Plan Change 12 – Enabling Housing: Part 3 Other Appendices

Appendix 3.5 Three Waters Performance Assessment Report

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PART 2 - EXECUTIVE SUMMARY

2.1.1 The purpose of this report is to inform and support Hamilton City Council's (HCC) response to the requirements of the Resource Management (Enabling Housing Supply and Other Matters) Amendment Act 2021 (the Act) and the National Policy Statement on Urban Development (NPS-UD) through District Plan Change 12 (PC12).

2.1.2 In particular, this report considers the implications of more intensive residential development across Hamilton City on the three waters networks (water supply, wastewater and stormwater) and, in turn, on the ability to give effect to relevant aspects of Te Ture Whaimana o te Awa o Waikato - the Vision and Strategy for the Waikato River (Te Ture Whaimana).

2.1.3 The Resource Management (Enabling Housing Supply and Other Matters) Amendment Act (the Act) came into law in December 2021, requiring HCC to implement a Medium Density Residential Standard (MDRS) across all residential zones in the city.

2.1.4 The MDRS permits three units up to three storeys high on all sites located in residential zones, regardless of lot size provided certain bulk and location requirements are met. Alongside the Act is also the NPS-UD. The latter requires HCC to up-zone (i.e. provide for increased density) around town centres commensurate with the level of demand.

2.1.5 The Act includes 'qualifying matters' (QM). Where these exist, the territorial authority may moderate the zoning response to accommodate the qualifying matter.

2.1.6 Te Ture Whaimana is the primary direction setting document for the Waikato River and activities within the catchment. It has the status of a National Policy Statement and prevails where there are inconsistencies with other national policy statements including the NPS-UD.

2.1.7 Te Ture Whaimana is identified as a QM in the Act alongside a number of other matters. For HCC, Te Ture Whaimana is a key qualifying matter given the City's location on the banks of and completely within the Waikato River catchment and how critical the river is to the city's existence.

2.1.8 This three waters performance assessment work evaluates the ability for HCC three waters networks to service development and intensification proposed by the MDRS and NPS-UD while continuing to give effect to Te Ture Whaimana. To do this, the performance assessments only use criteria that are considered to align with relevant objectives and strategies of Te Ture Whaimana. The assessments have not considered all of the criteria that would typically be used to assess overall system performance.

2.1.9 City land zoned for residential activity was divided into 19 discrete areas and the waters networks servicing each of the areas assessed against a set of criteria. Assessments of a 20th area (which includes the CBD, Frankton and

Kahikatea/Greenwood industrial and commercial areas) were also completed.

2.1.10 The assessment criteria focus largely on network performance, impacts and investment needs each of the discrete areas. It is however important to acknowledge other strategically important system wide challenges facing the city. These challenges have not been specifically included in the performance assessments as they are largely independent of the geographic locations of development and intensification. They include:

i. Water allocation constraints. i.e. recognising the finite water resources available from the Waikato River to service growth

ii. Environmental limits of the Waikato River to receive contaminants arising from urban land uses (wastewater and stormwater discharges) and the need to reduce the contaminant discharge loads and address the impacts of residual contaminant discharges.

iii. Climate change impacts on the water systems including reduced source security, and increased flood hazard risks, erosion and wastewater network overflows.

iv. Water supply intake, headworks and treatment system capacity.

v. Wastewater treatment plant and discharge system capacity.

vi. Impacts of intensification on local network capacity performance and the upgrades needed to ensure compliance with technical specifications and design standards (e.g. pipe sizes and methods of network connections).

vii. Satisfying the city's obligations under Te Ture Whaimana with respect to three waters network performance.

2.1.11 The methodology used to complete the assessments is described in Part 9 of this report along with key assumptions and limitations of the work.

2.1.12 Due to the tight timeframes associated with producing this report, the analyses carried out have relied on existing data, information, assessments, and strategies associated with Hamilton's three waters networks. The performance assessments use HCC most recent modelling results and three waters master plans. The water and wastewater modelling and master plans are based on 2017 population and growth projections. These population and growth figures do not reflect the current plan enabled capacity or the MDRS and NPS-UD requirements.

2.1.13 No new investigations or assessments to quantify the impacts of the MDRS and NPS-UD on the city's water networks or determine possible infrastructure investment programmes have been completed to inform this evaluation.

2.1.14 The criteria developed and used to complete the assessments are in Part 10 of this report. Te Ture Whaimana objectives and strategies considered relevant to each of the criteria and commentary on the rationale for including the criteria in the assessment are also outlined. The criteria used for the assessment relate to:

(a) Water Supply:

i. Head loss.

ii. Minimum pressure/ firefighting standard compliance.

iii. Scale of investment funded in the current LTP.

iv. Scale of investment needed to service "step change" in demand in long term.

(b) Wastewater Network:

i. Local and trunk pipeline utilisations under dry weather flow conditions (winter).

ii. Local and trunk wet weather overflows.

iii. Strategic interceptor pipeline utilisation under dry weather flow conditions (winter).

iv. Scale of investment funded in the current LTP.

v. Scale of investment in the current Master Plan.

vi. Scale of investment needed to service "step change" in demand in long term.

(c) Stormwater System:

i. Quality of supporting stormwater investigations for the area.

ii. Flood hazards.

iii. Watercourse quality risks.

iv. Watercourse erosion risks.

v. Stormwater capacity.

vi. Sites of cultural significance.

2.1.15 Four categories (low impact (green), medium impact (yellow), high impact (orange) and extreme impact (red)) have been defined for each of the criteria used in the assessment. These are described in Part 11 of this report.

2.1.16 Each of the discrete areas of the city were evaluated and scored between 1 and 4 against the criteria using the category definitions.

2.1.17 For the overall traffic light assessments the criteria for the water and wastewater assessments were grouped into three temporal bands (near, medium and long term). Criteria within each band are weighted equally.

2.1.18 For the water and wastewater assessments the 'sub-criteria' within each temporal band were weighted equally and the average score adopted for each temporal band.

2.1.19 For the water and wastewater assessments three different scenarios were considered which applied different weightings to each of the temporal bands tested:

(a) Scenario 1: Applied equal weighting to the scores from the three temporal bands (33% each)

(b) Scenario 2: Applied 60% weighting to the near term temporal band 30% to the medium term and 10% to the long term.

(c) Scenario 3: Applied 70% weighting to the near term temporal band 30% to the medium term. Scoring against the long term criteria was excluded.

2.1.20 For stormwater equal weighting was applied to all of the criteria to determine an overall 'traffic light' assessment for each discrete area.

2.1.21 The results of the overall traffic light assessments are summarised in Section 12.3 and adopt the same categories used for the individual criteria assessments.

2.1.22 Summaries of the three water assessments against each criterion are included in Sections 12.4, 12.5 and 12.6 with further details to support these assessments included in Appendix C, D and E.

2.1.23 The assessments highlight that all of the discrete areas have significant servicing challenges with one or more of the waters services.

2.1.24 This report notes that the City's 3-waters systems were designed and constructed to provide levels of service considered appropriate when they were developed and to respond to densities planned for at that time. These levels of service and densities do not reflect current requirements and plan enabled capacity, or those anticipated through NPS-UD and MDRS.

2.1.25 Today's environmental, social and cultural expectations and regulatory obligations require levels of service and performance that are significantly higher than delivered historically. Te Ture Whaimana sets out an obligation to deliver 'betterment' to the Waikato River, and not simply to avoid, remedy or mitigate environmental effects.

2.1.26 In addition to these regulatory drivers, the anticipated impacts of climate change are now better understood. Catchment planning and infrastructure investments should provide for more resilient communities through land use decisions that avoid creating or exacerbating natural hazards; investment in measures to reduce demand on the environment including through physical / asset (treatment improvements; network upgrades; leakage reduction; infiltration and ingress reduction; overland flow path and blue green corridor creation and protection) and non-asset based solutions (e.g. education, policy, planning).

2.1.27 This report provides an evidence base that demonstrates that Hamilton City's existing three waters systems have performance challenges with respect to meeting the obligations under Te Ture Whaimana to varying degrees across the city already. These existing challenges will be exacerbated by continued infill development in accordance with the City's current duplexing planning provisions, and further compounded by the densities contemplated by NPS-UD and MDRS.

2.1.28 The assessment clearly shows that the city's three waters infrastructure cannot accommodate higher levels of urban intensification as required through the Act and the NPS-UD without significant investment (in addition to that already funded). To deliver the intensification contemplated without significant investment would result in worsening the effects of urban land use activities on the Waikato River and its tributaries which is not in line with Te Ture Whaimana.

2.1.29 Solutions are available to address the infrastructure challenges and improve the health and wellbeing of the Awa from current baseline. More detailed work is needed to assess the implications of different land use and growth scenarios, including the proposed planning responses to NPS-UD and MDRS, and develop subsequent infrastructure investment programmes needed to respond to those increased demands. It is clear that supporting densification will require significant investment on top of what has previously been identified in master plans and LTP funding requests in order to uphold Te Ture Whaimana .

2.1.30 The NPS-UD and MDRS is a step change in development densities and will require a step change in infrastructure investment. The level of investment needed to implement the necessary solutions everywhere, all at once is beyond HCC's ability to sustainably afford.

2.1.31 Although this report does not identify specific areas of the city to intensify, it highlights that the costs to provide infrastructure necessary to respond to MDRS everywhere all at once is prohibitive and confirms the need to prioritise where MDRS and higher-density residential development is enabled.

