Estate Greenfield/Silverstream-Heretaunga	Medium	Area is within a SLUR site containing underground tanks which may need to be removed when installing a wetland. The area also used for sports fields reducing feasibility
Defence Land	Defence land greenfield	High	Location is within a greenfield area with nearby channel giving it high feasibility

Silverstream 1, 2&3	Defence land/Silverstream/ Pinehaven-Blue Mountains	Low	A SLUR site is within the area, and significant sloping is also present reducing feasibility. Area also does not have a large amount of open space
St Patricks Estate	St Patricks Estate greenfield	Medium	Area is within a SLUR site containing underground tanks which may need to be removed to install a wetland (same SLUR site as Heretaunga Park). However location is within a greenfield development and a wetland could match with district plan guidelines of having developments in the area be "low-profile with an emphasis on landscaping"
Pinehaven Reserve	Pinehaven/Blue Mountains	Medium	Currently a reserve used by scouts therefore reducing feasibility
Gillespies Block	Gillespies greenfield	Medium	Fault band is close to this location meaning earthquake risk may be too high. However it is within a greenfield area making it suitable for treating future developments' runoff
Maymorn	Gabites and Old School Road greenfield sites	High	Location is within greenfield area, and there is some evidence of contaminated land being removed making it quite feasible. There is also a pond in the area, which could be converted to wetland

8.3.1 Environmental limitations and interactions

Urban intensification and the change in land use from rural to urban has the potential to result in

- significant hydrological changes
- adverse effects on the health of urban waters.

Stormwater management relies on a mix of infrastructure, planning and building controls, emergency response and community preparedness to protect people and property from the risks of flooding as illustrated in Figure 18. Robust management requires the integration of these measures to effectively management the effects of growth and redevelopment.

Figure 18. Stormwater management relies on the interaction of infrastructure, planning controls and emergency response and community preparedness.

Development associated with population growth can be designed to avoid the unacceptable risks of flooding, for example by building above the flood level, and to avoid increasing the risk of flooding to others by not increasing the peak volume of runoff and by not impeding overland flow paths.

Without the use of development and planning controls that require stormwater to be managed so that flooding is not increased, urban development coupled with increased rainfall durations and intensities predicted from climate change will result in larger volumes of water, increased demand on the stormwater system and increase risks of flooding to people and property.

As detailed in Appendix A, section 12.1.5 (Level of service), Plan Change 42 for the UHCC District Plan is a good example of planning provisions that require stormwater management as a condition of subdivision and development.

In addition, contaminants in stormwater runoff from urbanised areas typically include sediment, especially during construction, as well as zinc, copper, lead and hydrocarbons. Urban catchments also have a higher risk of hazardous materials from contaminated land, landfills and industrial sites getting into the stormwater.

Elevated microbial and nutrient levels can result from urban stormwater runoff and a result of leaky and cross-connected wastewater pipes, dog droppings and fertiliser use on gardens and lawns. Some of the stormwater network within the Whaitua conveys a dry weather flow of contaminants which in some cases includes wastewater and associated organic, nutrient and microbial contaminants.

Without adequate stormwater treatment, developed areas and the stormwater networks contribute a significant proportion of the urban contaminant load to our streams and rivers.

8.3.2 Potential planning provisions

Integrated development of district plans, policies and bylaws with stormwater management planning can help reduce the future cost of flood and water quality protection. The investment needed to provide stormwater services to a growing population could be reduced by:

- Planning provisions that enable housing at locations that affect the ability to protect them from the stormwater hazards of overland flow paths and flooding.
- Planning provisions that affect the ability to locate, build, operate and maintain key assets (such as rain gardens and wetlands).
- Policies and bylaws regarding discharges the stormwater network. Currently Upper Hutt does not have a stormwater bylaw that could help control the discharge of contaminants to the stormwater network.
- Communication, education and behavioural change.

9. Summary of pre-feasibility options to support growth

The results of the Phase One investigation indicate that significant investment in the existing water supply and wastewater infrastructure as well as new infrastructure will be required to enable the anticipated population increase (detailed in Appendix B, section 13.4) up to year 2047. The identified upgrades are high-level, pre-feasibility concepts that have not been assessed against several alternatives to achieve solutions that are optimised for cost and outcomes. In addition, at this stage upgrades to the stormwater network are preliminary at best and have not been costed.

The scale of investment needed by growth area “catchment” includes network upgrades needed to meet the existing level of service as well as upgrades to service the projected population at year 2047. In general, the scale of investment is highest for greenfield sites, which are also the sites with the largest projected growth.

Overall, wastewater upgrades account for 63 percent of the total cost and water supply the other 37 percent. A portion of the wastewater upgrades that are for upgrades to the Hutt Valley Joint Venture network (e.g. upgrades to the storage tank at Silverstream and to the Seaview WWTP) will require additional financial contribution from Hutt City. UHCC contributes approximately 30 percent of the cost of the Hutt Valley Joint Venture network.

As noted previously the cost of stormwater upgrades has not been estimated as we rely on the use of hydraulic models and the stormwater hydraulic model for Upper Hutt is not yet complete.

The highest investment needed per growth area (Band D: $30M to $50M) are associated with four large greenfield sites:

- Akatarawa (Gillespies greenfield site for 2,075 people)
- Te Marua (Gabites greenfield site for 659 people)
- Pinehaven- Blue Mountains (Southern Growth Area greenfield site for 1,510 people)
- Silverstream-Heretaunga (infill of 720 people plus two greenfield sites – St Patricks Estate and Southern Growth Area for total of 2,595 people).

The second highest investment needed per growth area (Band C: $10M to $30M) includes two other large greenfield sites. The Trentham growth area also includes projected infill:

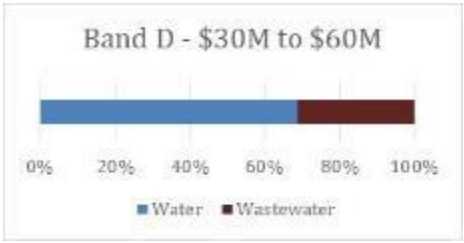
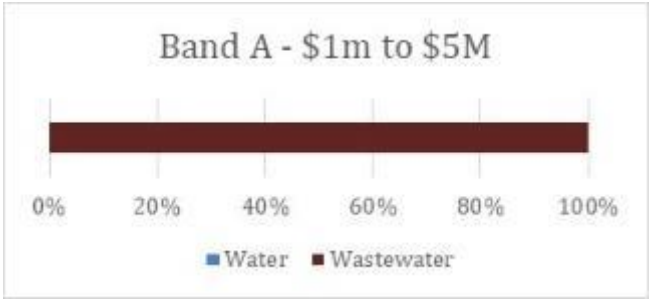
- Clouston-Kingsley Heights-Maidstone (Kingsley Heights greenfield site for 915 people)
- Trentham (Defence land greenfield site and some infill for a total of 2,654 people).

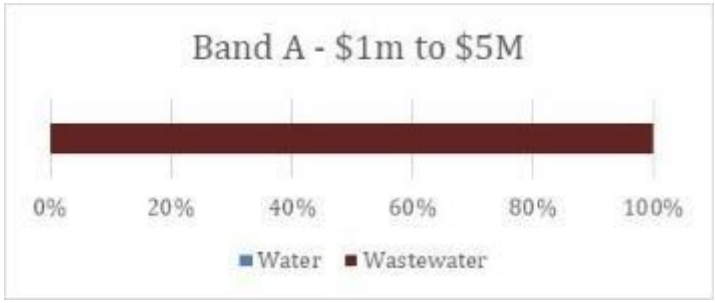
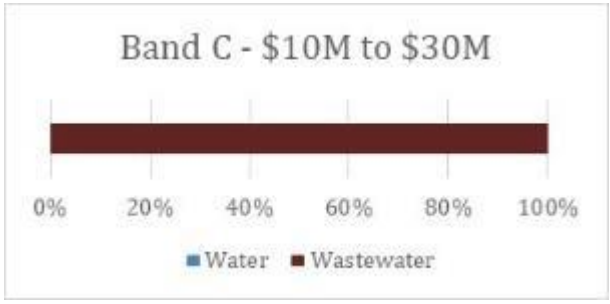
The remaining growth areas are primarily infill and the required water supply and wastewater investment levels are lower.

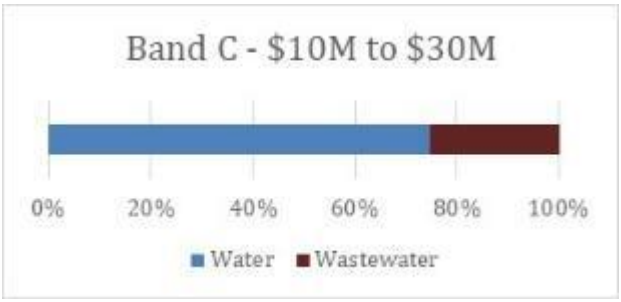
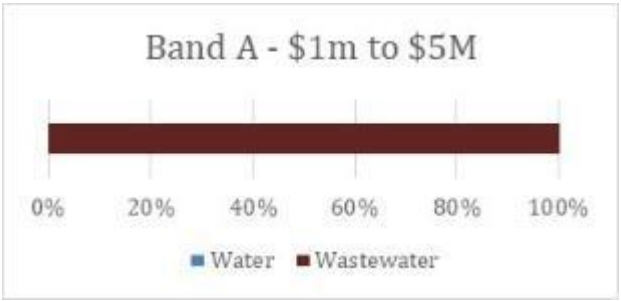
- Maoribank (Band B: $5M to $10M) for 233 people
- Trentham-Brentwood (Band A: $1 to $5M) for 719 people
- Elderslea (Band A: $1 to $5M) for 425 people
- Upper Hutt Central- Ebdentown (Band A: $1 to $5M) for 533 people
- Wallaceville (Band A: $1 to $5M) for 332 people
- Totara Park (Band A: $1 to $5M) for 174 people.

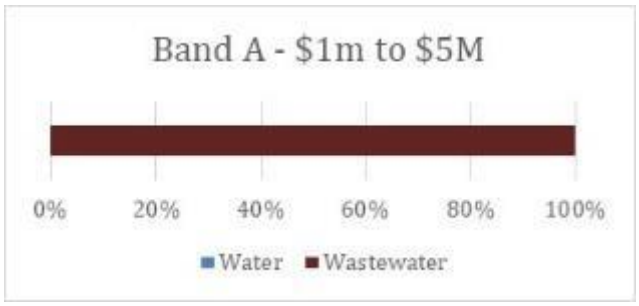
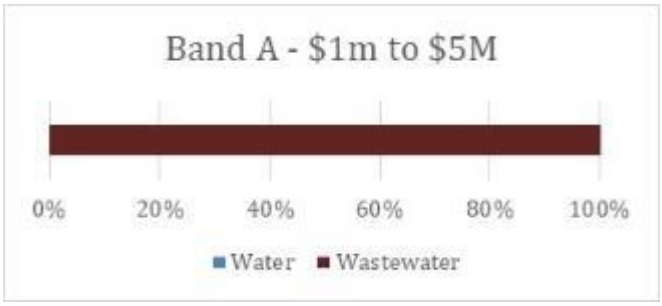
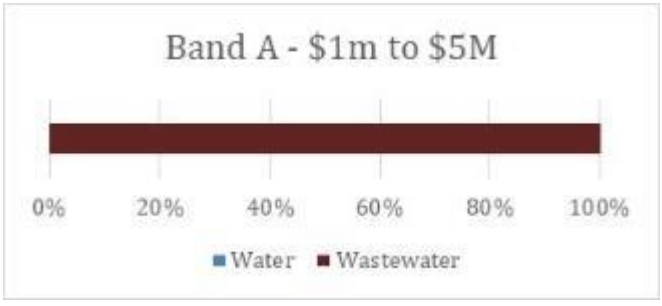
The identified upgrades needed and associated estimated costs are presented by potential growth area in Table 9 below and Figure 33 in Appendix D to inform the development of zoning provisions in Plan Change 50.

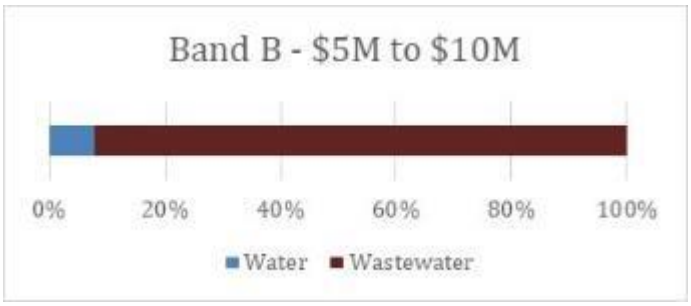
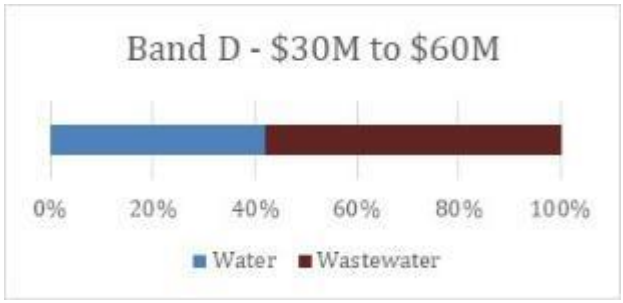
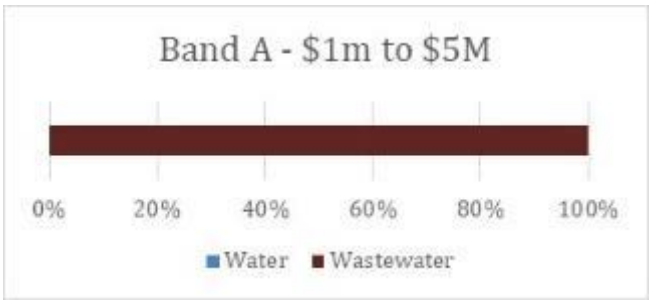
Table 9. Summary infrastructure and investment needed to support projected growth at 2047. Sensitivity tests refer to separate growth projections for select greenfield sites (see Table 4).

Growth Area	Water	Wastewater	Stormwater
Akatarawa **Greenfield site - Gillespies** **2075 additional people**	New connection to the bulk supply would need to cross the Te Awa Kairangi/Hutt River. It is assumed that this would be via a new road bridge that is outside the scope of this assessment. New reservoir at approx. 190 m elevation of 1.5 ML to 2.9 ML (Sensitivity Scenario), associated pump station, mains and PRV.	Most costs would be internal to the development, however the new pump station with storage prior to discharging to the trunk sewer has been costed. The site would also need to contribute to system-wide upgrades (WWTP and storage at Silverstream).	The location is subject to flooding from the Te Awa Kairangi Hutt River. Stormwater solutions to provide flood protection and water quality in the Greenfield site would be internal to the development
			
Mangaroa **Greenfield sites -MacLaren St and Old School** **No additional people**	See option for Te Marua growth area.	Growth included as sensitivity test only, in Scenario 2. Pipe upgrade and storage needed to address network degradation, including local 3ML storage tank. Greenfield sites would need to contribute to system-wide upgrades (WWTP and storage at Silverstream).	Stormwater solutions to provide flood protection and water quality in the Greenfield site will be internal to the development
			

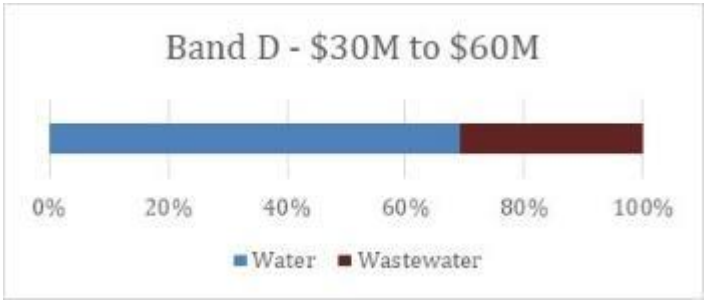
Trentham-Brentwood **Infill** **719 additional people**	No upgrades needed.	Pipe upgrade and storage needed to address network degradation. Contributions to system-wide upgrades (WWTP and storage at Silverstream).	Stormwater options are available to improve water quality within the infill area.
			