2.1.32 Just adopting MDRS as per the Enabling Act without a clear and committed infrastructure investment and delivery programme will increase network failures and adversely affect the Awa and communities. Accordingly, a targeted approach to increased densities is required to ensure that the necessary investment needed to service the increased densities is in place at the right time.

2.1.33 It is important to note that the traffic light colours in this report is not directly transferable into District Plan planning provisions. "Green " does not highlight 'go' areas of the city.

2.1.34 Further work is needed to consider updated growth projections for the city, identify potential three waters infrastructure investment and delivery programmes to respond to those growth projections; meet the city's obligations to contribute toward restoring and protecting the Waikato River as set out in Te Ture Whaimana and satisfy the city's obligations under other planning and regulatory instruments. This work includes:

(a) Updating the city's three waters models with updated growth projections to better understand the impacts planned and enabled growth will have on the city's urban water systems.

(b) Embedding and incorporating maatauranga maaori further into urban water system planning, delivery and management in and beyond the City boundaries.

(c) Further consideration of the impacts of climate change on the city's urban water systems.

(d) Evaluating the impacts of predicted network performance on public health, safety and prosperity.

(e) Evaluating the impacts of predicted system on sites of significance to mana whenua (i.e. hauanga kai/mahinga kai, wai tapu and wahi tapu, swimming locations).

(f) Evaluating and recommending investment and delivery programmes to meet future growth demands and gives effect to Te Ture Whaimana by contributing toward restoring the health and wellbeing of the Waikato River, including the relationship of communities and mana whenua with the river.

PART 3 - GLOSSARY

Council	Hamilton City Council
CSDC	Comprehensive Stormwater Discharge Consent
District Plan	Hamilton City District Plan
Ha	Hectare
HAF	Housing Acceleration Fund
HCC	Hamilton City Council
IPI	Intensification Planning Instrument
ICMP	Integrated Catchment Management Plan
LTP	2021-31 Long Term Plan
MDRS	Medium Density Residential Standards
MLD	Mega Litres per day (1,000,000 Litres per day)
NPS-UD	National Policy Statement on Urban Development
OLFP	Overland Flow Path
PC12	Plan Change 12
QM	Qualifying matter (Section 77I and 77O of the Act)
REEP	Regulatory Effectiveness and Efficiency Programme
RITS	Regional Infrastructure Technical Specifications
SWMPv2	Stormwater Management Plan, version 2
The Act	Resource Management (Enabling Housing Supply and Other Matters) Amendment Act 2021
Three Waters	Water supply, wastewater and stormwater networks and management systems
TLA	Traffic light assessment/s
Urban water systems	Freshwater systems in an urban area including the drinking water, wastewater and stormwater system of that urban area and natural waterways and drainage systems.
Waikato River	means the Waikato River and its catchment.
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant
TTWM	Te Ture Whaimana o te Awa o Waikato – Vision and Strategy for the Waikato River

PART 4 - PURPOSE

4.1.1 The purpose of this report is to provide information on water supply, wastewater and stormwater services as they relate to urban growth in Hamilton City.

4.1.2 In particular, this report considers the likely implications of more intensive residential development across the city on the three waters networks and in turn on the ability to give effect to o Te Awa o Waikato, the Vision and Strategy for the Waikato River, (Te Ture Whaimana), the primary direction setting document for activities that impact on the Waikato River.

4.1.3 The report achieves this purpose through assessing existing data, information, assessments and strategic plans based on servicing population and growth projections developed prior to the National Policy Statement – Urban Development 2020 (NPS-UD) and the Resource Management (Enabling Housing Supply and Other Matters) Amendment Act (the Act).

4.1.4 The data documented in this assessment will inform HCC's approach to the implementation of the Intensification Planning Instrument (IPIs) as required under the Act and NPS-UD. This data will be likely used in hearings to support some of HCC's proposed planning provisions in Plan Change 12 (PC12).

PART 5 - BACKGROUND

5.1 Context

5.1.1 The Resource Management (Enabling Housing Supply and Other Matters) Amendment Act (the Act) came into law in December 2021, requiring HCC to implement a Medium Density Residential Standard (MDRS) across all residential zones in the city.

5.1.2 The MDRS permits three units up to three storeys high on all sites located in the General Residential Zone, regardless of lot size, provided certain bulk and location requirements are met. Alongside the Act is also the National Policy Statement on Urban Development (NPS-UD). The latter requires HCC to up-zone (i.e. provide for increased density) around town centres commensurate with the level of demand.

5.1.3 Te Ture Whaimana is the primary direction setting document for the Waikato River and activities within the catchment. It has the status of a National Policy Statement and prevails where there are inconsistencies with other national policy statements including the NPS-UD.

5.1.4 The Act includes 'qualifying matters' (QM). Where these exist, the territorial authority may moderate the zoning response to accommodate the qualifying matter.

5.1.5 Te Ture Whaimana is identified as a QM in the Act alongside a number of other matters. For HCC, Te Ture Whaimana is a key qualifying matter given the relationship that mana whenua have with the Waikato River, that Hamilton is located on the banks of the river and the city's total reliance on the river for water and drainage.

5.1.6 This three waters performance assessment work helps to understand Te Ture Whaimana as a qualifying matter and in particular whether HCC should seek to moderate the zoning for intensification as a result of three waters system capacity impacting on the ability to give effect to Te Ture Whaimana.

5.2 **Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010**

5.2.1 The Waikato-Tainui Waikato River claim arose from the Crown's Raupatu (confiscation) in the 1860s which denied the rights and interests of Waikato-Tainui in the Waikato River. The river claim was excluded from the 1995 land settlement with Waikato-Tainui and was set aside for future negotiation.

5.2.2 In 2009, Waikato-Tainui entered into a deed of settlement in response of the Raupatu claims over the Waikato River. The Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010 (the Waikato-Tainui Act) gave effect to the 2009 deed of settlement. The overarching purpose of the settlement is to restore and protect the health and wellbeing of the river for future generations.

5.2.3 The purpose of the Waikato-Tainui Act, as set out in Section 4 is to:

1. *give effect to the settlement of raupatu claims under the 2009 deed:*
2. *recognise the significance of the Waikato River to Waikato-Tainui:*
3. *recognise the vision and strategy for the Waikato River:*
4. *establish and grant functions and powers to the Waikato River Authority:*
5. *establish the Waikato River Clean-up Trust:*
6. *recognise certain customary activities of Waikato-Tainui:*
7. *provide co-management arrangements for the Waikato River:*
8. *provide redress to Waikato-Tainui relating to certain assets:*
9. *recognise redress to Waikato-Tainui of the Kiingitanga Accord and other accords provided for in the schedule of the Kiingitanga Accord.*

5.2.4 The guiding principles of interpretation of the Waikato-Tainui Acre, as set out in Section 5 are:

1. *The vision and strategy is intended by Parliament to be the primary direction-setting document for the Waikato River and activities within its catchment affecting the Waikato River.*
2. *This Act must be interpreted in a manner that best furthers—*

   (a) the overarching purpose of the settlement; and

   (b) subsection (1); and

   (c) the agreements expressed in the 2009 deed and the Kiingitanga Accord.

5.2.5 Additionally, the Ngāti Tūwharetoa, Raukawa, Te Arawa River Iwi Waikato River Act 2010 and the Ngā Wai o Maniapoto (Waipa River) Act 2012 are important pieces of legislation that give effect to Te Ture Whaimana.

5.3 Te Ture Whaimana o Te Awa o Waikato: Vision and Strategy for the Waikato River

5.3.1 Through the Waikato River settlement process between Waikato-Tainui and the Crown, the Guardians Establishment Committee was formed, with the support of other river iwi (Ngāti Tūwharetoa, Raukawa, Te Arawa River Iwi and Maniapoto). In 2009, this committee finalised Te Ture Whaimana. Te Ture Whaimana is set out in schedules to the above Acts.

5.3.2 Te Ture Whaimana is the primary direction-setting document for the Waikato and Waipa Rivers and their catchments which include the lower reaches of the Waipa and responds to four fundamental issues:

a. The degradation of the Waikato River and its catchment has severely compromised Waikato River iwi in their ability to exercise mana whakahaere of conduct their tikanga and kawa.
b. Over time, human activities along the Waikato River and land uses through its catchments have degraded the Waikato River and reduced the relationships and aspirations of communities with the Waikato River.

c. The natural processes of the Waikato River have been altered over time by physical intervention, land use and sub-surface hydrological changes. The cumulative effects of these uses have degraded the Waikato River.

d. It will take commitment and time to restore and protect the health and well-being of the Waikato River.

5.3.3 Te Ture Whaimana takes a holistic approach and aims for the restoration and protection of the economic, social, cultural and spiritual relationships that Waikato and Waipā River Iwi have with the Waikato and Waipā Rivers.

5.3.4 Te Ture Whaimana states the vision for the Waikato River as follows:

"Tooku awa koiora me oona pikonga he kura tangihia o te maataamuri.

The river of life, each curve more beautiful than the last

Our Vision is for a future where a healthy Waikato River sustains abundant life and prosperous communities who, in turn, are all responsible for restoring and protecting the health and wellbeing of the Waikato River, and all it embraces, for generations to come."

5.3.5 Te Ture Whaimana includes 13 objectives that were developed to support achieving the vision:

a. The restoration and protection of the health and wellbeing of the Waikato River.

b. The restoration and protection of the relationship of Waikato-Tainui with the Waikato River, including their economic, social, cultural and spiritual relationships.

c. The restoration and protection of the relationship of Waikato River iwi, according to their tikanga and kawa, with the Waikato River, including their economic, social, cultural and spiritual relationships.

d. The restoration and protection of the relationship of the Waikato region's communities with the Waikato River including their economic, social, cultural and spiritual relationships.

e. The integrated, holistic and coordinated approach to management of the natural, physical, cultural and historic resources of the Waikato River.

f. The adoption of a precautionary approach towards decisions that may result in significant adverse effects on the Waikato River.

g. The recognition and avoidance of adverse cumulative effects, and potential cumulative effects, of activities undertaken both on the Waikato River and within its catchments.

h. The recognition that the Waikato River is degraded and should not be required to absorb further degradation as a result of human activities.

i. The protection and enhancement of significant sites, fisheries, flora and fauna.

j. The recognition that the strategic importance of the Waikato River to New Zealand's social, cultural, environmental and economic wellbeing is subject to the restoration and protection of the health and wellbeing of the Waikato River.

k. The restoration of water quality within the Waikato River so that it is safe for people to swim in and take food from over its entire length.

l. The promotion of improved access to the Waikato River to better enable sporting, recreational, and cultural opportunities..

m. The application of both maatauranga Māori (body of Māori knowledge originating from ancestors) and latest available scientific methods.

5.3.6 Te Ture Whaimana includes 12 strategies to support achieving the objectives and vision.

5.3.7 Te Ture Whaimana has status through at least 20 enactments which influence the management and use of the Waikato and Waipa Rivers and their catchments.

5.3.8 Importantly, if there is any inconsistent provision in an RMA planning document, including any national policy statement (e.g., NPS-UD), Te Ture Whaimana prevails.

5.3.9 Together the 'River Settlements' and Te Ture Whaimana provide everyone along the river, within the catchment or undertaking activities that impact the river, with the common goal of restoring and protecting the health and wellbeing of the river. Collective, concerted and consistent effort (including from developers and local government) is needed to achieve and maintain this goal.

5.4 National Policy Statement on Urban Development 2020 (NPS-UD)

5.4.1 The NPS-UD directs HCC to remove overly restrictive planning rules that make it more difficult to build homes. It requires Council to respond to changes in demand by enabling greater housing density within walkable distances of areas such as the city centre, local amenity nodes and rapid transit stops.

5.5 Resource Management (Enabling Housing Supply and Other Matters) Amendment Act 2021

5.5.1 This amendment to the Resource Management Act requires tier 1 councils, including Hamilton, to adopt Medium Density Residential Standards (MDRS). The MDRS' will enable landowners to build up to three houses of up to three storeys on their site as a permitted activity on most sites.

5.5.2 The RMA (Housing Supply) Amendment Act, provides for a territorial authority may make the MDRS and the relevant building height or density requirements under policy 3 less enabling of development in relation to an area within a relevant residential zone only to the extent necessary to accommodate 1 or more of the following qualifying matters that are present:

a. a matter of national importance that decision makers are required to recognise and provide for under section 6:

b. a matter required in order to give effect to a national policy statement (other than the NPS-UD) or the New Zealand Coastal Policy Statement 2010:

c. a matter required to give effect to Te Ture Whaimana o Te Awa o Waikato—the Vision and Strategy for the Waikato River:

d. a matter required to give effect to the Hauraki Gulf Marine Park Act 2000 or the Waitakere Ranges Heritage Area Act 2008:

e. a matter required for the purpose of ensuring the safe or efficient operation of nationally significant infrastructure:

f. open space provided for public use, but only in relation to land that is open space:

g. the need to give effect to a designation or heritage order, but only in relation to land that is subject to the designation or heritage order:

h. a matter necessary to implement, or to ensure consistency with, iwi participation legislation:

i. the requirement in the NPS-UD to provide sufficient business land suitable for low density uses to meet expected demand:

j. any other matter that makes higher density, as provided for by the MDRS or policy 3, inappropriate in an area, but only if section 77L is satisfied.

5.6 Te Ture Whaimana as a Qualifying Matter

5.6.1 The Act specifically identifies Te Ture Whaimana as a Qualifying Matter.

5.6.2 This three waters system performance assessment is focussed primarily on infrastructure performance criteria relevant to giving effect to Te Ture Whaimana. The criteria developed for the assessment are considered to have direct linkages with Te Ture Whaimana. It is important to note that the assessment does not include all of the criteria that would typically be utilised for a comprehensive infrastructure performance assessment, as infrastructure performance in and off itself is not a qualifying matter defined in the Act.

5.6.3 It is also important to note that this assessment does not include or consider all of the elements (objectives and strategies) in Te Ture Whaimana or identify investments and programmes that may be appropriate to giving effect to all of the elements of Te Ture Whaimana.

5.7 Hamilton City District Plan

5.7.1 The purpose of the Hamilton City District Plan (the District Plan) is to enable the Council to carry out its functions under the Resource Management Act 1991, the purpose of which is to promote the sustainable management of natural and physical resources.

5.7.2 **Area Plans**

(a) Area Plans are being developed for four areas in the city: North of the Central

City, Eastern Hamilton, Five Cross Roads and Chartwell. The locations of these Area Plans were chosen based on the high levels of accessibility in these areas to the Central City or to suburban/subregional centres, per the requirements of the NPS-UD, and considering the potential for these areas to transform into denser well-functioning urban environments.

(b) The Area Plans review the natural, infrastructure, social, and environmental constraints, and opportunities of each of these areas. These considerations inform key moves and recommendations intended to help these places become well-functioning urban environments as they intensify over time.

(c) The Area Plans also set out recommendations for PC12 with respect to the four areas (including rezoning) and actions relating to other processes and projects, including the Long Term Plan and future Business Cases.

5.8 2021-31 Long Term Plan and 2021-51 Infrastructure Strategy

5.8.1 Council currently manages a $4.5 billion portfolio of assets, and this is expected to grow significantly over the next 30 years. HCC's 2021-31 Long Term Plan and 2021 – 2051 Infrastructure Strategy identify some of the significant investments required to meet the growing needs of the city.

5.8.2 HCC's 2021-31 Long Term Plan outlines Council's plans, budgets, and priorities for the next decade, with a focus on the next three years.

5.8.3 HCC's 2021 – 2051 Infrastructure Strategy identifies significant infrastructure challenges for HCC expected over the next 30 years, and identifies the recommended approaches for managing those challenges along with and the implications of those approaches.

5.8.4 Specific issues outlined in the Infrastructure Strategy include:

(a) The increasing costs to ensure compliance, adequate capacity, and provide resilient three water systems.

(b) Enabling growth.

(c) Increasing requirements and expectations for transport mode shift.

(d) Affordability.

(e) Increasing requirements and expectations relating to climate change and natural hazards.

5.8.5 Three Waters Master Plans and Asset Management Plans (AMPs) informed the 2021-2031 LTP and the Infrastructure Strategy. However, not all of the projects and interventions recommended in the Master Plans and AMPs were funded. Resulting in a significant deficit in infrastructure to meet the needs of the city, based on population projections at that time. The population projections used to develop the Master Plans did not include for the capacity enabled by the current district plan, or the level of intensification proposed by the NPS-UD and MDRS. Providing for the increased intensification contemplated by the NPS-UD and MDRS will require a step-change in infrastructure investment.

5.9 Wellington Water Three Waters Assessment report

5.9.1 In 2021, Wellington Water used a traffic light system to indicate the state and capacity of three waters infrastructure in its "Wellington City Council - Spatial Plan Three Waters Assessment – Growth Catchments Mahi Table and Cost Estimates" report.

5.9.2 The assessment summarised the existing three waters network constraints, infrastructure upgrades and environmental considerations to support growth.

5.9.3 Wellington was divided up into 22 areas for the purpose of their report; a similar approach has been taken by HCC in producing this report.

5.9.4 The Wellington Water report used 'mahi tables' to "demonstrate the level of network constraint or the effort/work (mahi) required in each suburb, for each of the three waters to support growth information from previous assessments combined with updates". The 'mahi tables' utilised a traffic light assessment approach, with mahi categorised as low (green), medium (yellow) or high (red). This simple, visual, broad categorisation has also been utilised in this report prepared by HCC.

PART 6 - THREE WATERS INFRASTRUCTURE DESCRIPTIONS

6.1 Water Supply

6.1.1 HCC provides Hamilton's residents and businesses with a safe, high-quality, reliable and sustainable service, through treatment, distribution and management of Hamilton's water supply.

6.1.2 Raw water is drawn from the Waikato River into the water treatment plant (WTP), where it is treated to provide a high standard of drinking water. HCC also strives to provide water at the appropriate pressure for its intended use and firefighting purposes.

6.1.3 The City's water supply system is made up of a single treatment plant, nine reservoirs and over 1,250 km of associated pipe network.