Trentham **Infill plus Greenfield site, Defence Land** **2654 additional people**	No upgrades needed.	Pipe upgrade and storage needed to address network degradation. Contributions to system-wide upgrades (WWTP and storage at Silverstream).	Stormwater options are available to improve water quality within the infill area.
			
Clouston-Kingsley Heights-Maidstone **Greenfill site, Kingsley Height plus a little infill** **915 additional people**	A new reservoir 1.0 ML to 1.5 ML (Sensitivity Scenario) at approx. 210 m elevation to replace the Maidstone Reservoir to service the existing population and the new development area of Kingsley Heights.	Pipe upgrade and storage needed to address network degradation. Contributions to system-wide upgrades (WWTP and storage at Silverstream).	Potential 650m upgrade of the stormwater main on Cruickshank Road needed to convey stormwater flows from the Kingsley Heights greenfield site. This option is to be investigated further using hydraulic modelling in Phase 2.

	Over 1.5 km of 150 mm diameter main, upgrade of pump station and a PRV are needed.		
			
Elderslea **Infill** **425 additional people**	No upgrades needed.	Pipe upgrade and storage needed to address network degradation. Contributions to system-wide upgrades (WWTP and storage at Silverstream).	Stormwater options are available to improve water quality within the infill area.
			
Upper Hutt Central – Ebdentown **Infill** **533 additional people**	No upgrades needed.	Pipe upgrade and storage needed to address network degradation. Contributions to system-wide upgrades (WWTP and storage at Silverstream).	Stormwater options are available to improve water quality within the infill area.

			
Wallaceville **Infill** **332 additional people**	Upgrade approximately 260 m of 150 mm main.	Pipe upgrade and storage needed to address network degradation. Contributions to system-wide upgrades (WWTP and storage at Silverstream).	Stormwater options are available to improve water quality within the infill area.
			
Emerald Hill-Birchville **No additional people**	No growth is predicted	Pipe upgrade and storage needed to address network degradation.	No growth is predicted
			
Maoribank **Infill plus Greenfield site, Brown Owl** **233 additional people**	No upgrades needed.	Pipe upgrade and storage needed to address network degradation. Contributions to system-wide upgrades (WWTP and storage at Silverstream).	Stormwater options are available to improve water quality within the infill area.

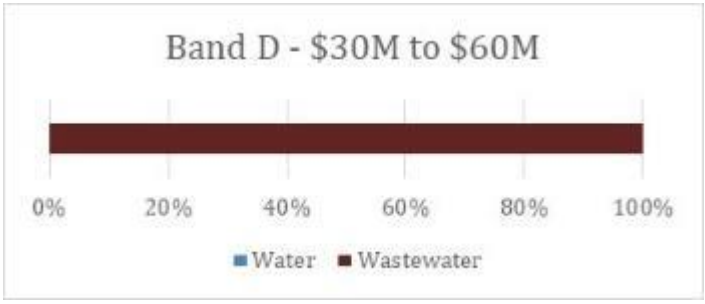
			
Te Marua **Infill plus Greenfield site, Gabites** **659 additional people**	New reservoir (1.4ML to 1.7ML), upgraded pump station and separate bulk main (would also service Mangaroa greenfield sites).	Pipe upgrade and storage needed to address network degradation. Contributions to system-wide upgrades (WWTP and storage at Silverstream).	Stormwater options are available to improve water quality within the infill area.
			
Totara Park **Greenfield site, Cannon Point** **174 additional people**	No upgrades needed.	Pipe upgrade and storage needed to address network degradation. Contributions to system-wide upgrades (WWTP and storage at Silverstream).	Stormwater solutions to provide flood protection and water quality in the Greenfield site will be internal to the development
			
Pinehaven-Blue Mountains	Replace Pinehaven No 1 reservoir (0.7ML) with a larger 1ML reservoir to service	Pipe upgrade and storage needed to address network degradation.	Stormwater solutions to provide flood protection and water quality in the Greenfield

<table>
<tr><td rowspan="2">Greenfield site, Southern Growth Area plus a little infill

1510 additional people</td><td>existing and infill population.</td><td>Contributions to system-wide upgrades (WWTP and storage at Silverstream).</td><td>site will be internal to the development</td></tr>
<tr><td colspan="3"> 
</td></tr>
<tr><td rowspan="2">Silverstream-Heretaunga

Infill plus Greenfield sites, Southern Growth Area and St Patricks Estate

2595 additional people</td><td>Two new reservoirs (1.3 ML and 1.4 ML), two pump stations, mains and upgraded bulk water pump station.</td><td>Pipe upgrade and storage needed to address network degradation.

Contributions to system-wide upgrades (WWTP and storage at Silverstream).</td><td>Stormwater solutions to provide flood protection and water quality in the Greenfield site will be internal to the development</td></tr>
<tr><td colspan="3"> 
</td></tr>
</table>

10. Recommendations and next steps

This catchment plan for growth was developed specifically to inform the initial development of Plan Change 50 to the Upper Hutt District Plan and as such, the assessment focused on the locations identified a potential growth areas.

The information contained in this report can also be used for other purposes, such as those outlined in section 3 (Strategic context of this report).

The next steps rely on the completion of hydraulic models for each for the three water networks to identify optimised solutions that can include more detailed investigations and construction cost estimates to better inform the development of Plan Change 50.

In particular, a completed hydraulic model is needed that considers the Upper and Lower Hutt wastewater network together to fully inform decisions that affect the Hutt Valley Joint Venture assets and how they are operated.

Regardless of the scheduled Phase Two investigation, the information presented in this report should be reviewed:

- When hydraulic models are completed for each network
- After significant upgrades or alterations have been made to any of the networks
- When urban development concepts are being initiated or finalised
- When population predictions are altered
- When zoning provisions in the District Plan other than those in Plan Change 50 are considered for review through a private or council sponsored plan change
- When target levels of service or network performance outcomes are changed (e.g. through revisions of the RSWS).

In addition to the schedule Phase Two investigations, this report identifies opportunities to:

- Reduce wet weather flows in the wastewater network and potential leaking that adversely affects the health of urban waters by addressing inflow and infiltration on private property.
- Look at changes in policies and bylaws that can affect the provision of three waters services, such as requirements for hydraulic neutrality and the management of contaminant loading to the stormwater network.
- Reduce water use and loss to avoid the need for an additional water source in the near future.
- Improved communication and education to help drive behavioural changes relevant to the provision of three waters services.

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12. Appendix A – Three Waters Level of Service, assumptions and exclusions

The assessment of the adequacy of the three waters services and the identification of what is needed in the future depends in part on the outcomes, or levels of service, that are desired. For Wellington Water, at a minimum these levels of service need to achieve the customer outcomes of safe and healthy water, respect for the environment and resilient networks that support the economy.

Networks that were built to meet yesterday's outcomes do not necessarily meet today's levels of service.

For example, in the recent past we were able to manage and design stormwater systems for a level of service that prevented nuisance flooding during average rainfall events. Today, we must consider the effects of climate change and planning direction to manage flood risks from 1 in 100 year flood events, as well as the effects of stormwater on the health of urban waterways.

12.1.1 Level of service and assumptions for the assessment of the water supply network

To describe the existing constraints in the performance of the water supply network, this Phase One project relied on the model results provided for the NPS-UDC report (WWL, 2019a), which was based on a model of the Upper Hutt water supply network calibrated in 2015.

The identification of constraints for future populations and potential solutions for these constraints were limited to a desktop assessment of reservoir requirements (and associated mains reticulation) to fix existing and future storage shortfalls.

The levels of service for assessing the network performance in relation to growth are defined in the Regional Standard for Water Services (RSWS) and are summarised as follows:

- Minimum pressure requirement of 25m at the point of supply within the network.
- Reservoir storage requirement is the maximum of:
    - Storage for operational level of service of 2 x Average Day Demand (ADD), or
    - Storage for operational level of service of 1.2 x Peak Day Demand (PDD) plus firefighting storage requirements, or
    - Storage for seismic resilience to meet the minimum levels of service after a significant earthquake based on 20 litres per person per day for days 8 to 30.

Where anticipated population growth would require a new reservoir, the assumption was that there will not be any constraints on minimum pressure (e.g. a new reservoir can be sited at an appropriate elevation that provides adequate pressure). Where growth is anticipated that would not require an additional reservoir, options qualitatively consider the effects that growth will have on pressure.

A number of assumptions were made to assess the impact of growth on the Upper Hutt water supply and to identify needed upgrades:

- Where the growth populations are split across WSAs, the population was split based on the area of growth within each WSA. The costs associated with upgrading reservoirs, pump stations and pipework associated with a WSA were shared proportionally across each growth area based on the projected population increase
- The 2017 consumption rates used in the NPS-UDC report (WWL, 2019a) as assessed in the Stantec (2018) report were used to assess 2047 consumption rates
- The consumption rates include leakage and metered customer demand (Stantec, 2018). No increase in leakage, metered customer demand or critical user demand has been considered for this exercise
- The fire water classifications (FW numbers) used (Stantec, 2018) to support the NPS-UDC report (WWL, 2019a) were assumed for this assessment
- It was assumed that consumption rates within a WSA will remain the same when greenfield development occurs within the existing WSA. The rate of 700 litre/person to determine the storage level of service has otherwise been used for development outside of existing WSAs
- A broad-brush approach was used to identify water supply trunk mains that would need to be upgraded to provide suitable water pressure in any specific areas identified by the NPS-UDC (Stantec, 2018) as being unable to support future growth, and at the edge of any greenfield development area where a water supply may be provided.

12.1.2 Exclusions to the assessment for water supply

Options for new or upgraded assets are based on what is needed to support the projected population at 2047 and address existing shortfalls. Therefore solutions also include what is needed to address existing backlogs.

For this Phase One assessment, the following exclusions are noted:

- Most upgrades to the regional bulk water supply, such as source of water and treatment plants are excluded. Some upgrades such as bulk water branch mains are included
- The use of hydraulic models to assess the performance (feasibility) of potential upgrades needed to support urban growth (optioneering) are excluded
- Asset renewals not associated with required upgrades to accommodate growth are excluded
- Upgrades for seismic resilience not associated with required upgrades to accommodate growth are excluded
- The exact siting of reservoirs and pump stations are excluded. The locations of new reservoirs required to provide additional storage for growth were estimated based on the location of existing reservoirs (if additional storage is required for an existing WSA), or based on elevation and subsequent ability to service the area of any greenfield development. No site, survey, land ownership or geotechnical investigations were carried out in order to accurately site any new reservoirs.

12.1.3 Level of service and assumptions for the assessment of the wastewater network

The level of service for assessing constraints in the Upper Hutt wastewater network in relation to growth were defined as:

- No wet weather overflows at the 1-year Average Recurrence Interval (ARI).

Overflows were defined as spill volumes of more than two cubic metres (2 m^3).

The distribution of anticipated development was inputted into the future 2047 hydraulic model for wastewater in the following manner:

- For greenfield development, the density used in the model was based on area of the greenfield site divided by the number of a new dwellings.
- For infill, it was assumed that development would occur evenly across all growth areas identified for infill. An exception was made for Clouston Park-Kingsley Heights-Maidstone catchment where the infill population is only 22 additional people (please see Table 12 in Appendix B, section 13.4). This relatively small number of additional people was applied to the modelling sub-catchment FG08_SC3290.
- It was assumed that each infill dwelling would have density of 500 m^2. The adequacy of this assumption will be revisited for the Phase Two assessment, given the NPS-UD direction for intensification upwards.
- An assumed increase in prison population at RimutakaPrison was included in the model run for 2047.

A number of assumptions were made to assess the impact of growth on the Upper Hutt wastewater system and to identify needed upgrades:

- A complete list of all modelling assumptions is contained in the Mott MacDonald (2020) report. In particular, inflow and infiltration (I&I) is modelled to change over time based on the Regional Wastewater Model Specification (WWL, 2017b), which assumes a 25 percent increase in inflow and infiltration per 50 years as the network ages. This also includes an assumed 10 percent reduction in water use over the next 35 years. Increased density is assumed to increase I&I due to more private laterals and possible cross connections until density is assumed to result from building upwards (e.g. apartments), at which point no increase in I&I is assumed
- Pre-feasibility options for upgrades were limited to pipe duplication (rather than pipe upgrades) and storage (rather than increased conveyance)
- Sensitivity scenarios were assessed by combining several of the potential scenario areas (see Appendix B, section 13.4.2) into three separate scenarios
- For the Gillespies Block greenfield site, it was assumed that this development would discharge to a new pump station (the total cost of which is allocated to this growth area) prior to discharging to the trunk sewer
- For the two Southern Growth Area greenfield sites, it was assumed that the additional population could not connect to the local networks, which are already at capacity, but would have to discharge to a new sewer main to the trunk

- Separate to the modelling assessment, an assessment was made based on the investment cost related to replacing poor condition pipes. For that assessment, all pipes with poor condition (grade 4 and 5) within a growth area were assumed to require replacement (to help achieve healthy urban waters). The results of this assessment are presented separately, as poor condition pipes are also associated with increased I&I, resulting in increased wet weather flows which can lead to overflows. Therefore, storage and pump station solutions to reduce overflows could be redundant with solutions based on replacement of poor condition pipes. This is discussed in more detail in the results, section 8.2.

- **Inflow and Infiltration**, also known as **I&I**
- I&I is term used to describe the inflow of stormwater and infiltration of groundwater into the sewer pipes. During heavy rainfall, stormwater can enter the wastewater network through gutters and downpipes that are cross-connected to the sewer system. Stormwater can also enter through gully traps that are not properly elevated. Groundwater can enter into the sewer pipes through cracks in the pipes and manholes.
- It is estimated that in general, 50 percent of the volume of water from I&I originates on private property through private laterals and cross-connections with the stormwater system prior to their connection to the public wastewater network.
- Exfiltration, is the opposite of I&I and refers to the wastewater that leaks out from the sewer, typically during low flow or dry weather conditions.

12.1.4 Exclusions to the assessment for wastewater

The wastewater hydraulic model is not integrated with the downstream wastewater model, including the operational control of the discharge from the Silverstream storage tank to the downstream trunk mains or to the Te Awa Kairangi/Hutt River during large wet weather events.