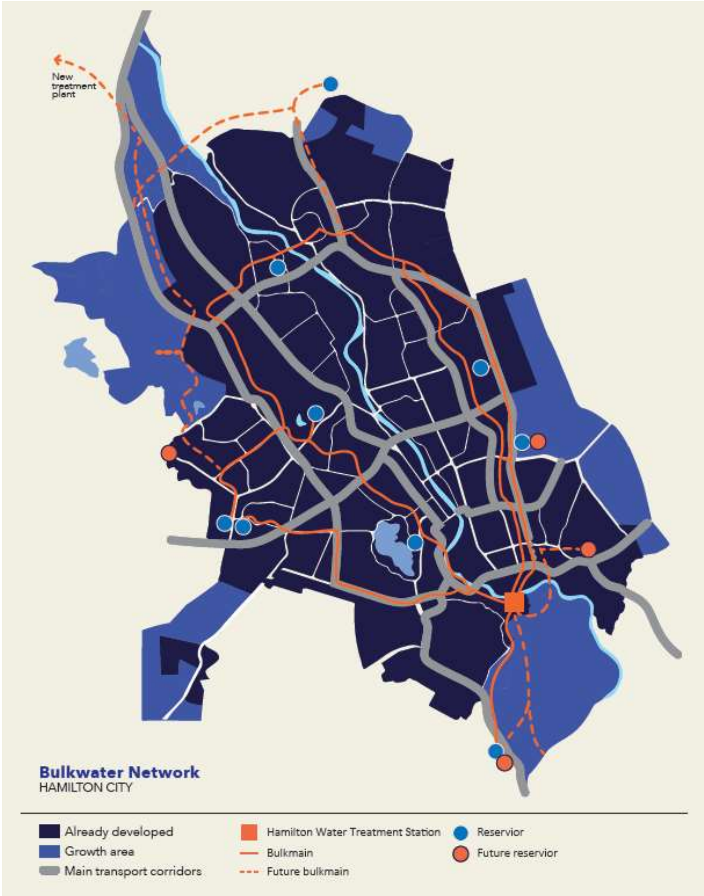


Figure 1- Hamilton City Bulk Water Supply Network

6.1.4 Figure 1 diagrammatically shows the key strategic elements of the current and planned water networks (based on the recommendations in the 2020 Water Master Plan).

Water Allocation Consent

6.1.5 Hamilton is wholly dependent on the Waikato River for its water supply, as are many other Waikato towns.

6.1.6 In 2009, WRC granted HCC a 35-year consent to extract water from the Waikato River (HCC consent). This consent expires in 2044 and provides for increases in maximum daily take volumes to meet demand, starting from 105,000 cubic metres per day in 2009 to 146,000 cubic metres per day from December 2038.

6.1.7 HCC can apply to Waikato Regional Council every 6 years to increase the maximum daily take volume. This stepped approach to increasing the maximum daily take volume ensures that, as the city grows, the amount of water HCC can take from the river can meet increased demand. It also allows other users of the Waikato River access to the water on a short to medium-term until such time as the population within Hamilton grows to necessitate the additional take authorised by the consent.

6.1.8 The ‘stepped’ take volumes authorised in the HCC consent were based on growth forecasted at the time of consent. These forecasts do not reflect the rate of growth being experienced in HCC in recent times for both residential and non-residential land use activities, nor the capacity proposed by the NPS-UD and MDRS.

Water treatment

6.1.9 The treatment plant relies on the Waikato River as a single water source. The plant is capable of drawing up to 105 million litres of water per day from the river. Between 2.5 and 5.0% of all water is returned to the river as part of the treatment process. Currently, the sustainable peak treatment capability of the plant is about 78 million litres per day. During summer, peak demand has reached up to 90 million litres per day and in the evenings a large portion of the demand for water is met from reservoir storage.

Water storage

6.1.10 The City has nine reservoirs, providing a total of 112 million litres storage. Water storage equivalent to a minimum of peak daily demand is required for emergency purposes. As the city grows, additional reservoir storage will be required for emergency purposes, water supply during peak periods and system resilience

Water distribution

6.1.11 Treated water is pumped from the treatment plant to the reservoirs and users through approximately 1,250 km of pipe network. As is expected in any urban centre, the network is made up of various pipe materials of different ages and conditions which results in some water loss through leakages. The leakage in Hamilton is estimated to currently be about 16% of water that is treated.

Water Supply Master Plan

6.1.12 The Water Supply Master Plan 2020 for the Hamilton Water Network has been prepared to provide HCC with a blueprint that addresses the current technical requirements needed to meet current and future demand from growth.

6.1.13 The Master Plan is a technical, strategic infrastructure-focussed document, summarising the high-level assumptions, objectives and recommendations.

6.1.14 The Master Plan considers Hamilton’s projected growth over several design horizons between 2021 and 2061. Projected consumption increases are based on the 2017 population projections developed by HCC.

6.1.15 The level of service targets that are used to assess and determine infrastructure needs across the city are described in the Water Master Plan 2020 and summarised below.

Table 1 - Water Supply Target Levels of Service (Water Master Plan 2020)

Parameter	Target	Source
Minimum Pressure	20m	Regional Infrastructure Technical Specifications (RITS)
Maximum Pressure	80m	Desirable operating level for this Master Plan based on observed/modelled maximum pressure
Fire Fighting	Conform to NZ Code of Practice	NZ Fire Fighting Water Supplies Code of Practice (SNZ PAS 4509).
Reservoir Minimum Storage Volume	24 hour of 1.15 peak day demand for each zone and across the whole water network	Desirable operating level for this Master Plan based on operational needs and emergency strategy
Reservoir Turnover	• 50% turnover once a day whilst maintaining: • Volume equivalent to the maximum fire class required in the zone • 4 hours peak day storage	Desirable operating level for this Master Plan in line with WTP requirements
Maximum Head Losses	• 5m/km for 50mm to 249mm diameter pipes • 3m/km for 250mm to 599mm diameter pipes • 2m/km for ≥600mm diameter pipes	Desirable operating level for this Master Plan based on modelled maximum head losses for new infrastructure

6.1.16 The Water Master Plan provides a detailed infrastructure programme of works to respond to the projected growth and development, meet the target levels of service, reduce water demand (through reduced leakage, reduced per capital consumption and alternative water sources) and recognise the limitations on the existing Water Treatment Plant.

6.1.17 The Water Master Plan future operating strategy has been developed to increase network resilience, energy efficiency, optimise investment and simply operations across the network to deliver consistent levels of service. Key elements of the recommended investment programme include:

- Creation of new demand management zones
- New and upgraded bulk mains, ring mains and booster pump stations
- New reservoirs
- New service mains
- Universal metering
- Brownfield network upsizing
- Capacity and quality upgrades of the Waiora WTP
- New Northern WTP

6.1.18 Currently, Hamilton's water network is subdivided into four pressures zones, three single-reservoir zones (Red, Orange and Rototuna) and one large zone (Blue Zone). The Blue Zone is serviced from 4 reservoirs and associated pump stations. Several (21) supply points distribute water through the Blue Zone local reticulation.

6.1.19 Isolating all the reservoirs into water supply zones is the recommended approach for future operation. This means that the existing bulk ring main will be used as a dedicated reservoir filling line. Some sections of the existing bulk ring main will also be used as strategic bulk supply mains so that each reservoir will have both a dedicated fill line from the bulk ring main and supply line into the distribution network.

6.1.20 Isolating each reservoir will simplify network operation for each zone and help with identifying and prioritising network water loss. Reservoir isolation also allows the reduction of peak flows in the network with storage; it provides a much more consistent level of service in each zone and minimises flow fluctuations out of the WTP, while increasing reservoir turnover. This then reduces the need for WTP upgrades and overall power costs.

6.1.21 Investment in asset renewals and strategic planning tools (including water network models) are also integral components maintaining and operating the water supply system.

6.2 Wastewater System

6.2.1 HCC provides Hamilton's residents and businesses with a sustainable, reliable and cost-effective service which includes collection, conveyance and treatment of wastewater and trade wastes discharges.

6.2.2 The City's wastewater system is comprised of a single centralised wastewater treatment plant (WWTP), over 130 pump stations and over 800 km of connecting pipework. The system services over 50,000 households and provides trade waste services to over 5,000 commercial and industrial premises.

6.2.3 Figure 2 diagrammatically shows the key strategic elements of the current and planned wastewater networks (based on the recommendations in the 2020 Wastewater Master Plan).

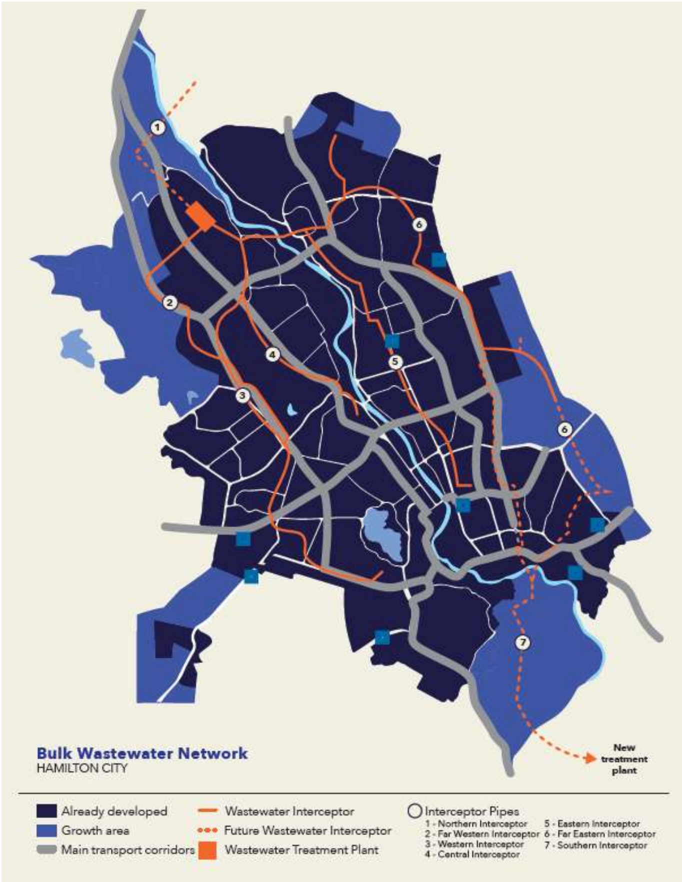


Figure 2- Strategic Wastewater Network – *proposed bulk storage facilities are shown as blue squares*

Wastewater reticulation and pump stations

6.2.4 Wastewater is removed from commercial, industrial and residential properties via various pumping station and pipe networks to the WWTP. As is expected in any urban centre, the network is made up of various pipe materials and ages, which results in some water infiltration.

6.2.5 Hamilton is served by five wastewater interceptors (Western, Far Western, Central, Eastern, Far eastern). All interceptors operate by gravity except for the Western Interceptor which has two on-line pump stations (Dinsdale and Lorne Street).

Interceptors receive wastewater from local gravity trunk pipelines and satellite pump stations within the trunk network.

6.2.6 The city has over 130 pump stations which are controlled through a centralised computer system. HCC has commenced an upgrade programme to achieve a six-hour storage standard for all wastewater pump stations to provide improved environmental performance in the event of power or pump failure.

6.2.7 The HCC wastewater network is subject to overflows. Overflows occur for a variety of reasons including stormwater infiltration during wet weather, wastewater flows in excess of design capacity, and blockages. Overflow discharges of wastewater from the HCC wastewater network are not currently authorised by a resource consent.

Wastewater treatment

6.2.8 Hamilton City is currently serviced through a single WWTP at Pukete. The treatment plant is a biological plant that can receive and provide primary treatment for up to 2,000 litres per second of wastewater and up to 600 litres per second for secondary treatment.

6.2.9 The WWTP relies on the Waikato River as the receiving environment for final treated effluent. The quality of final discharge has improved over time as capital improvements have occurred on site, however ongoing investment in system upgrades is necessary to maintain compliance with relevant discharge limits year-round and to ensure adequate treatment capacity is available to service growth.

6.2.10 The existing Pukete WWTP site has limited space for future expansion and an additional treatment plant will be needed to meet the long term needs of Hamilton. In addition, given that Pukete WWTP is located at the northern end of Hamilton, the cost of strategic network upgrades to convey wastewater from the southern areas to the Pukete WWTP is likely to be cost prohibitive.

6.2.11 The Hamilton-Waikato Metro Wastewater Detailed Business Case project has investigated and recommended a preferred servicing solution for the Metro Area to overcome these challenges.

Wastewater Discharge Consents

6.2.12 The existing resource consent to discharge treated wastewater from Pukete to the Waikato River expires in 2027.

6.2.13 Given the primacy of Te Ture Whaimana and the requirements of the NPS-Freshwater Management a high focus on discharge quality is expected as part of replacing the existing consents for discharges from the Pukete WWTP.

6.2.14 As is typical for urban wastewater networks, the Hamilton City wastewater network experiences overflow discharges during storm events and as a result of network blockages. These overflows currently occur as unauthorised discharges (i.e. HCC does not hold discharge consents to specifically authorise and manage these discharges).

Wastewater Master Plan

6.2.15 The Wastewater Master Plan 2020 for the Hamilton Wastewater Network provides HCC with a blueprint that addresses the current technical requirements needed to meet current and future demand from growth.

6.2.16 The Master Plan is a technical, strategic infrastructure-focussed document, summarising the high-level assumptions, objectives and recommendations.

6.2.17 The Master Plan considers Hamilton's projected growth over s seven design horizons: 2021 to 2061, RITS densities and City Full. The increased demand, network performance assessments and recommended network upgrades are based on the 2017 population projections developed by HCC.

6.2.18 The level of service targets that are used to assess and determine infrastructure needs across the city are described in the Wastewater Master Plan 2020 and include:

(a) Recommending upgrades to avoid capacity related dry-weather wastewater overflows

(b) Reducing the frequency, location and scale of wet weather wastewater overflows in 5% Average Exceedance Probability (AEP) rainfall events (equivalent to 2-year average recurrence interval rainfall events)

6.2.19 The Wastewater Master Plan provides a detailed infrastructure programme of works to respond to the projected growth and development and meet the target levels of service. Key elements of the recommended investment programme include:

- Wastewater interceptor network upgrades
- Bulk wastewater storage facilities across the city
- Trunk pump station and pipeline upgrades and diversions
- Local network upgrades in brownfield areas
- Continued investment to reduce water use (and therefore wastewater generation) and inflow and infiltration into the network.
- Treatment plant upgrades

6.2.20 Options for treatment of wet weather overflows prior to discharge to the receiving environment and for authorising the discharge of wastewater from the network under wet weather conditions were also recommended for further investigation.

6.2.21 Investment in asset renewals and strategic planning tools (including wastewater network monitoring systems and models) are also integral components of maintaining and operating the wastewater supply system.

6.2.22 The Wastewater Master Plan notes that as aged pipelines are renewed that it is important that growth related demands are also considered and that the opportunity to provide for future flows is taken up by upsizing pipelines on renewal rather than replacing 'like for like'.

Hamilton-Waikato Metro Wastewater Detailed Business Case

6.2.23 The Waikato - Hamilton – Waipā Southern and Northern Metro Wastewater Detailed Business Cases are being jointly delivered through strong collaboration between the Iwi, mana whenua and Waikato, Hamilton and Waipā Councils.

6.2.24 The Waikato region has seen tremendous growth and development in commercial, industrial, and residential areas, placing pressure on existing wastewater services and creating further demand for wastewater treatment and management services.

6.2.25 The collaborative relationships established to deliver this project seeks to give effect to co-management in respect of the Waikato River and activities within its catchment and joint recognition of the benefits of "boundaryless" planning to restore and protect the health and wellbeing of the Waikato River and meet the current and future needs of the Metro Area.

6.2.26 Te Ture Whaimana forms the foundation for this project. The recommendations in the DBC seek to actively contribute to achieving the vision and objectives set out in Te Ture Whaimana by delivering "best for river" wastewater management solutions, recognising and providing for the unique relationship that taangata whenua have with the awa as well as contributing toward the social and cultural wellbeing of the community.

6.2.27 Through the DBC, the parties have identified preferred servicing solutions for wastewater infrastructure and have worked through how these might be planned for, constructed, and funded. The preferred servicing solution for Hamilton (and the broader Metro Area) involves:

i. The adoption of minimum treatment performance standards across all WWTPs, over time

ii. A new Southern Sub-Regional WWTP to service the airport area and environs (including Mātangi/ Tamahere commercial area) and southern Hamilton.

iii. Retaining and upgrading the Tauwhare Pā WWTP and land discharge to service local growth with the potential to be reticulated to the SS WWTP or HCC network in the future.

iv. Upgrading the Pukete WWTP to service the majority of Hamilton City, and the reticulated communities north of Hamilton to Taupiri.

6.2.28 The minimum performance standards adopted for the WWTPs support a significant reduction in the nutrient contaminant loading rates to the Waikato River from the current baseline, thus contributing toward Te Ture Whaimana.

6.3 Stormwater System

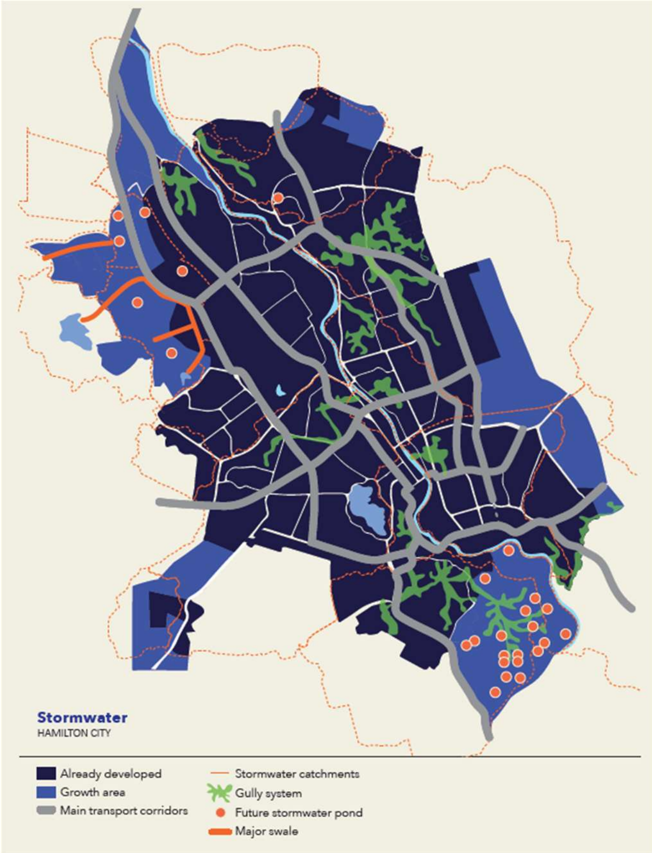


Figure 3 – Stormwater Elements

6.3.1 Council provides services to Hamilton's residents and businesses that protects the health of people and to prevent habitable building inundation from flooding and minimises the pollution of the city's streams, lakes and the Waikato River.

6.3.2 The stormwater system collects, diverts, conveys, treats and discharges rainwater to land or surface water. It comprises the piped network, including inlets and outfalls, artificial drains, stormwater treatment devices such as ground soakage, raingardens and constructed wetlands, and natural features such as gullies and streams, the Waikato River or lakes to which the stormwater is discharged. The stormwater system also includes overland flow paths, which may lie anywhere - on roads, parks or private property.