The Silverstream Storage Tank is also not a part of this model as it is included in the Lower Hutt wastewater hydraulic model, which is currently being constructed. The wastewater hydraulic model used for this Phase One assessment assumed free outfall at manhole EASTE0093SM at Eastern Hutt Road, upstream of the Silverstream tank. The Phase Two assessment will use a combined hydraulic model for both Lower Hutt and Upper Hutt, and this combined model will be used for solutions optimisation.

The options assessed with the wastewater model for this report were specifically limited to only two potential options – pipe duplication and additional storage. During the assessment, the need for specific additional pumping stations was also included. This limitation on assessed options highlights that the proposed solutions are potentially “workable” rather than optimised for the best outcome (including cost). In regards to cost, workable solutions are generally a worse case (highest cost). For this Phase One initial assessment, a worse case assessment is considered to be best practice.

Options for new or upgraded assets are based on what is needed to support the projected population at 2047 and address existing shortfalls, as well as constraints projected to result from network degradation (e.g. increased I&I). Therefore solutions also include what is needed to address existing backlogs.

The identified options specifically **exclude** the following:

1. Modelled solutions do not include options to reduce inflow of stormwater and I&I, including options to upgrade private laterals as a way to reduce wet weather flows. A separately assessed option to replace all poor condition (Grade 4 and 5) pipes in the public network - as a method of improving the health of urban water from exfiltration during dry weather conditions rather than to optimise the capacity of the network by reducing I&I – was also carried out. However, we note that poor pipe condition grades are not necessarily correlated with how leaky a pipe is.

2. Assessments of internal infrastructure requirements needed to service greenfield areas are excluded, as these costs are typically borne directly by the developer.

Other limitations associated with pre-feasibility level options include the lack of site investigation to confirm GIS data, optimisation of options, performance testing, and the timing or staging of options.

12.1.5 Level of service and assumptions for the assessment of the stormwater network

The level of service for stormwater in the RSWS is for a combined network of pipes, channels, soakage systems and overland flow paths to protect habitable floors, other buildings and access roads from flooding during a 1 in 100-year storm event, including the predicted impacts of climate change.

For this Phase One report, hydraulic stormwater modelling is not available. Therefore, the identification of areas with unacceptable flooding and network constraints are based on existing reports, including existing modelling results, GIS information and relevant reports (Connect Water, 2019).

Future development is assumed to not increase the risk of flooding through designs that avoid flood hazards, such as through location or floor height, and which achieve hydraulic neutrality[5], such as with on-site detention or soakage. These are realistic assumptions as these are required levels of service in the UHCC District Plan and the RSWS.

In particular, the UHCC District Plan (as a result of Plan Change 42) has rules which require intersecting sites within the Southern Growth Area greenfield site in the Pinehaven growth area to not only be hydraulically neutral but to reduce the flood flows to 80 percent of the pre-development flows if a site-based assessment is used in the application (see Subdivision Rule 18.34 and Rule 19.28 and requirements of General Procedure 1.8.11 in the UHCC District Plan). Reducing flood flows to 80 percent of the pre-development peak flood flows is a more stringent requirement than requiring a development to result in no increased flooding. Managing the effects of development on stormwater runoff at this level would result in developments decreasing the existing flood flows in the lower catchment.

Greater Wellington Regional Council (GWRC) has produced floodplain management plans (FMP) for the Pinehaven Stream (GWRC, 2016), the Mangaroa River (Jacobs Group, 2015) and the Hutt River (GWRC, 2001). Brief overviews of these FMPs are provided below.

[5] Methods to achieve hydraulic neutrality result in the peak flow rate of stormwater that discharges from a site after it is developed not being greater than the peak flow rate of stormwater runoff prior to development. This avoids increasing the stormwater runoff and exacerbating the effect of the flood risk to people and property downstream.

- Pinehaven Stream FMP (GWRC, 2016) – Flood modelling was undertaken to identify flood hazards within the Pinehaven catchment. A combination of flood management methods was then proposed to mitigate these flood hazards. These included physical works in the stream channel to increase capacity, planning controls for development, community preparedness and emergency procedures and day-to-day maintenance of the stream to avoid blockages. The FMP is intended to be a long-term plan that will be reviewed and updated where necessary. The Pinehaven Stream FMP identified flood hazards and proposed stormwater flooding mitigation options for the Pinehaven catchment. This includes over $18M of flood protection works which are funded in the UHCC Long Term Plan and are not repeated in this report.

- Hutt River FMP (GWRC, 2001) – This plan is the foundation for implementing structural and non-structural measures to mitigate flood risk hazards from fluvial flooding. It also provides an environmental strategy for enhancing the Hutt River environment. A flood extent for the 100-year ARI flood was derived as part of the flood hazard mapping for the FMP. This has been used as part of this assessment to determine the impact of river flooding on future growth within the Upper Hutt catchment. GWRC is revising the flood model for the Hutt River. The results of this work may be available to inform the stormwater assessment for the Phase Two report.

- Mangaroa River (Jacobs, 2015) - As there is little urban development in the Mangaroa River catchment, the assessment did not include an urban stormwater component

New provisions in the Natural Resources Plan for the Wellington Region (Regional Plan) and Wellington Water's global stormwater consent conditions (please see Appendix A) will require increased levels of service for the management of stormwater discharges and its effects on the health of urban waters. Therefore, the assessment of options to manage stormwater to accommodate growth also includes options to treat stormwater quality through the use of appropriately sized wetlands, raingardens and the use of permeable paving, in accordance with Wellington Water's guidelines for the design of these devices (WWL, 2019d).

12.1.6 Exclusions to the assessment for stormwater

Given the lack of a hydraulic model, the areas and extent of flood risks that need to be addressed to support population growth are unquantified. Therefore, a long list of potential stormwater mitigation options was identified with a focus on treating stormwater to improve water quality across the Upper Hutt catchment. This long list of solutions are included in this report but have not been costed at this stage.

13. Appendix B - Urban Planning

Upper Hutt City Council is planning for how their city will grow to accommodate projected population increases. This includes providing suitable zoning and planning rules through the drafting of Plan Change 50 and the provision of adequate infrastructure, such as roads and water services.

Planning for population growth is not only a good idea, it is a requirement under the NPS-UD. One of the ways UHCC is responding to this requirement is through the development of Plan Change 50.

As noted in section 4, this integrated catchment management report provides a way for Wellington Water to describe the existing performance of the three waters networks and to assess what is needed to meet the needs of a growing population. Catchment planning requires the three waters networks to be assessed as whole systems and in relation to their surrounding environment. The following sub-sections include background information on urban planning in Upper Hutt that is relevant to the provision of three waters services.

13.1 The people

Mana whenua of Upper Hutt include Taranaki Whānui ki te Upoko o Te Ika a Māui, Ngāti Toa Rangatira and at times Rangitāne o Wairarapa.[6]

Under Treaty of Waitangi settlements, Te Awa Kairangi /Hutt River is subject to statutory acknowledgements for Taranaki Whānui ki Te Upoko o Te Ika and for Ngāti Toa Rangatira. Statutory acknowledgements recognise the mana of a tangata whenua group in relation to specified areas, which include areas of land, geographic features, lakes, rivers, wetlands and coastal marine areas, but are only given over Crown-owned land.

The Statutory Acknowledgement of Taranaki Whānui ki Te Upoko o Te Ika specifically mentions the Hutt River and notes that they

> *…travelled in the Hutt Valley largely by waka. There were few trails through the heavy forest of the valley. Many Taranaki Whānui ki Te Upoko o Te Ika Kainga and Pā were close to the river including at Haukaretu (Māoribank), Whakataka Pā (which was across the bank from what is now Te Marua), Mawaihakona (Wallaceville), Whirinaki, Motutawa Pā (Avalon), Maraenuku Pā (Boulcott), Paetutu Pā and at the mouth of the river, Hikoikoi Pā to the west and Waiwhetu Pā (Owhiti) to the east.*
>
> *Te Awakairangi linked the settlements as well as being a food supply for the pā and kainga along the river. Mahinga kai were found along the river such as Te Momi (Petone) which was a wetland that held abundant resources of birds, tuna and other food sources. The river ranged across the valley floor and changed course several times leaving rich garden sites. Waka were carved from forest trees felled for that purpose close to the river*.

The Statutory Acknowledgement of Ngāti Toa Rangatira specifically mentions the Hutt River and its tributaries and notes that:

[6] Upper Hutt City Council. 2016. Land use strategy 2016-2043. Adopted September 2016.

…the Hutt River (Te Awa Kairangi) is of historical and cultural importance to Ngati Toa Rangatira. The iwi claim an association with the Hutt River from the time of their participation in the invasion of the Hutt Valley during 1819 and 1820.

During that campaign, the taua marched around the western side of Te Whanganui a Tara, defeating the local iwi as they went. When the war party reached the Hutt River, they constructed rafts which they used to aid them in their invasion of the Hutt Valley.

Although Ngati Toa Rangatira did not remain in the area after this invasion, the Hutt River continued to be important to the iwi following their permanent migration and settlement in the lower North Island in the late 1820s and early 1830s. The relationship of Ngati Toa Rangatira to the Hutt Valley and River was not one defined by concentrated settlement and physical presence. Rather, the iwi felt their claim to the land was strong based on the powerful leadership of Te Rauparaha and Te Rangihaeata and the relationship they had with iwi residing in the Hutt Valley who had been placed there by Ngati Toa in the 1830s. For some years these iwi in the Hutt Valley paid tribute of goods such as canoes, eels and birds to Te Rauparaha and Te Rangihaeata.

Ngati Toa Rangatira have a strong historical connection with the Hutt River and its tributaries, and the iwi consider that the river is included within their extended rohe and it is an important symbol of their interests in the Harataunga area.

Te Awa Kairangi was traditionally an area for gathering piharau, or the freshwater blind eel, as well as tuna (eel) from its tributaries. Harataunga also supported flax plantations, which were used by early Maori for trading with settlers. The River was also of great importance as it was the largest source of freshwater in the area.

The river was also an important transport route, and small waka were used along the length of Te Awa Kairangi.

Currently in Upper Hutt there are few Māori settlements of Māori land holding, wāhi tapu, sites with physical taonga or identifiable Māori settlements. The local marae, Ōrongomai, is a mātāwaka marae and representative of the many tribal affiliations of all who live in this region.

Wellington Water's direction is to develop a Te Ao Māori Framework to establish high-level priorities to help guide the organisation within te ao Māori.

Following the Second World War, Upper Hutt grew rapidly as new land was subdivided and commuter rail services enabled civil servants to buy their own homes. By the 1960s, Upper Hutt was one of the fastest growing districts in New Zealand, but by the 1980s population growth had slowed, partly in response to the decline of manufacturing activities in the Hutt Valley. In the 1990's, Upper Hutt had a declining population.

The 2018 census indicates that approximately 18 percent of the population in Upper Hutt identify as having Maori descent and about 81 percent identify as European, 5 percent as Pacific peoples and 6 percent as Asian. Over a quarter of the people identify their profession as "professional". The suburb with the highest deprivation index was Ebdentown-Upper Hutt Central and the lowest was Mangaroa.

As reported in the HBA (WMC, 2019), the 2013 census results show that Upper Hutt stands out regionally from metropolitan Wellington Region as having higher proportions of single detached dwellings, with lower proportions of medium or higher density living.

13.1 Existing land use and District Plan zoning

The urban areas of Upper Hutt are provided with water supply, wastewater reticulation and stormwater services. These areas that are provided with three waters services are located primarily along the broad valley that flanks the southern bank of Te Awa Kairangi/Hutt River from where it flows out of the hills of the Remutaka ranges. Figure 19 illustrates the existing land use and Figure 20 shows the current zoning in the Upper Hutt City Council District Plan.