6.3.3 The system drains an urban catchment of approximately 9,000 ha however the total catchment area draining to the city reach of the Waikato River is much larger at approximately 30,000 ha.

6.3.4 Figure 3 diagrammatically shows the key strategic elements of the stormwater system including catchment boundaries, significant transport routes, gullies and planned significant stormwater management devices based on the recommendations in the 2020 Stormwater Master Plan.

6.3.5 Hamilton's stormwater network services a variety of land uses including:

- Residential land uses (e.g., Private homes and driveways).
- Industrial and commercial land uses (e.g., Wholesale and retail outlets, depots, manufacturing sites, warehouses, workshops).
- Roads and car parks.
- Community facilities (e.g., Hamilton Lake, Claudelands Event Centre, parks and sports areas, Waikato Hospital, schools, and tertiary educational institutions).
- Runoff from undeveloped catchments both inside and outside the City boundary.

6.3.6 The stormwater network is also used to dispose of potable water during the maintenance of reservoirs, and from flushing and testing of fire hydrants.

Comprehensive Stormwater Discharge Consent

6.3.7 Stormwater discharge activities require assessment under the Waikato Regional Plan. HCC has a 'City-wide' comprehensive stormwater discharge consent (CSDC) from Waikato Regional Council to divert and discharge stormwater to receiving environments from its existing urban network.

6.3.8 The consent was granted in 2011 and will expire on 30 June 2036. It authorises discharges existing at that time in the City and new discharges, subject to conditions requiring mitigation of effects on the receiving environment, water quality improvements and compliance with Catchment Management Plans (CMPs). The CSDC shifted Council's focus from managing only flooding effects to a more holistic environmental-outcomes approach using CMPs.

6.3.9 Integrated catchment management plans are being developed for each of the city's stormwater catchments to make sure stormwater infrastructure is planned, developed and managed in the most efficient and practicable way for the specific catchment. There are different options for dealing with stormwater and the most efficient approach depends on the specific catchment.

6.3.10 HCC must seek certification from Waikato Regional Council that additional development (e.g. infill) within the existing area is consistent with the CSDC. Any new discharges will only be approved if they are supported by an approved catchment management plan.

6.3.11 The purpose of these plans in relation to stormwater is to:

- Provide guidance to developers and regulatory bodies on how stormwater from new developments will be managed and integrated with other water services and proposed future land uses.
- Minimise the need for stormwater treatment and detention devices.
- Propose opportunities for the reuse of stormwater to reduce water demand.
- Minimise stormwater and the effects of urbanisation on river and streams.
- Lessen flood hazards on private property
- Involve other stakeholders (such as taangata whenua, recreational and local interest groups) who may wish to contribute to the management of the catchment's waterbodies.

Stormwater Master Plan

6.3.12 The Stormwater Masterplan is underpinned by the strategic stormwater modules. The Stormwater Modules provide best practice guidance and a consistent methodology around the collection, delivery and use of data for the management of stormwater.

6.3.13 Figure 4 shows how the modules make up the technical delivery framework and the delivery workflow developed as part of this Masterplan to generate consistent outcomes.

6.3.14 The key issues identified (based on data analysis where available) in the Stormwater Master Plan are:

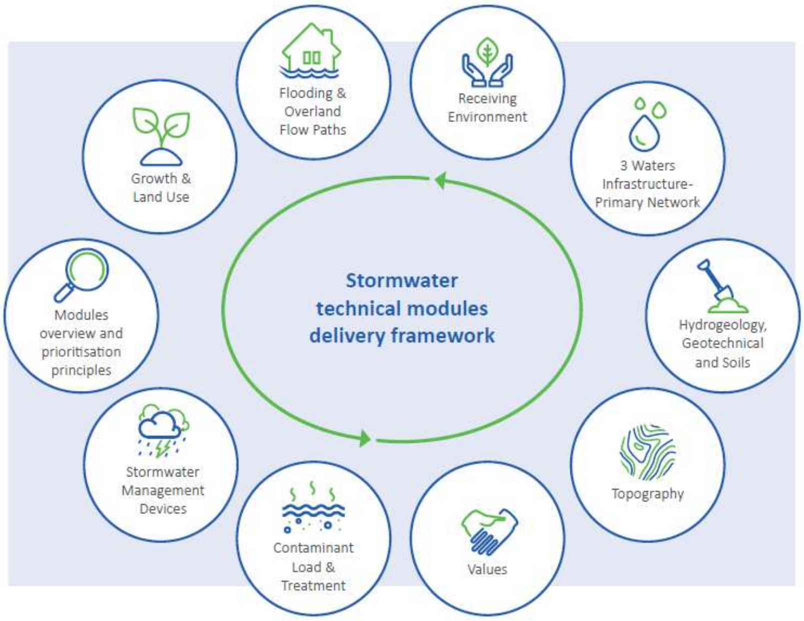


Figure 4 - Stormwater Masterplan technical modules and delivery framework

Flooding and Overland Flow Paths
• A total of 16,600 building footprints were intersected by a flood hazard in a 100-year flood event based on available data. • More than 1,500 building footprints are within areas designated 'high hazard' (>1.5m depth of water). However, 90% of these were identified from the rapid flood hazard results • Nearly 9,000 building footprints were intersected by an OLFP (based on raw data).
Receiving Environment
• 238 high watercourse reaches were identified as high susceptibility to erosion and have nearly 1,000 building footprints within 6m. • 700 ha of potential restoration within the current city boundary. This needs to be refined by removing completed areas (including community planting). • 55 fish passage barriers.
Devices
• Approximately 5,000 ha greenfield area (including some areas outside HUGS) • Approximately 5,000 ha untreated brownfield, which requires treatment to restore the Waikato River and its tributaries. Retrofit is significantly more expensive.

6.3.15 The Stormwater Master Plan (2020) recommends a number of mega programmes and associated programmes to address the identified issues. These programmes include:

- Watercourse Restoration and Protection
  - Erosion control
  - Watercourse restoration
  - Investments for compliance with comprehensive consent (e.g., fish passage)
- Stormwater Management Device needs for greenfield development areas and for brownfield area improvements

- Stormwater Network improvements
- Flood Management and overland flow path management.

6.3.16 In addition to the capital works programmes, a key outcome of each module is the identification of opportunities to improve processes, recommend regulatory change or fill key data gaps. A summary of key opportunities identified as part of the 2020 Stormwater Master Plan is given below.

Flooding and Overland Flowpaths (OLFP)
• Development and implementation of a capital works programme targeted at flooding and OLFP mitigation works. • The flooding module identified a number of building footprints with potentially significant impacts, which needs to be effectively communicated. • Update the current modelling specification to align with current industry best-practices and focus on the delivery of outputs in a way that maximises usefulness for HCC. • Update the current suite of flood modelling outputs city-wide. The majority of current flood modelling outputs were generated 7-8 years' ago using 2008 terrain data. The latest LiDAR capture offers an opportunity to update flood information across the city.
Primary Network
• Existing stormwater modelling may have network capacity data that can be processed into useful outputs for HCC. • More network capacity information is required city-wide to understand network constraints. This can be captured through the updated modelling methodology. • Maintenance access to brownfield primary network systems (watercourses and open channels) needs to be improved and current access points collated into a useful tool for the operations team.
Values
• Development and implementation of a programme to implement identified values projects. • The 'Te Mana O Te Wai' layer developed as part of SMPv2 is a powerful geospatial tool. An appropriate communications platform should be identified.
Receiving Environment
• Continued refinement of the data update, issue prioritisation and project scoping processes – incorporation of resilience and business continuity. • Refinement of the issue prioritisation, including refining a biodiversity/restoration prioritisation indicator, and increasing the weighting of values. • The receiving environment module identified a number of waterway reaches with significant erosion impacts. This could have effects beyond waterway stability (i.e., properties/infrastructure) and needs to be effectively communicated.
Contaminant Load Model
• Stormwater management for all redevelopment needs to be implemented through a District Plan change. • Some form of water quality management on all new lots, requires a District Plan change. • Industry is moving towards more sophisticated approaches to estimating containment loads, resulting in more efficient management outcomes. An example of this is a continuous simulation approach, combining a baseline hydrology, water quality model and a stormwater management model to simulate the effectiveness of performance of stormwater management devices and non-structural measures.
Devices

• Hundreds of millions will be invested in green infrastructure (best practice stormwater management devices). This is a relatively new, and very specific area that crosses many disciplines and Council units. Investment into the design, auditing, vestment and maintenance aspects is critical. It is recommended that Council creates a 'green infrastructure' role to ensure optimal outcomes, educate business owners, ensure certification of contractors, oversee maintenance programmes, update design guidance and hold educational workshops with internal and external stakeholders. • Life Cycle cost comparison shows small scale bioretention devices (raingardens) are significantly more expensive. An update to the RITS for device hierarchy is recommended to lower the acceptability of these outcomes. • Stormwater Management usually involves a 'treatment train', starting at source, which is often at the road or on private lots. Recording of all devices is critical to understanding the overall effect on protection of, the receiving environment. A system to record devices, and educate owners, is required to be refined and implemented. • Enhancement of the existing brownfield device works program.
General
• Completion of the current update to the Stormwater Modules document. • Internal access and education of the available datasets, with a move towards public availability. • Regular (6-monthly) meetings between Strategic Unit and Business Owners to support updates of data (to GIS) and issue prioritisation on registers to improve business resilience, continuity and transparency.

PART 7 - INFRASTRUCTURE INVESTMENT TO SUPPORT GROWTH

7.1 Unfunded infrastructure in the 2021-51 Infrastructure Strategy

7.1.1 HCC has over $1 billion of unfunded infrastructure projects in the first ten years of the 30-year Infrastructure Strategy. For the three waters asset classes, these unfunded projects total $399 million:

(a) Water $145 million

(b) Wastewater $204 million

(c) Stormwater $ 49 million

7.1.2 The Infrastructure Strategy indicates significant future funding challenges and estimates a requirement for $12.8 billion of capital investment over the next 30 years to meet the city's current needs. While this includes investment in sub-regional infrastructure to service growth outside Hamilton City's boundaries, such as HCC's anticipated share of $244 million for a new WWTP and $336 million for a new WTP, it has not fully captured the needs of infill and intensification plan-enabled capacity, expanding growth areas outside the current city boundary nor the potential full extent of the recent NPS-UD changes and its intensification expectations.

7.2 Stormwater

7.2.1 HCC's Stormwater Master Plan has identified there is a significant investment in stormwater infrastructure required to deliver on the Vision of enhancing the health of the Waikato River. To improve stormwater treatment in the existing city, Council has identified the need for $1.68 billion from 2032-2051 in the 2021-51 Infrastructure Strategy.

7.3 Wastewater

7.3.1 The 2021-2031 LTP includes several major programmes to improve the performance of the wastewater network. These programmes include:

- Major investment in wastewater treatment
- Bulk wastewater storage programme
- Trunk network upgrade programme
- New wastewater interceptor pipelines and strategic pump stations

7.3.2 The Hamilton-Waikato Metro Wastewater Detailed Business Cases have recommended boundaryless wastewater treatment solutions for the broader Metro area. The Southern Metro WW DBC recommends that HCC partner with other Councils in the subregion to create a new subregional wastewater facility to meet the long term needs of Hamilton and the surrounding environs. The new WWTP will adopt very high treatment standards. HCC has budgeted $9.3 million in the 2021-

31 Long Term Plan for HCC's share of planning, design and to secure a site for the wastewater facility. Over $120 million remains unfunded from 2028/29 to 2030/31 for construction of the new facility. In total, $244 million has been included in the 2021-51 Infrastructure Strategy for the new WWTP but is unfunded.

7.3.3 The Northern Metro WW DBC recommends adopting very high treatment standards, and treating the northern metro communities (Taupiri, Hopuhopu, Ngaaruawaahia, Te Kowhai, Horotiu) at the Pukete WWTP. Major upgrades are needed at Pukete to achieve the treatment standards proposed in order to deliver 'betterment' to the Waikato River and meet growth demands.

7.3.4 The draft P50 capital cost estimates to upgrade Pukete WWTP only (excluding conveyance network upgrades and assuming a continued discharge to water) to these standards and provide for growth to 2061 (based on 2017 projections) is approx. $771 million (in $2022). The draft P95 capital cost estimates is approx. $1.3 billion (in $2022). The current LTP includes for $172 million to upgrade the Pukete WWTP, with the first tranche of work taking place in 2024.

7.4 Water supply

7.4.1 $336 million is identified in the 2021-51 Infrastructure Strategy to construct an additional WTP. This is in years 2031/32 to 2034/35. A second treatment plant could increase treatment capacity for the subregion and significantly improve resilience for water supply.

7.4.2 As part of any water take consent HCC needs to demonstrate that it is a responsible manager of the limited water resource. The Council has a range of initiatives and tools to help manage the increase in demand for water as the city grows. However, by 2029 the need for a further significant demand management intervention is forecasted. The nature of this intervention is yet to be determined. The intervention included in the infrastructure strategy is forecasted at $53 million – this includes installation of meters throughout the city.

7.5 Proactive intensification - Infrastructure to support future District Plan changes

7.5.1 A multi-decade programme with three packages of investments in three waters and transport infrastructure is identified in the 2021-2031 LTP and 2021-2051 Infrastructure Strategy. This programme provides some funding to support changes in land use for intensification precincts within the existing city.

7.5.2 In years 2024-2031 in the 2021-31 Long Term Plan, $114 million has been allocated. A further $262 million has been identified for 2031-2041, with the final package of investments totalling $64 million for 2041-2051. The three packages of work total $440 million.

Note: refer to Appendix B for an infographic from the 2021-51 Hamilton City Infrastructure Strategy

PART 8 - SYSTEM-WIDE INFRASTRUCTURE / SERVICING CHALLENGES

8.1.1 This section provides a high-level overview of the system wide servicing challenges affecting all of Hamilton city wide irrespective of the geographic location of growth within the city. These matters include but are not limited to:

(a) Water allocation constraints. i.e. recognising the finite water resources available from the Waikato River to service growth

(b) Environmental limits of the Waikato River to receive contaminants arising from urban land uses (wastewater and stormwater discharges) and the need to reduce the contaminant discharge loads and address the impacts of residual contaminant discharges.

(c) Climate change impacts on the city's water systems including reduced source security, and increased flood hazard risks, erosion and wastewater network overflows.

(d) Water supply intake, headworks and treatment system capacity.

(e) Wastewater treatment plant and discharge system capacity.

(f) Impacts of intensification on local network capacity performance and upgrades needed to ensure compliance with technical specifications and design standards (e.g. pipe sizes and methods of network connections).

(g) Satisfying the city's obligations under Te Ture Whaimana with respect to network performance.

8.1.2 As the impact of these matters are independent of specific development areas, they are not included in the area-based traffic light assessments. However, they are extremely relevant to the ability for Hamilton City to provide for growth in a manner that contributes toward achieving Te Ture Whaimana. In most cases, solutions are available to these challenges, however, the costs may render the solutions to be unfeasible.

8.2 Water allocation

8.2.1 HCC is responsible for supplying water to the residents of Hamilton City.

8.2.2 As noted in Part 6 of this report, Hamilton is wholly dependent on the Waikato River for its water supply, as are many other Waikato towns. The regional consent provides for increases in maximum daily take volumes starting from 105,000 cubic metres per day in 2009 to 146,000 cubic metres per day from December 2038. The 'stepped' takes were based on municipal growth forecasted at the time of consent.

8.2.3 Substantial growth is predicted for the Hamilton-Waikato Metropolitan area. Recent assessments completed to support HCC position on the Watercare Board of Inquiry process predicted that providing for the population growth in Hamilton alone means would exceed its existing Waikato River water take consent (146 MLD) before the current water take consent expires in 2044. The water demand is projected to reach between 159 MLD and 184 MLD by 2065 – an increase of up to 38 MLD. Importantly, municipal water demand on the Waikato River will continue to increase into the future as cities and towns continue to grow placing even further pressure on the river.

8.2.4 HCC is concerned to avoid over-allocation of the Waikato River which may have a profound negative impact on the flow of the river and, as a consequence, the on the health and wellbeing of the Waikato River itself.

8.2.5 The Waikato River is not an unlimited supply and is under pressure from growth in the Waikato and Auckland. These challenges will be exacerbated by the impacts of climate change. It is inappropriate to assume that Hamilton can simply take more from the Waikato River to meet its ongoing needs.

8.2.6 Methods to reduce HCC demand and reliance on the Waikato River (such as water metering, leakage reduction, large scale storage and supplementary water sources) will need to be implemented in order to contribute to Te Ture Whaimana and meet the future needs of Hamilton City.

8.3 Wastewater discharge

8.3.1 All of Hamilton City's wastewater is currently conveyed to and treated at the Pukete Wastewater Treatment Plant (WWTP), at the northern end of the city.

8.3.2 Network capacity constraints and declining condition, coupled with population growth is expected to increase wastewater overflow events and contamination of receiving waters with consequent social and cultural effects and risk to public health.

8.3.3 Significant investment in network upgrades will be necessary to reduce the number and frequency of overflows from the network to the receiving environment, and to minimise the potential for adverse impacts in the event that overflows do occur.

8.3.4 In addition to network capacity constraints and necessary interventions, significant investment will be required to upgrade the Pukete WWTP to manage the additional flows and loads from the city. Significant investment will be necessary to improve the levels of treatment from the plant which will be one element of demonstrating betterment to the Waikato River as required by Te Ture Whaimana.

8.3.5 A step change in treatment standards (i.e., higher levels of water quality) and processes will be necessary to provide for growth while also reducing the contaminant loading to the receiving environment. Alternative or supplementary discharge methods and re-use opportunities may also be needed to improve the health and wellbeing of the Waikato River. Indicative costs to achieve the step change in treatment standards are described in Part 6 of this report.

8.4 Climate change

8.4.1 The climate is changing and New Zealand, like all countries will be affected. The effects of climate change are already beginning to be felt in the Waikato region and in Hamilton City. Changing weather patterns are predicted to cause more frequent and severe rainfall events, windier weather and drier summers.

8.4.2 The Ministry for the Environment (2018) predicts that by 2090, the Waikato will likely spend more time in drought, which will lead to water shortages and increased fire risk.[1] More frequent heavy rainfall events will increase the risk of flooding, which can damage homes and infrastructure, as well as increasing the likelihood of landslides and accelerated erosion.

8.4.3 Heavy rainfall events also have the potential to overwhelm Council's stormwater and wastewater infrastructure, with risks of wastewater overflows which may be hazardous to human health and the environment.