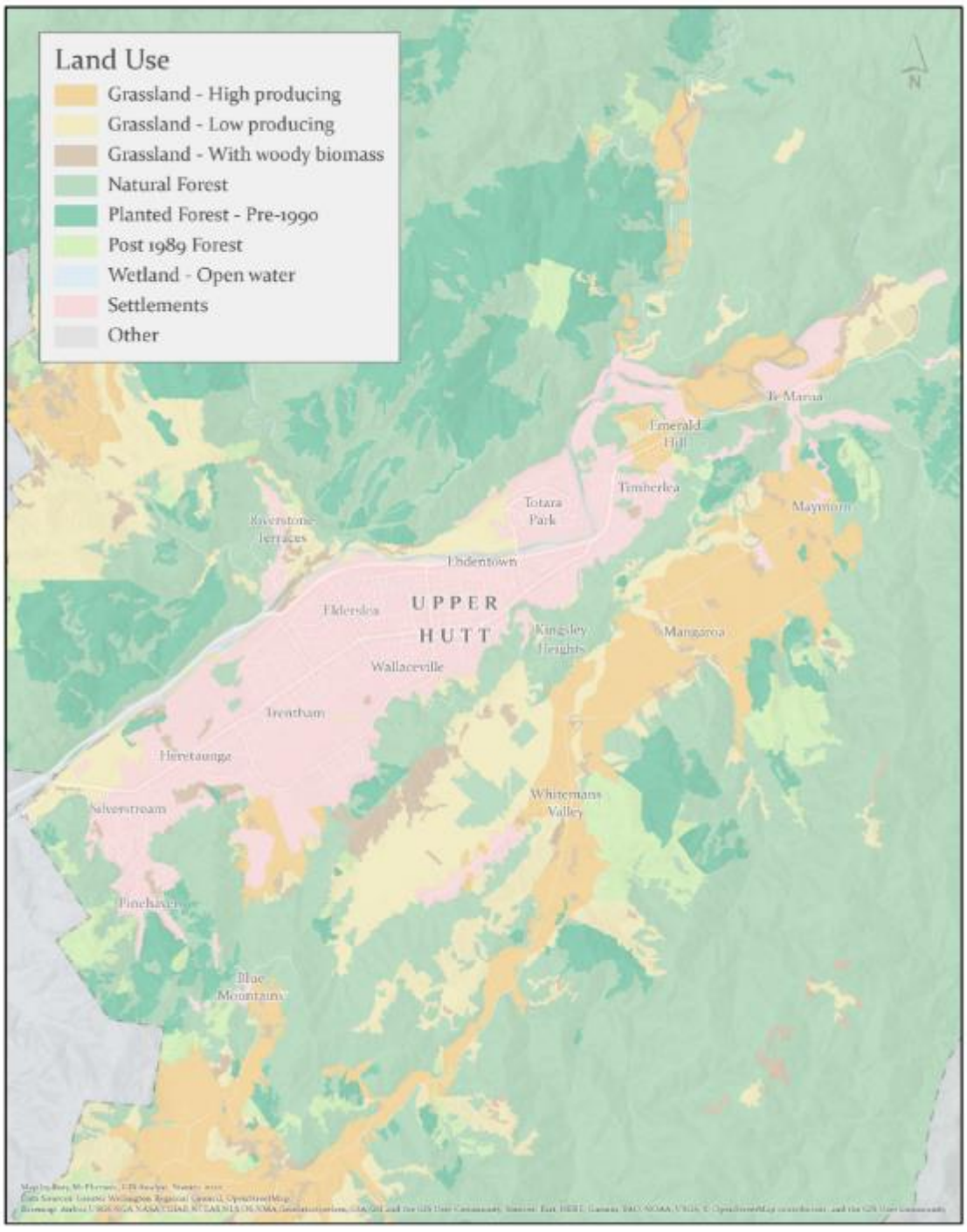

Figure 19. Existing land use in Upper Hutt

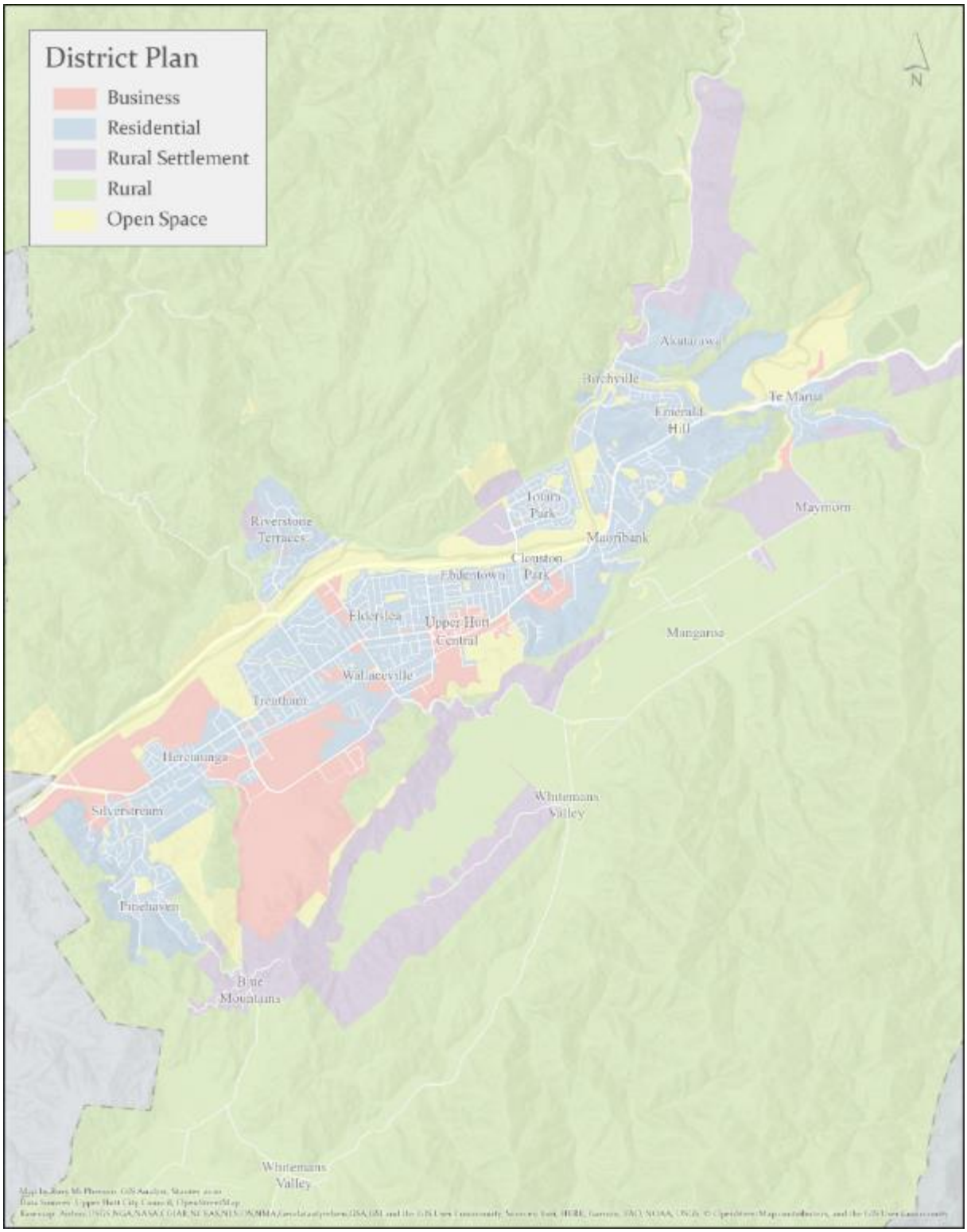

Figure 20. Operative Upper Hutt City Council District Plan zoning

As described in the Land Use Strategy 2016 – 2043 (UHCC, 2016), the city centre comprises that part of the city zoned 'Business Commercial', including Main Street, Fergusson Drive, Queen Street and intersecting streets north of the railway. Suburban centres are spread throughout the valley and range from small groups of shops such as those at Brown Owl to the larger and busier shops and services at Silverstream as shown in Figure 21. There are industrial areas at Alexander Road,

Montgomery Crescent, Park Street, South Pacific Industrial Park and Whakatiki Street. Other economic activities are spread throughout the balance of both urban and rural areas.

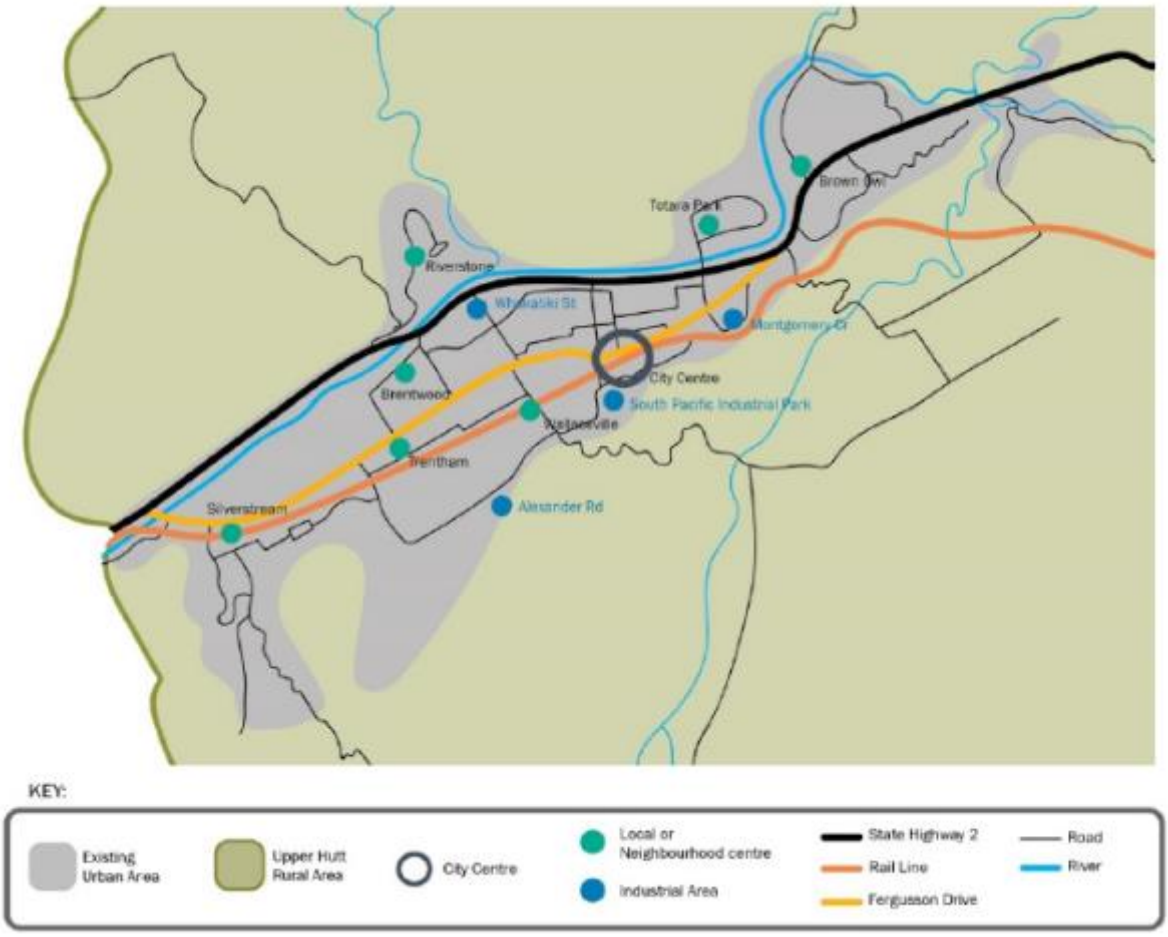

Figure 21. Illustration of existing urban area in Upper Hutt[7]

The Land Use Strategy (UHCC, 2016) identified several potential locations for urban development, which are similar in many ways to the locations assessed in this three waters catchment plan to support the development of Plan Change 50. The Land Use Strategy notes on page 101 that,

> "*the efficient use of infrastructure and services in the City and the amount of infrastructure required to be maintained, improved and upgraded depends on the future shape and size of the city. Being more directive about where new development can occur will assist in achieving efficiencies in both the provision and upgrade of essential services*."

In addition to three waters infrastructure, urban areas also rely on the provision of other significant infrastructure.

The relationship between environmental constraints and regionally significant infrastructure is managed, in part, through policies and rules in the Regional Plan. The Regional Plan defines "regionally significant infrastructure" as including *the local authority water supply network (including intake structures) and water treatment plants* and *the local authority wastewater and stormwater*

[7] Sourced from: Land Use Strategy (UHCC 2016) page 30

network among other items such as gas pipelines, the National (electricity) grid and the Strategic Transport Network (which includes railway corridors state highways).

The key regionally significant infrastructure of the State Highway 2 (SH2), the railway line and a major transmission line corridor within the study area are illustrated on Figure 22.

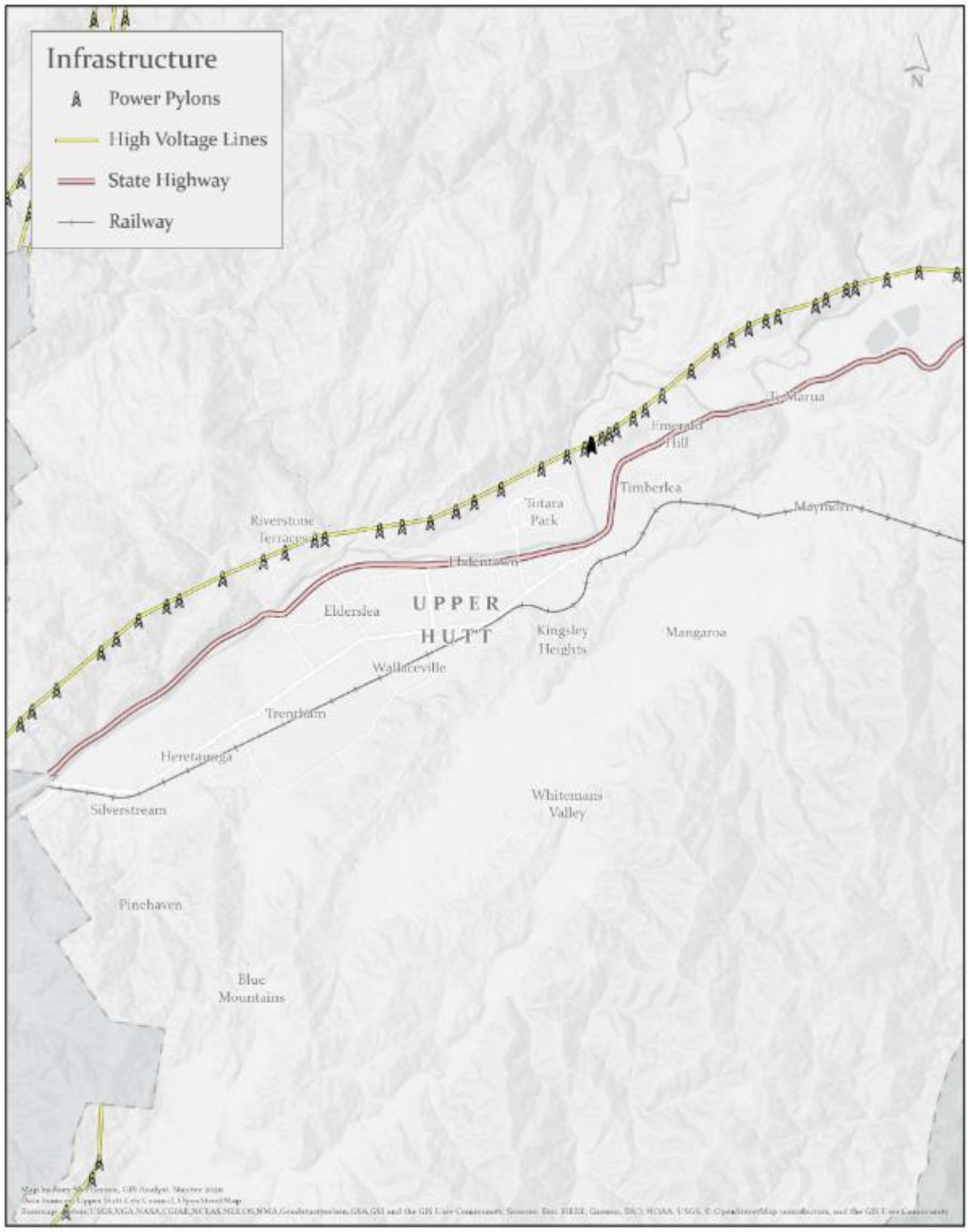

Figure 22. Key regionally significant infrastructure other than the three waters networks.

13.2 National Policy Statement for Urban Development

During the drafting of this report, the National Policy Statement for Urban Development Capacity 2016 was replaced by the National Policy Statement for Urban Development (NPS-UD). The NPS-UD took effect on 20 August 2020.

The NPS-UD 2020 recognises the national significance of having well-functioning urban environments that enable all people and communities to provide for their social, economic, and cultural wellbeing, and for their health and safety, now and into the future and the significance of providing sufficient development capacity to meet the different needs of people and communities.

The Regulatory Impact Statement on the NPS-UD acknowledges that the implementation of the NPS-UD is expected to require increased spending and a significant portion of the costs will not be new, but will existing growth-relate costs, particularly for infrastructure.

One of the main changes is that the NPS-UD provides direction on where urban growth should occur and what form it should take to meet the diverse demands of communities and to encourage well-functioning, liveable urban environments. For Upper Hutt this includes directives which will result in more intensive infill, such the requirement that buildings within a walkable range from city centre and end existing or planned rapid transit stops may now be six storeys , or higher.

Under the previous NPS-UDC, UHCC was required under Policy PB1 to ensure that at any one time there is sufficient housing and business land development capacity available according to the time periods shown in Table 10. As shown in Table 10, available capacity for development includes the servicing of infrastructure (such as three waters infrastructure) in the short term, funding for infrastructure in the medium term and identification of infrastructure in the long-term.

Table 10. Short, medium and long-term under Policy PB1 of the NPS-UDC

Short Term *Between 0 to 3 years*	Development capacity must be feasible, zoned and serviced with development infrastructure
Medium Term *Between 3 to 10 years*	Development capacity must be feasible, zoned and either: • Serviced with development infrastructure, or • The funding for the development infrastructure required to service that development capacity must be identified in a Long Term Plan required under the Local Government Act 2002.
Long Term *Between 10 to 30 years*	Development capacity must be feasible, identified in relevant plans and strategies, and the development infrastructure required to service it must be identified in the relevant Infrastructure Strategy required under the Local Government Act 2002.

13.2.1 Housing and Business Assessment Report

To respond to the evidence and monitoring requirements of the NPS-UDC, Upper Hutt City Council completed their HBA report in November 2019.

The HBA evaluates housing and business demand over a 30-year period from 2017 - 2047. This demand is compared against land that is currently available or identified as a future growth area, in order to test whether each city can meet projected demand. The assessment also looks at the capacity of three waters (drinking water, wastewater and stormwater), roading and other infrastructure required to service development.

For the purposes of the HBA, Upper Hutt was divided into six broad catchments (four urban) as shown in Figure 23.

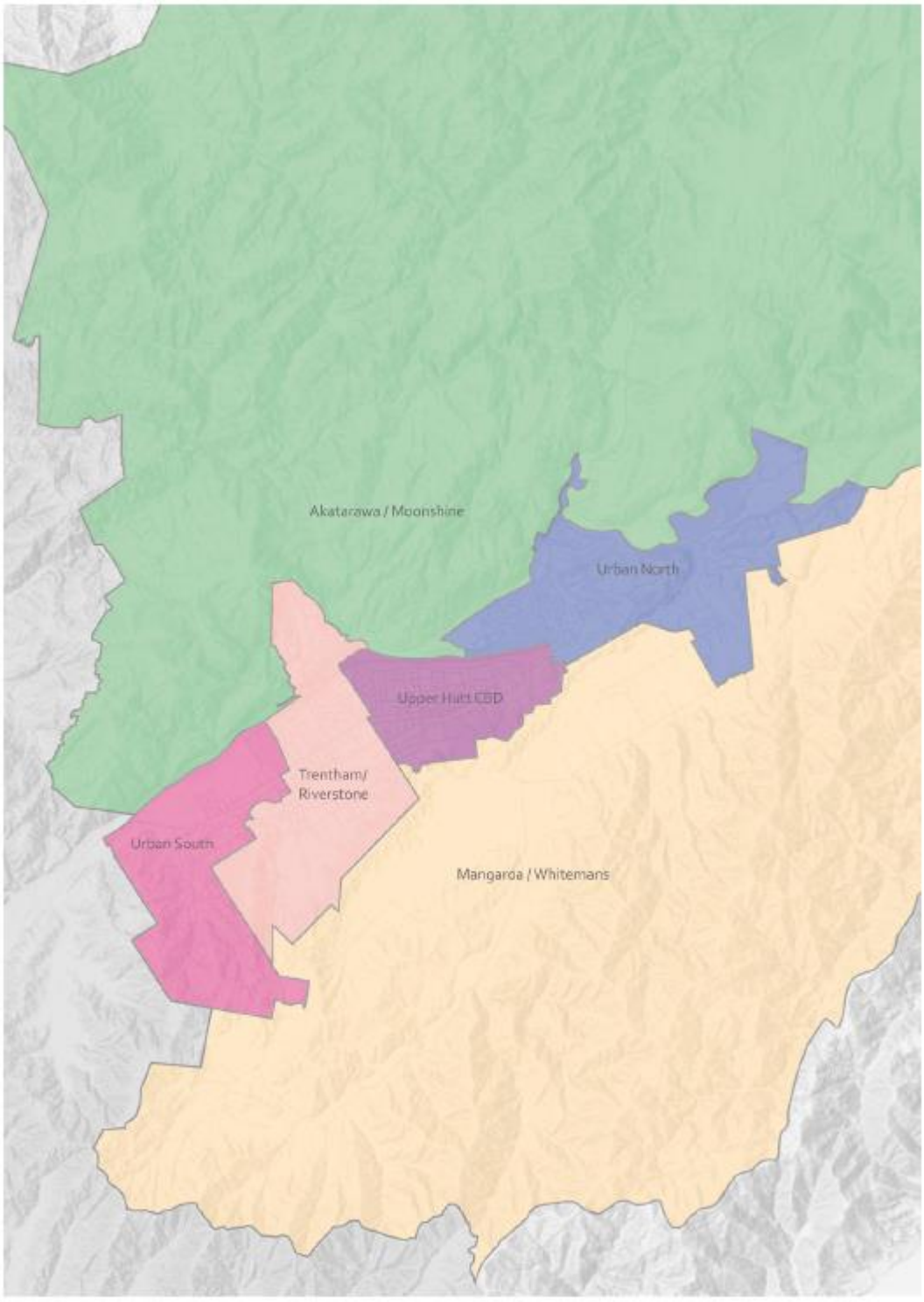

Figure 23. Upper Hutt housing areas as identified for the HBA

The HBA indicated that with a high-growth scenario just over 5,600 dwellings should be anticipated in urban Upper Hutt by 2047. The assessment estimates that District Plan zoning can provide for about 3,500 homes (700 within existing urban areas and just over 2,800 in greenfield sites). This means that without changes to existing policies that control housing development, the city could be faced with a shortfall of up to 2,100 homes by 2047 if the high-growth scenarios are met. Upper Hutt

City Council is responding to the results of the HBA through Plan Change 50, discussed in the section below.

The HBA noted that all four urban housing areas had constraints in the available and planned networks to provide water supply and wastewater services (Table 11)

Table 11. Overall three waters capacity summarised for the four urban Housing Areas (from Table 6.46 in the HBA)

Urban Housing Area	Water network capacity	Water storage capacity	Wastewater capacity	Stormwater Capacity
Urban South	Available	Constrained	Highly Constrained	Available*
Trentham/Riverstone	Available	Highly Constrained	Moderate	Not modelled
Upper Hutt CBD	Available	Highly Constrained	Moderate	Not modelled
Urban North	Highly Constrained	Highly Constrained	Constrained	Not modelled

'* = Assuming hydraulic neutrality is achieved.

Greenfield – Land that is currently not developed or provided with reticulated three waters services.

Brownfield – Urban areas that were previously developed and which are suitable for redevelopment. In this type of development existing buildings are removed and typically replaced with more dense townhouses, multi-level apartments or commercial development. The existing three waters networks may need to be reconfigured and increased in capacity to cater for this type of development.

Infill – New urban development on land that is mostly built out. Development occurs by adding second houses to existing lots, subdividing lots to support additional dwellings or by building terraced units and apartments. Infill results in "filling in" the gaps. The existing three waters networks may need to be reconfigured and increased in capacity to cater for this type of development.

13.3 Drafting of Plan Change 50

UHCC has initiated a significant review of the residential and rural chapters of their District Plan, which will be proposed as Plan Change 50. This plan change will include changes to zoning boundaries, policies and rules that enable urban development.

UHCC is in the early stage in the process as shown in Figure 24. UHCC has collected background information infrastructure, urban character and design, and environmental qualities to help determine what the future needs of Upper Hutt will be. Council sought public feedback on identified Issues and Opportunities from March to May 2020 and is continuing to refine its proposal to inform a full public consultation on draft provisions in 2021. Development of Plan Change 50 is anticipated to

continue until 2022, when they will transition into the more formal notification stage set out in the Resource Management Act 1991 (RMA).

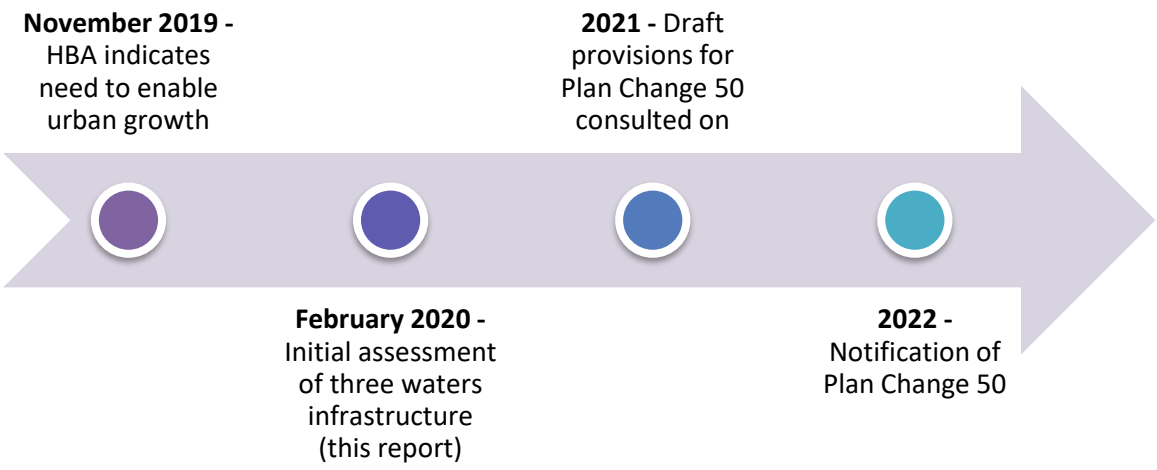

Figure 24. Timeline for drafting and notification of Plan Change 50

13.4 Predicted urban growth

The predicted 30-year urban growth for Upper Hutt is approximately 13,000 more people[8]. This is from a baseline of just over 43,000 people in 2017 to over 56,000 people by 2047. This represents a growth rate of 0.9 percent per year.

For this report, the potential urban areas where this growth would be enabled with planning regulations were identified in consultation with the UHCC Planning and Policy team to assist the

[8] The Upper Hutt wastewater system is part of the larger Hutt Valley system which also services Hutt City. All of the wastewater from this system is conveyed to the Seaview Plant for treatment and disposal. Therefore the total predicted 30-year urban growth for the wastewater system is approximately 13,000 more people for Upper Hutt plus approximately 25,000 people for Hutt City for a total of 38,000 additional people by the year 2047.

drafting of Plan Change 50.

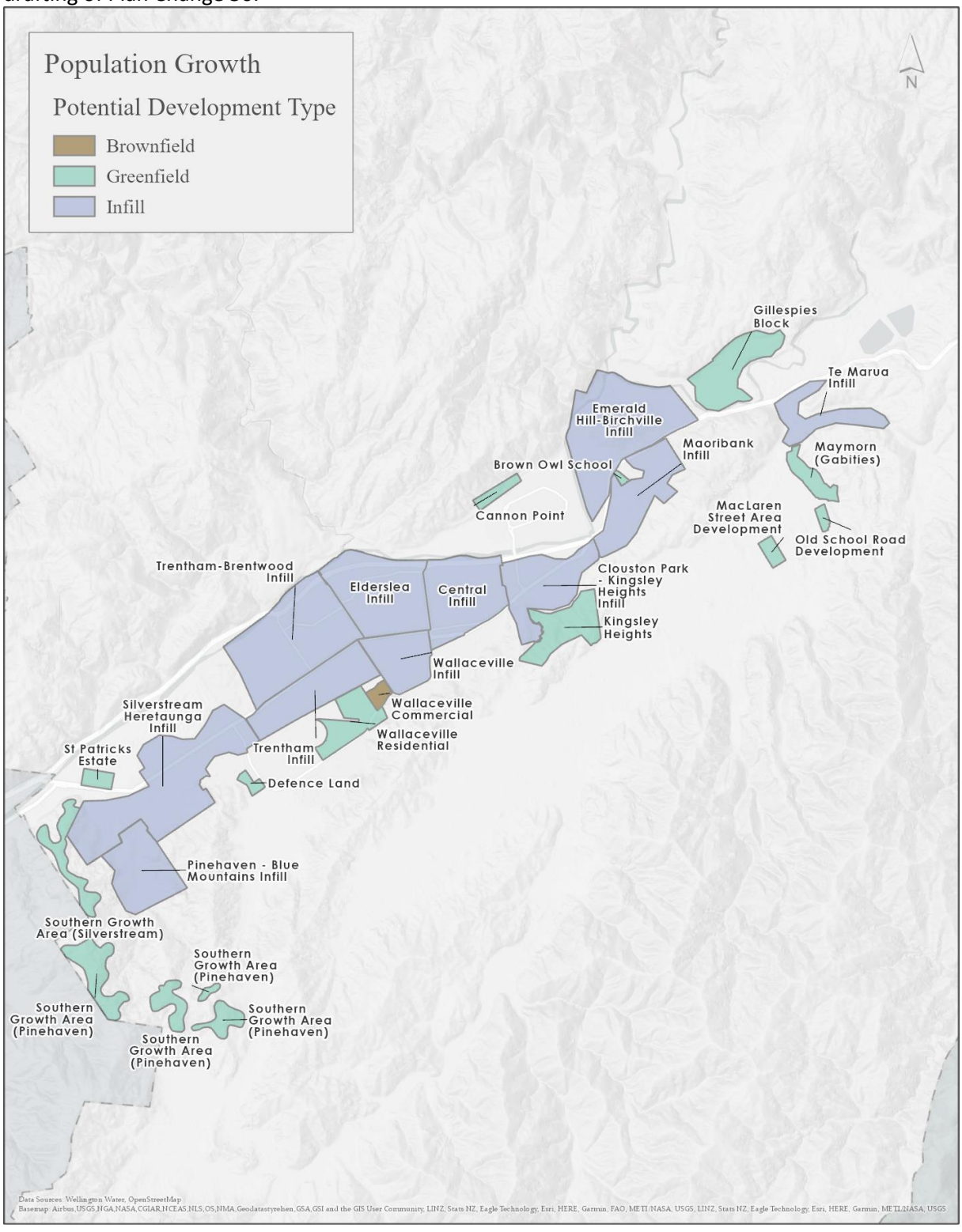

Figure 25. The potential growth areas assessed in this catchment plan.

13.4.1 Growth areas

The projected population growth over 30 years within each potential growth area are summarised in Table 12 below. These urban "catchment" areas are described primarily by the existing urban and

greenfield areas within 13 ForecastID suburbs and they can also be grouped into the six HBA areas (WMC, 2019). Although there are 15 ForecastID residential areas delineated, for this assessment growth was projected in only 13 of these suburbs, also referred to as growth areas.

These potential growth areas and the population forecasts considering recent changes, such as Covid-19 and the gazetting of the NPS-UD will be revised for the Phase Two assessment.

Table 12. Projected population growth at year 2047 in HBA areas and ForecastID suburbs.

HBA	ForecastID suburb (Growth Area)	Pop'n Growth – additional people in 2047	2017 Pop'n	2047 Future Pop'n	Annual growth (%)	Note
Akatarawa/ Moonshine	Akatarawa	2075	1346	3421	3.2%	Assumption is that all growth is in greenfield site (Gillespies Block)
Mangaroa/ Whitemans	Mangaroa	0	1737	1737	0%	Only as sensitivity test
Trentham/ Riverstone	Riverstone Terraces	0	1773	1773	0%	No growth anticipated
Trentham/ Riverstone	Trentham-Brentwood	719	4556	5275	0.5%	All infill
Trentham/ Riverstone	Trentham	2654	4600	7254	1.9%	Infill of 546 people with the rest in greenfield sites (Defence Land and Wallaceville) Also allow for 40,200m2 commercial development at Ward Street Business Park
Upper Hutt CBD	Clouston-Kingsley Heights-Maidstone	915	2914	3829	0.9%	Infill of 22 additional people with the rest in greenfield site (Kingsley Heights)
Upper Hutt CBD	Elderslea	425	3427	3852	0.4%	Infill growth
Upper Hutt CBD	Upper Hutt Central – Ebdentown	533	2685	3218	0.6%	Infill growth

Upper Hutt CBD	Wallaceville	332	2254	2586	0.5%	Infill growth
Urban North	Emerald Hill-Birchville	0	2889	2889	0%	No growth anticipated
Urban North	Maoribank	233	3313	3546	0.2%	Infill of 148 people with the rest in greenfield site (Brown Owl School)
Urban North	Te Marua	659	1203	1862	1.5%	Infill of 70 people with the rest in greenfield site (Gabites Block)
Urban North	Totara Park	174	2970	3144	0.2%	No infill. All development in greenfield site (Cannon Point)
Urban South	Pinehaven-Blue Mountains	1510	2942	4452	1.4%	Infill of 39 people with rest within the greenfield site (Southern Growth Area in Pinehaven)
Urban South	Silverstream-Heretaunga	2595	5172	7767	1.4%	Infill of 720 people with the rest in greenfield sites
Total		**12824**	**43781**	**56605**	**0.9%**	

13.4.2 Greenfield sites and sensitivity scenarios

In consultation with the UHCC Planning and Policy Team, twelve greenfield sites were identified (see Table 13).

In ten of these greenfield sites, separate sensitivity scenarios were investigated. The HBA sensitivity testing seeks to evaluate what the most commercially profitable total density is over a greenfield site when allowing for a density of between 10-30 dwellings per hectare. The purpose of including sensitivity results is to account for any future changes to development controls that may alter the maximum density that may be possible over the 30 year assessment period.

The purpose of investigating these potential sensitivity scenarios was to provide a three-waters investment lens for Plan Change 50 decision-making.

Table 13. Greenfield sites and projected growth over 30 years.

HBA	ForecastID Suburb	Greenfield Site	2047 Population	Sensitivity scenario total population 2047
Akatarawa/Moonshine	Akatarawa	Gillespies Block	2075	4095
Mangaroa/Whitemans	Mangaroa	MacLaren Street	0	131
Mangaroa/Whitemans	Mangaroa	Old School Area	0	134
Trentham/Riverstone	Trentham	Defence Land	372	NA
Trentham/Riverstone	Trentham	Wallaceville	1736	NA
Upper Hutt CBD	Clouston Park – Kingsley eight-Maidstone	Kingsley Heights	893	1452
Urban North	Te Marua	Maymorn/Gabites Block	590	1090
Urban North	Maoribank	Brown Owl School	86	167
Urban North	Totara Park	Cannon Point	174	223
Urban South	Pinehaven-Blue Mountains	Southern Growth Area Pinehaven)	1471	1974
Urban South	Silverstream-Heretaunga	Southern Growth Area (Silverstream and Blue Mountains)	1365	1865
Urban South	Silverstream-Heretaunga	St Patricks Estate	510	747

14. Appendix C - Environmental Planning

The key environmental planning document for Upper Hutt is the Regional Plan.

The sub-sections below describe the key environmental conditions that can affect the cost and implementation of upgrades to the three water networks.

14.1 Water quality and aquatic ecosystem health

New and more stringent provisions for the protection of water quantity and quality affect how Wellington Water sources drinking water and how discharges from the wastewater and stormwater systems are managed.

The 2017 amendment to the NPS-FM introduced four different numeric attribute states for *E. coli* across five bands or attribute states, being A to E that vary according to the amount of time microbial water quality meets the swimming thresholds of 260 and 540 cfu/100mL for *E. coli*. 'Swimmable' is defined as NPS-FM Bands A to C (excellent, good and fair).

Water Quality Attribute State

"Attribute" is a measureable characteristic of water, including physical, chemical and biological properties, which supports particular value (e.g. *E. coli* levels which affect safety for contact recreation, ecosystem health indicators such as the presence of native fish).

"Attribute State" is the level to which an attribute is to be managed. This is effectively an objective. The National Policy Statement for Freshwater Management presents attribute states in five Bands from A to E. Band A is the best state and Band D is the worst state. The national bottom line is the boundary between Bands C and D.

Generalised descriptions in the table below indicate how each attribute state reflects water quality and ecosystem health.

Attribute State	Generalised relationship to water quality and ecosystem health
A	High quality water bodies that are generally in a natural state, largely unaffected by human activities and pollution
B	Generally represents slight impacts on water quality
C	Relates to moderate impacts on water quality and ecosystem health
D	Highly impacted and degraded
E	Used specifically in respect of human health contact recreation indicators (E.coli) and reflects low quality waterbodies, where infection risk is high for more than 30 percent of the time.

E. coli and *Enterococci* are bacteria that indicate the presence of faecal material in water and therefore the possible presence of pathogens (i.e., disease-causing bacteria, viruses and protozoa). *E. coli* concentrations are an indicator of the risk to human health in fresh water. *Enterococci* can survive in salt water and therefore an indicator of the risk to human health in salt water.

Zinc and copper can have toxic effects on aquatic life in both a dissolved state and when attached to sediment particles. It is common for zinc and copper to be used as proxies[9] for the suite of other urban contaminants (e.g. polycyclic aromatic hydrocarbons, other toxic metals (such as cadmium and chromium), detergents/ surfactants and other chemicals).

Monthly data (2014-2019 data) from the GWRC Rivers State of Environment (as reported in WWL, 2019c) identified that:

- the Mangaroa River at Te Marua and the Hutt River opposite Manor Park Golf Club sites, failed to achieve an attribute state of C or above
- All sites monitored during the summer months in the Upper Hutt catchment as part of the recreational monitoring programme, were assigned attribute B or A.

Under the RMA, Councils must 'give effect to' objectives and policies in the NPS-FM. GWRC's approach has been to set region-wide provisions for freshwater in the Regional Plan and then to add chapters with catchment specific objectives, policies, limits and rules over time.

It is anticipated that in the future, rules in the Regional Plan will not allow incremental "minor" adverse effects associated with discharges to freshwater and coastal bodies, including those associated with discharges from urban development. The expectation is that network operators will need to demonstrate improvements to water quality as a result of improved discharge quality from the wastewater and stormwater networks.

While improvements need to occur today in respect of the existing discharges associated with the wastewater and stormwater networks, accommodating growth means that the level of improvement needed will be greater. This is because, even with best practice treatment, additional urban growth will not be able to demonstrate an improvement in water quality (e.g. some residual contaminants will be discharged from stormwater even after best practice treatment). Accordingly, it is expected that improvements to the water quality outcomes of the existing stormwater and wastewater networks, or through offset mitigation measures in the receiving catchment will be needed to facilitate urban growth.

The Regional Plan identifies five relatively large management or catchment areas that comprise in the greater Wellington region. GWRC intends that the water quality within each management area will be guided by a collaborative group called a Whaitua[10]. The whaitua process is intended to provide a decentralised approach to establishing priorities and programmes within each area.

In order to do this, freshwater management units (FMUs) must be created, and objectives and limits for each FMU set out in regional plans. FMUs are water management areas that identify and spatially delineate water bodies and the surrounding land that drains to those water bodies. The activities that affect land and water within these FMUs need to be managed to meet the freshwater objectives and limits.

[9] For example as was done in the *Te Awarua-o-Porirua Whaitua Implementation Plan (April 2019).*

[10] Whaitua is the Māori work for space or catchment.

The Whaitua te Whanganui-a-Tara committee was established in November 2018 and includes māna whenua, members of the community and councillors from the four councils in the region being Upper Hutt City Council, Hutt City Council, Wellington City Council and GWRC. This committee will develop a Whaitua Implementation Programme that will contain recommendations for the integrated management of land and water resources in the Hutt Valley and Wellington region.

The Whaitua te Whanganui-a-Tara Committee is expected to recommend that all catchments or FMU's in the Wellington Harbour and Hutt Valley Whaitua achieve an *E. coli* attribute state of C or above.

14.2 Hydrological catchments

Hydrological catchments are defined by the shape of the land. In simple terms, a hydrological catchment is the common area of land where all rainfall that falls on it, flows to a common receiving waterbody. Hydrological catchments are therefore:

- typically bowl-shaped, with the upper limits being a ridgeline or the top of a hill
- can be made up of smaller sub-catchments, such as a sub-catchment for a stream that flows into a bigger catchment of a river.

The land comprised by Upper Hutt City Council is drained by Te Awa Kairangi/Hutt River, one of the largest rivers in the Wellington Region. Te Awa Kairangi/Hutt River is an alluvial river, approximately 56 km in length. The river within the Upper Hutt City Council includes four main headwater tributary catchments:

- Pakuratahi
- Mangaroa
- Akatarawa
- Whakatiki, as well as
- the smaller Hulls Creek.

Large rainfall events in any of these four main catchments can cause the river to flood, and large rainfall events in more than one can cause significant flows in the Te Awa Kairangi/Hutt River.

The descriptions of each catchment are provide below[11] and illustrated in Figure 26 and described in Table 14.

The Pakuratahi River is approximately 15 km long and flows in a north-west direction through the southern Rimutaka Ranges, before discharging to the Hutt River near Kaitoke. Its 7,954 hectare catchment is primarily covered in hardwood and indigenous forest. However, the low gradient area near where the Pakuratahi meets the Hutt River has been extensively developed for pastoral land-use, and 11 percent of the catchment is covered in high productivity pasture.

The Mangaroa River is an approximately 20 km river that drains the western foothills of the Remutaka Ranges. Its headwaters lie at the top of Whiteman's Valley, to the west of Lower Hutt, and

[11] From - Potential Implications for Upper Hutt to meet the 2017 NPS-FM *E. coli* Objectives (WWL 2019c)

it discharges to the Hutt River just upstream of Upper Hutt. The 8,406 hectare catchment has been extensively developed for agricultural and pastoral land-use. The remainder of the catchment is primarily covered in hardwood and indigenous forest and planation forestry. There is also a large area of peatland to the south of Wallaceville Road, which is known as Waipango Swamp.

The Akatarawa River catchment is the largest sub-catchment of the Hutt River. Its headwaters arise in the Tararua Ranges, approximately 10 km south of Waikanae. The river runs southward for approximately 20 km through the Akatarawa Valley before discharging to the Hutt River near Birchville. The catchment of the Akatarawa River is 11,582 hectare in area and is primarily covered in hardwood and indigenous forest. However, there are areas of plantation forestry on the hills above the Akatarawa Valley and on the hills above its major tributary the Akatarawa River West. The floor of the Akatarawa Valley is largely deforested and has been converted to pasture.

The headwaters of the Whakatikei River are also in the Tararua Ranges, 5km south-east of Paekakariki. The river is approximately 15 km long, and discharges to the Hutt River opposite the suburb of Trentham. The 8,005 hectare catchment is primarily covered in hardwood and indigenous forest. However, there is a concentrated area of pastoral land-use and plantation forestry in the lower half of the catchment.

Hulls Creek is a small tributary of the Hutt River that runs through the suburbs of Trentham, Silverstream and Pinehaven. A 2007 water quality report from GWRC (Warr, 2007) described the catchment as follows. In its upper catchment, Hulls Creek receives runoff from scrub and indigenous forest as well as the Rimutaka Prison farm. Just below the prison farm a tributary draining the northern catchment, which includes the Trentham Racecourse, a golf course, the old General Motors factory and areas of pastoral farming, enters the stream. The mid catchment is drained by the Pinehaven Stream which is dominated by plantation forestry and scrub in its headwaters and urban residential areas in its middle and lower reaches. The lower catchment is drained by Tip Stream which includes the Silverstream Landfill in its headwaters and indigenous forest and scrub in its lower reaches.

Figure 26. Hydrological catchment boundaries.

Table 14. Hydrological catchments[12]

Catchment	Urban area (ha)	Catchment (ha)
Pakuratahi River	8	7,954
	0%	
Hutt River (Main)	3,696	11,052
	33.4%	
Mangaroa River	145	8,407
	2%	
Akatarawa River	5	11,582
	0%	
Whakatikei River	20.7	8,005
	0%	
Hulls Creek	584	1,658
	35%	

[12] From - Potential Implications for Upper Hutt to meet the 2017 NPS-FM *E. coli* Objectives (WWL, 2019c)

14.3 Topography

As illustrated on Figure 27, the majority of the urban and residential areas of Upper Hutt are located on the flats. Topography affects flooding from stormwater and can affect to cost of water supply and wastewater networks which generally rely on gravity.

Figure 27. Topography of Upper Hutt.

14.4 Geology and seismic hazards

Geology and seismic hazards can affect the cost and location of three water assets.

The geology of Upper Hutt is shown in Figure 28. The geological map shows the developed area is generally underlain by gravel.

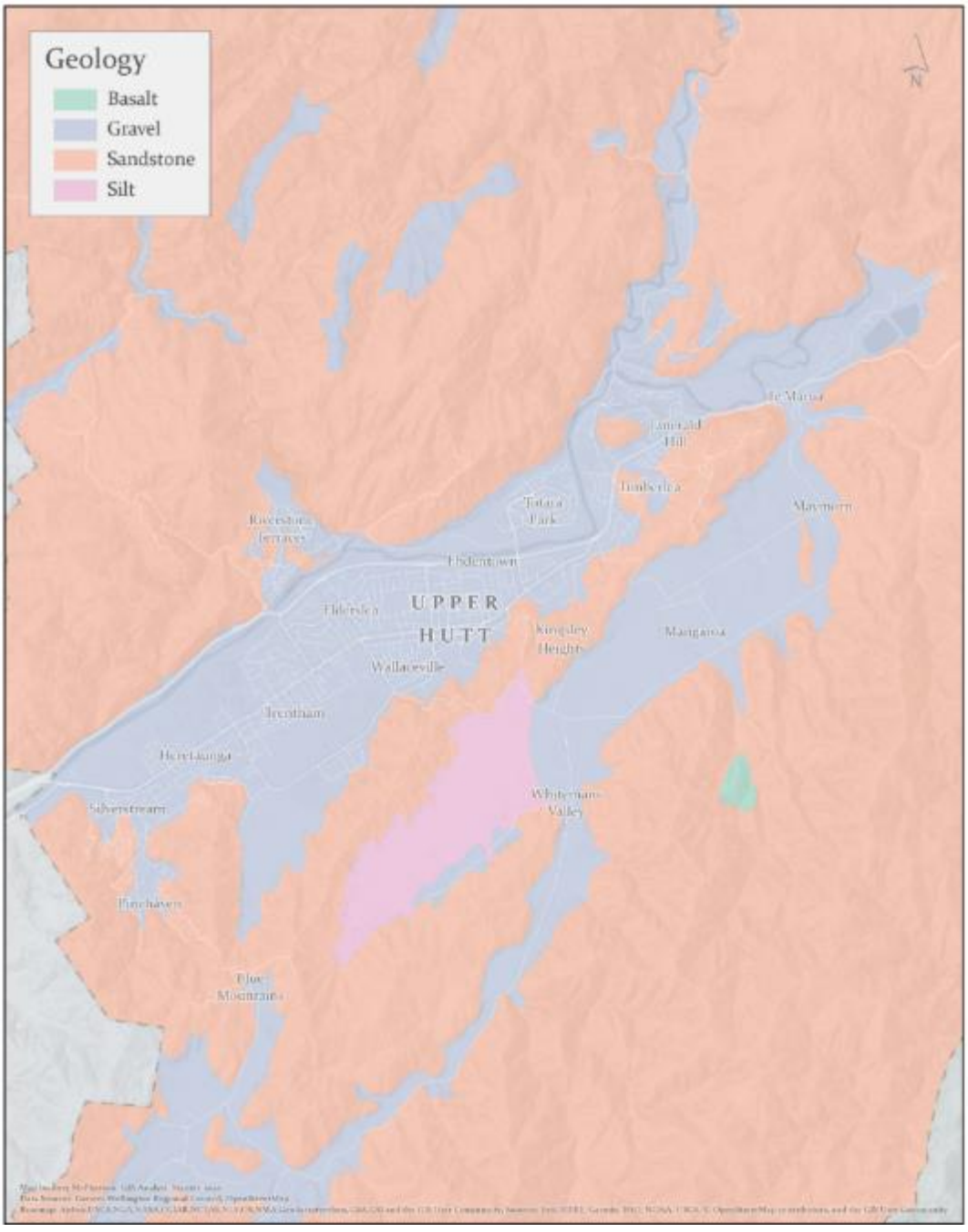

Figure 28. Geology.

Figure 29 illustrates areas of seismic hazard within the city, such as the potential fault rupture zones and areas of potential liquefaction and earth shaking.

A recent geotechnical assessment for UHCC (Coffey, 2019) notes that the liquefaction hazard across most of Upper Hutt was considered none or negligible, due to the soil conditions typically being

dense, gravelly, elevated and/or greater than 10,000 years old. The exception to this was an area in Trentham near the Rimutaka Prison which has historically been considered medium/high liquefaction hazard. This location is indicated on Figure 29. The Coffey report states that further investigation is needed and the area might be reclassified as negligible hazard. Updated information may be available to inform the Phase Two catchment plan for growth report.

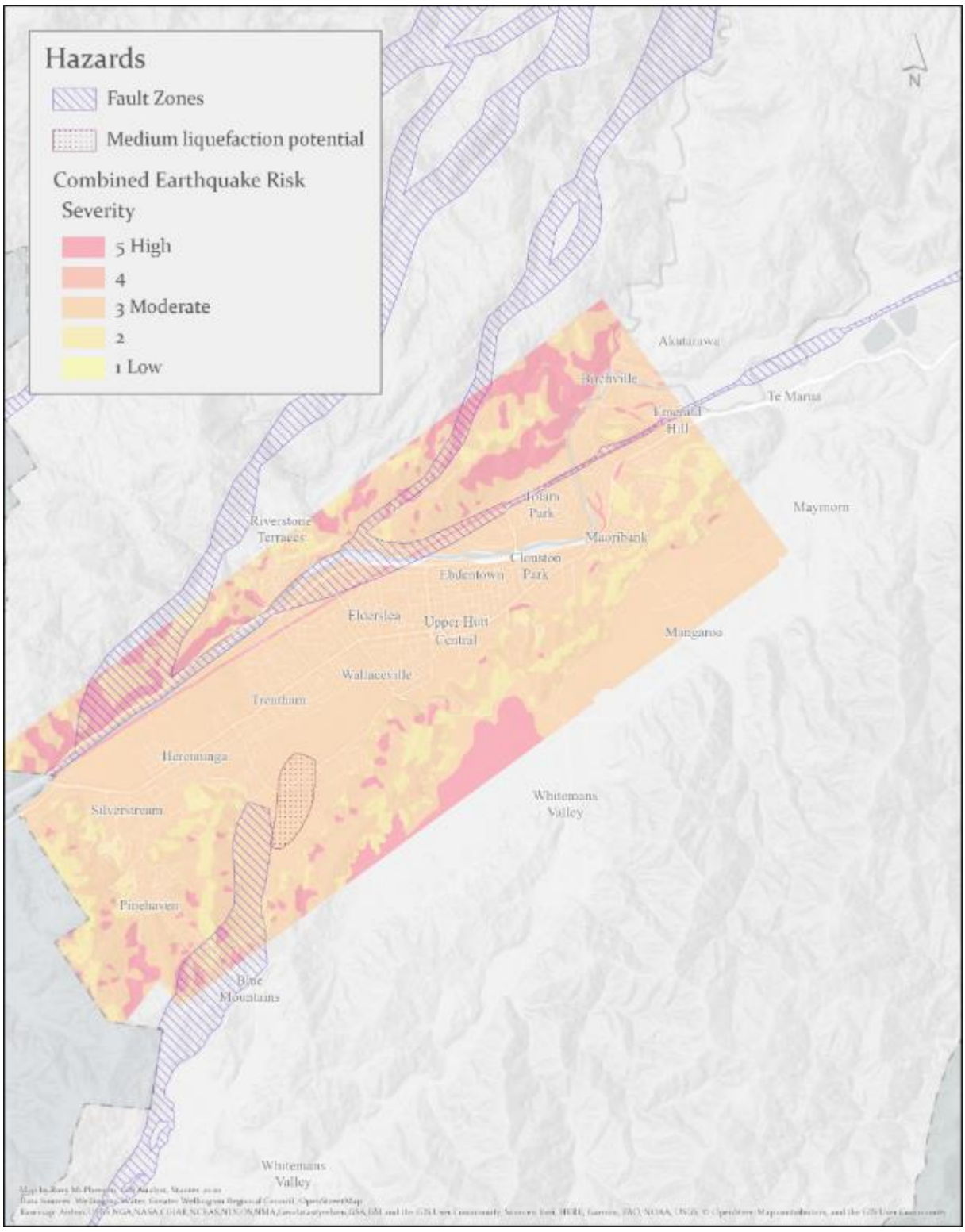

Figure 29. Seismic hazards.

14.5 Contaminated sites

Known and potentially contaminated sites from GWRC's selected land use register (SLUR) are illustrated in Figure 30. These are sites that are known or suspected to have been involved in the use, storage, or disposal of hazardous substances and which may contain residues of these substances.

Trenching and excavation in contaminated sites can increase the risks and costs of new three water infrastructure.

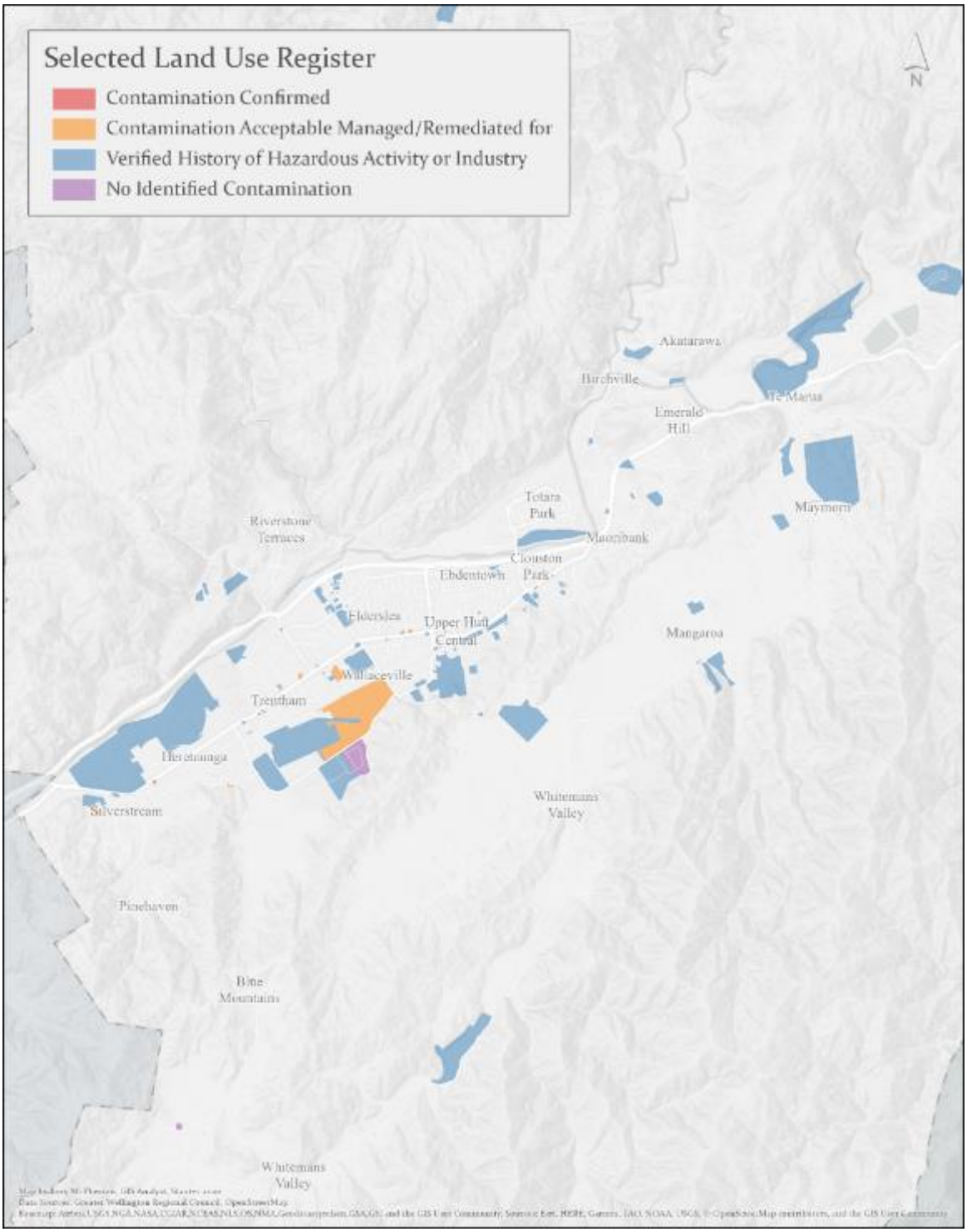

Figure 30. Selected Land Use Register sites of known and potentially contaminated sites.

14.6 Significant natural areas, protected ridgelines and areas of significance to mana whenua

Te Awa Kairangi/Hutt River is scheduled in the Regional Plan as Ngā Taonga Nui a Kiwi, as shown in Figure 15. Ngā Taonga Nui a Kiwi are areas with significance to and identified as taonga by mana whenua iwi in the Wellington Region. For areas on this schedule, the Regional Plan recognises that kaitiakitanga shall be recognised and provided for by managing natural and physical resources in accordance with tikanga and kaupapa Māori as exercised by mana whenua, and that land and water resources will be managed recognising ki uta ki tai by using the principles of integrated catchment management.

The UHCC District Plan identifies Protected Ridgelines and areas of high ecological value through the Southern Hills overlay as shown in Figure 31.

Ecological, cultural and important landscape areas should be considered when planning and costing new infrastructure, particularly water supply reservoirs which typically need to be located on elevated hill sites.

It is anticipated that in outstanding or special amenity locations, there may be a requirement for infrastructure to be screened, buried or otherwise avoided in order for future RMA approvals to be obtained for earthworks and/or structures within these areas.

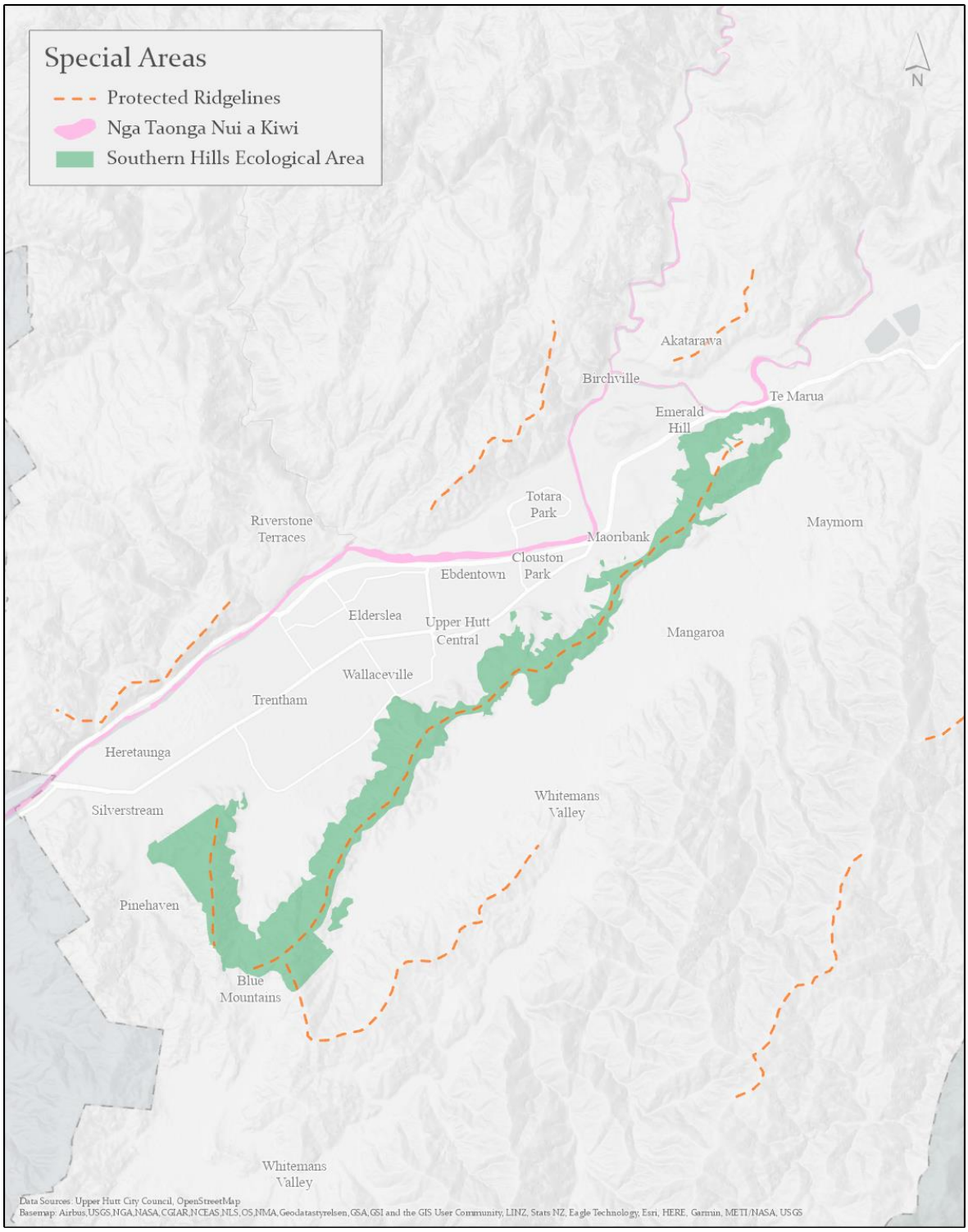

Figure 31. Locations of high ecological value, protected ridgelines and areas of significance to mana whenua.

14.7 Heritage

Heritage features scheduled in the Upper Hutt District Plan are illustrated on Figure 32. These heritage items includes buildings, structures, features and sites.

It is important to avoid adverse effects on heritage when siting new three water infrastructure, to the extent practicable, taking account of the functional needs of the service.

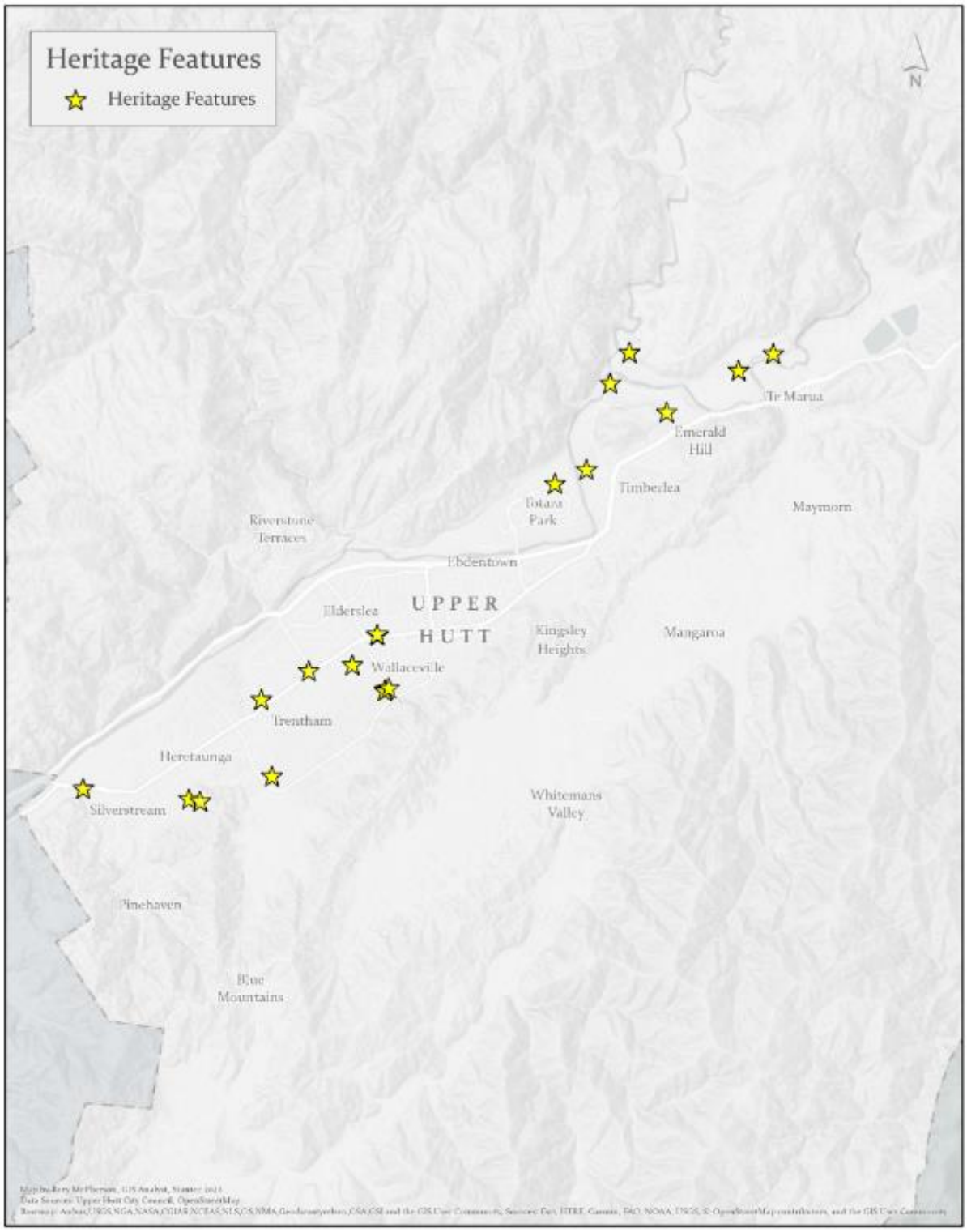

Figure 32. Scheduled heritage buildings, structures, features and sites in Upper Hutt.

15. Appendix D - Statutory and Regulatory Requirements

Specific statutory and regulatory documents and their anticipated outcomes, as they relate to the integrated planning of three waters infrastructure and urban growth, are summarised in Table 15.

Table 15. Statutory and regulatory documents and outcomes important to integrated planning in Upper Hutt.

Statutory and regulatory document	Outcome
Local Government Act 2002	To meet the current and future needs of communities for good-quality local infrastructure, local public services, and performance of regulatory functions in a way that is most cost-effective for households and businesses
Resource Management Act 1991 New Zealand Coastal Policy Statement 2010 National Policy Statement -Freshwater Management 2014	Sustainable management of coastal and freshwater quality, including a statutory requirement for regional plans to implement provisions to improve water quality in degraded catchments
Resource Management Act 1991 National Policy Statement-Urban Development Capacity 2016	Local authorities provide sufficient development capacity for business and housing development in RPS and District Plans, supported by infrastructure to meet current and future needs
Resource Management Act 1991 Operative Regional Plans and Proposed Natural Resources Plan for the Wellington Region	Sustainable management of water, land and coastal resources including water quality targets rules requiring consents for water takes and discharges
Statutory Acknowledgements	Regard for the association of the iwi with their statutory acknowledged areas
Upper Hutt District Plan	Urban form
Regional Standard for Water Services - Wellington Water	Code of practice for the provision of water services. Provides overall objectives and performance criteria for the design and construction of infrastructure in new subdivisions, and the maintenance, renewal and upgrade of existing council infrastructure

UHCC Bylaws	Bylaws for the control and approvals of connections to the three water networks, to enable access and maintenance and allow council to make charges

Additional drivers and outcomes important to the provision of three waters infrastructure are contained in non-regulatory strategies and plans, which are discussed below and summarised in Table 16.

Table 16. Strategic documents and outcomes important to integrated planning in Upper Hutt.

Strategic document	Outcome
Regional Service Plan, Long Term Plan and Infrastructure Strategy and Development Contributions Policy	Assets are managed in a sustainable manner that allows the achievement of council and community outcomes
Three Waters Strategy for the Wellington Metropolitan Region	The management of the three waters services in a way that provides safe and healthy drinking water, is respectful of the environment, and provides resilient networks that support our economy (see Appendix 12 of this report)
HBA	(see Appendix B, section 13.2.1 of this report)

15.1 Consents held for three waters infrastructure

The operation and extension of the three waters infrastructure require resource consents from GWRC that authorise key aspects, such as permits for taking water from rivers and aquifers and consents for discharging treated wastewater and discharging stormwater from the outlets to streams and coastal waters.

15.1.1 Water supply consents

Multiple water take permits are held by Wellington Water on behalf of GWRC for the bulk water supply network for the Wellington Metropolitan Region, which includes Upper Hutt.

At this stage Wellington Water does not expect to be able to increase the bulk water take, given that the maximum take allowed in the regional plan is allocated to the existing consents.

This means that urban growth in the medium to longer term will need to be accommodated through increased efficiency and water conservation measures.

15.1.2 Wastewater consents

Wellington Water has lodged renewal application for the Seaview WWTP discharges to Waiwhetu (seeking to discharge location), and Silverstream storage discharges. The engagement process incorporates a strategy for managing unconsented wastewater network overflows direct to the receiving environment.

A catchment level resource consent is also being developed for all wastewater overflows in Hutt and Upper Hutt Cities. In the UHCC catchment there is one constructed overflow of partially treated (screened) wastewater to freshwater associated with the Silverstream storage facility. The Silverstream storage facility is used to relieve pressure on the downstream Hutt City network and is designed to limit sewer flows to the Hutt Valley Western Trunk Sewer.

The storage tank is used to control the flow from the Upper Hutt catchment before it enters the Hutt City wastewater network on its way to the Seaview WWTP. The operation of the Silverstream storage facility, including wet weather overflows of partially treated wastewater to Te Awa Kairangi/Hutt River is not currently included in the UHCC hydraulic wastewater model. This outlet will be included when the Hutt City wastewater model is completed and both models are combined for use in the Phase Two catchment plan for growth assessment.

15.1.3 Stormwater consents

Wellington Water has a short-term global resource consent (WGN180027 that expires 30 November 2023) for stormwater. This includes the majority of the constructed wastewater overflows that go to the stormwater network and overflow from the Totara Park pump station plus four others. The overflows discharge at varying frequency. Constructed and unconstructed wastewater network overflows to stormwater that are included in this consent are listed below.

- Ashington Road Pump Station (located in the Silverstream sub-catchment upstream of the GWRC Hutt River opposite Manor Park Golf Club monitoring location);
- Weir Road Manhole (located within the Heretaunga sub-catchment upstream of the Wellington Water Coates Grove stormwater monitoring location); and
- Lila Gillies Lane Pump Station (located within the Riverstone Terraces catchment upstream of the GWRC Hutt River at Poets Park monitoring location).

Unconstructed overflows are from manholes that surcharge due to excessive flows that exceed the hydraulic capacity of the pipes or, in some cases, operational issues such as partial blockages from gravel, tree roots or fat. Many of these locations overflow into the stormwater network before discharging to fresh water.

The consent permits the "*Discharge permit for the discharge of stormwater occasionally contaminated with wastewater into fresh or coastal water, and onto or into land where it may enter fresh and coastal water from the Wellington City Council, Porirua City Council, Hutt City Council and Upper Hutt City Council owned stormwater network*."

As part of this consent, a stormwater monitoring plan has been developed and approved by GWRC. To support a longer-term consent, a Stormwater Management Strategy will be developed in 20/21 and 21/22 financial years. This strategy will set out methods to achieve NPS-FM and Whaitua objectives and limits, and prioritise sub-catchments for stormwater management (implementation) plans.

The consents relevant to the ability of the three waters infrastructure to support urban growth in Upper Hutt are detailed in Table 17. These resource consents, and the likely future requirements for consented activities, are key drivers which influenced the infrastructure solutions identified in this catchment management plan.

Table 17. Key resource consents relevant to three waters infrastructure and urban growth.

Consent type	Consent/Permit- expiry date
Multiple water take permits are held by Wellington Water on behalf of GWRC for the bulk water supply network for the Wellington Metropolitan Region, which includes Upper Hutt	WGN000200-20540 - Orongorongo abstraction – exp 17/08/2036 WGN000200-20544 - Big Huia abstraction – exp 17/08/2036 WGN000200-20548 - Little Huia abstraction – exp 17/08/2036 WGN000200-20550 - Telephone creek abstraction – exp 17/08/2036 WGN000201-20552 - Wainuiomata abstraction – exp 17/08/2036 WGN000201-20554 - Upper George abstraction – exp 17/08/2036 WGN000201-20558 - Lower George abstraction – exp 17/08/2036 WGN000199-33824 (supersedes [30733]) - Kaitoke abstraction – exp 17/08/2036 WGN970036-25813 - Waiwhetu artesian abstraction – exp 12/08/2033
Consents authorise the discharge of treated wastewater and contaminants to air from the Seaview wastewater treatment plant (WWTP), wastewater overflows from the treatment plant and Silverstream storage and the disposal of sludge to Landfill, which serves Hutt and Upper Hutt Cities	WGN050359 [24539] & WGN120142 [33407] – Discharge at Bluff Point – exp 25/08/2031 WGN110494 [31241] – Wainuiomata storm tank discharge – exp 19/12/2029 WGN120142 [33406] – discharge to Waiwhetu Stream – exp 1/02/2018 (renewal lodged – on hold) WGN930193(1) & (2) – air discharge – exp. 17/01/2029 WGN930194 – coastal occupation – exp 13/01/2029 WGN960002 [23747] – Silverstream overflow discharge – exp 17/06/2019 (renewal application lodge – on hold)
A global consent which authorises the discharge of stormwater to land, freshwater and coastal water from the stormwater network, including wastewater which may overflow to the stormwater network across Upper Hutt City, as well as the Wellington, Hutt and Porirua city stormwater networks.	WGN180027 [34920] – exp 30/11/2023

16. Appendix E - Identified water supply and wastewater upgrades on one map

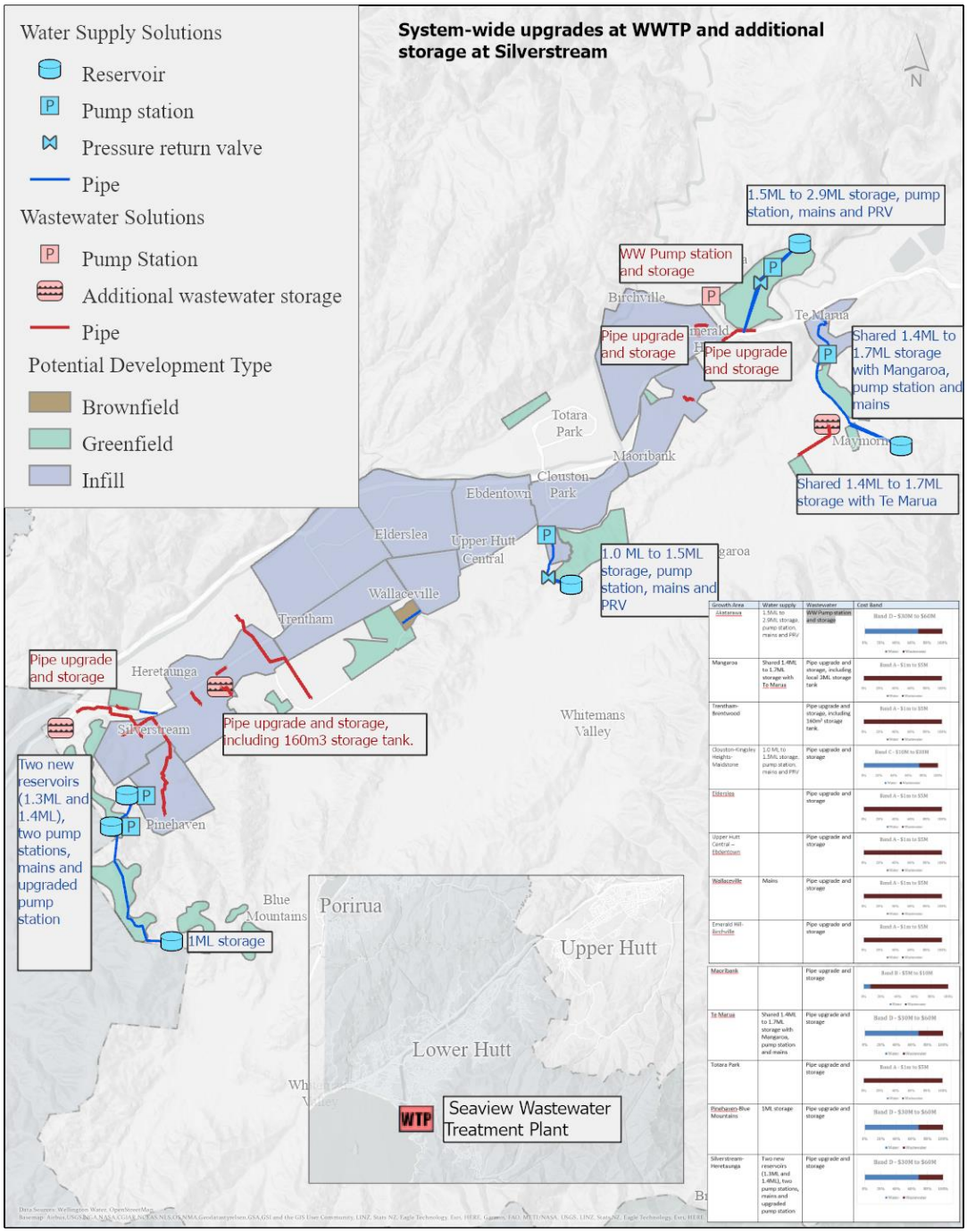

Figure 33. **Identified water supply and wastewater upgrades needed to support the potential population in Upper Hutt in year 2047.**