Water Supply

8.4.4 Whilst the design of HCC stormwater systems uses climate-change adjusted rainfall data for stormwater flows, there has been no allowance made when designing strategic infrastructure in the most recent Water Master Plan.

8.4.5 The anticipated extreme weather conditions will impact on the current, single water intake structure from the Waikato River, which is likely to be lower in summer and higher in winter.

8.4.6 Those lower river flows in summer will raise water temperatures that contribute to elevated water quality problems such as increased algae growth.

8.4.7 Regional droughts and changing rainfall patterns may result in shortages in water supply and greater demand over the summer period. This has implications for the cities future water supply, which (based on 2017 population projections) will require a second WTP in the Northern metro area by 2052.

8.4.8 Further network investment in storage, treatment and demand management will likely be needed to respond to climate change. The timing of investments currently identified in the 2020 Master Plan (including the timing of the second WTP) may need to shift forward significantly.

Wastewater System

8.4.9 The wastewater master plan process tested the existing and planned system performance by modelling the network using flow monitoring from a 1 in 10-year return period rainfall event as a proxy for testing the impacts of climate change on the network.

8.4.10 More consideration is required to gain an improved understanding of the potential impacts of climate change on the extent, frequency and volume of wastewater overflows from the wastewater network.

8.4.11 Increased investment in asset renewals and system upgrades may be needed to better respond to the potential impacts of climate change.

[1] (Ministry for the Environment, 2018)

8.4.12 Projected climate change conditions suggest receiving water bodies may be less able to assimilate the effects of contaminants to water bodies due to warmer water temperatures and lower water flows which will in turn require higher levels of wastewater treatment and other investments to contribute to the restoration and protection of the Awa.

Stormwater System

8.4.13 The anticipated increase in extreme rainfall intensity and frequency will potentially:

- Increase the burden on existing stormwater networks, resulting in more frequent 'nuisance' flooding of roading networks and properties.
- Increase flooding risks to private properties, particularly those in older brownfield urban areas where overland flow paths have not been allowed for.
- Increase levels of erosion in watercourses which have urbanised catchments.
- Increase the volume of contaminants and increase the temperature in stormwater runoff discharging to streams; and
- Exacerbate inflow and infiltration of stormwater into the wastewater network resulting in discharge of untreated wastewater into the receiving environment. This could affect human health, ecology, cultural and recreational spaces, and water supply for drinking[2],[3].

8.4.14 The projected increase in drought conditions could result in loss, or decline in the quality, of urban green spaces and a consequential reduction in the City's amenity and liveability.

8.4.15 In the future, HCC will face significant additional costs to address these issues in order to respond to mana whenua and community expectations and regulations.

8.5 Local network capacity

8.5.1 Growing areas need appropriate infrastructure to be in place to create a well-functioning urban environment and avoid unacceptable risks to, and adverse effects on, people and the environment. Incremental patching of existing networks in response to individual development proposals will likely result in reduced performance of the three waters networks with consequential adverse impacts on the Waikato River (including its tributaries), which is counter to the objectives of Te Ture Whaimana. Furthermore, an ad-hoc, reactionary approach will not deliver the step-change needed to ensure an infrastructure network capable of efficiently and effectively servicing the needs of existing and future generations, while supporting the restoration and protection of the Waikato River and its catchment.

8.5.2 For much of the existing (brownfield) parts of the city, the local infrastructure is decades old and constructed for much lower density than enabled in the current

[2] https://www.deepsouthchallenge.co.nz/sites/default/files/2017-11/Climate%20Change%20Stormwater%20Wastewater%20Systems%20Exec%20Summary.pdf

[3] [1] According to *District Plan - Section 32 Analysis* (Hamilton City Council, 2017, p.22-28), rainfall data was based on *Analysis of High Intensity Rainfall for Hamilton City* (NIWA, 2008) D-196476.

HCC District Plan or proposed through the NPS-UD and MDRS. The local networks for relatively new residential development areas have also been designed to service 16 dwelling /ha densities.

8.5.3 Providing for the intensification requirements set out in the NPS-UD and MDRS requires a significant step-change in local network design standards and will require extensive upgrade and replacement of the existing local networks. Some potentially well before the end of asset life.

8.5.4 The 2021-2031 Long Term Plan does not provide for any substantive funding to upgrade the local networks to cater for future intensification (or even upsizing existing networks to accommodate growth at the same time as planned asset renewals and replacement).

8.5.5 Providing for intensification across all residential areas as proposed in the Act without prioritising the areas to be serviced will require city wide local network upgrades (which are currently unfunded and will be cost prohibitive) or acceptance of a reduced level of system performance and associated impacts on the Waikato River.

8.5.6 Examples of adverse environmental effects and risks that arise from allowing growth without adequate infrastructure include:

(a) Increased contaminated stormwater run-off impacting on water quality, ecology, public health, cultural activities and the relationship between people and the River.

(b) Erosion from unmanaged stormwater impacting on water quality, habitat, accessibility, cultural activities, and the relationship between people and the River.

(c) Increased number, locations, and volume of wastewater overflows impacting on water quality, ecology, public health, cultural activities and the relationship between people and the River.

(d) Reduced water pressure compromising fire-fighting capacity

(e) Increased risk to people, property, and the environment from flood hazards

8.5.7 The effects of inadequate three waters infrastructure are in direct conflict with the requirement to give effect to Te Ture Whaimana. As Te Ture Whaimana is a higher-order requirement to the NPS-UD and a qualifying matter, this will mean the infrastructure planning, funding, and implementation to support increased plan-enabled capacity will be a fundamental influence on where, when and what additional intensification opportunities will be provided.

PART 9 - PERFORMANCE ASSESSMENT METHODOLOGY, ASSUMPTIONS AND LIMITATIONS

9.1 Methodology

9.1.1 The performance assessment provides analysis and commentary on the ability of Hamilton's three waters systems to provide for growth and in term contribute toward achieving Te Ture Whaimana.

9.1.2 This assessment has been prepared in a short timeframe, and as such relies of existing data, information, assessments, strategies associated with Hamilton's three waters networks.

9.1.3 No new capacity assessments, network modelling, options assessments, or pre-feasibility solution development has been completed to inform this assessment.

9.1.4 The overall approach to the assessments comprises three key parts:

(a) Developing and confirming appropriate assessment criteria that aligns with Te Ture Whaimana.

(b) Completing the performance assessments for residential zones around key town centres.

(c) Recommending further investments and assessments to fill significant gaps in existing information.

9.1.5 The key steps taken to develop and confirm the assessment criteria are shown in Figure 5.

Figure 5: Key steps taken to develop Three Waters Infrastructure Assessment Criteria

Assessment Criteria Development

Collate and evaluate	Collate and evaluate existing 3 waters infrastructure information
Assess and align	Assess infrastructure information and alignment with TTWM
Develop	Develop suitable assessment criteria relevant to giving effect to TTWM
Engage and Review	Engage with Waikato-Tainui and WRA on criteria alignment with TTWM
Finalise and apply	Finalise criteria to be used for the assessment

9.1.6 Engagement with representatives of Waikato Tainui and other key stakeholders, including the Waikato River Authority, was integral to development and confirmation of the assessment criteria.

9.1.7 Independent technical peer review of the assessments has also been used to test and improve the veracity of the assessments and identify areas for further development and investigation.

9.1.8 Key information sources used to develop the assessment criteria and to complete the assessments include:

(a) Te Ture Whaimana o te Awa o Waikato

(b) Disaggregation of the residential zones and key centres within the city into discrete areas for the purpose of the assessment (Refer to Figure 6). The area located between Areas 10 and 11 (as shown on Figure 6) has also been assessed as Area 20.

(c) Current and previous Water, Wastewater and Stormwater Master Plans and associated data, including hydraulic modelling results.

HCC has a programme of developing master plans for water, wastewater and storm water infrastructure which in turn informs funding requests through the Long-Term Planning process. These master plans provide roadmaps for future investments in Hamilton's 3-Waters infrastructure. They are keystone documents for short and long-term funding decisions. They are prepared on a 3-yearly cycle to support long-term planning and funding processes and to reflect changes to population projections.

The most recent master plans were completed in late 2020/early 2021 to inform the current 2021-2031 long term plan. The Water and Wastewater Master Plans rely on growth forecasts and population projections and network models to assess the impacts of growth on these networks, and to identify and prioritise interventions and investments needed to maintain or improve levels of service.

While the investment programmes in the Master Plans do not reflect the infrastructure needed to service the density contemplated in the Act and NPS-UD, they provide an indication of the scale of investment currently identified to meet the growth projections available at the time.

(d) 2021-2031 Long Term Plan specifically the recommended three waters investment projects and programmes funded in the LTP. Not all of the recommended investment in the master plan documents are funded in the LTP and so there is an existing funding deficit to maintain and improve levels of service for current growth projections. The infrastructure investment deficit will be exacerbated by further intensification.

(e) Available information used to evaluate investment needed to support a "Step Change" in growth contemplated through the Act and NPS-UD:

(i) High level assessments completed to assess the impact of REEP Plan Change 11 on infrastructure (2019)

(ii) Investigations completed to inform recent Housing Acceleration Fund (HAF) applications (2021) and to inform Area Plans produced for Chartwell, Five Crossroads, Hamilton East, North City and

Enderley/Fairfield.

(f) The stormwater system assessment has generally taken a long-term risk approach. The key information sources used for the assessment include:

(i) Integrated catchment management plans: Mangakotukutuku, Rotokauri, Te Awa o Katapaki, Mangaheka

(ii) Available flood hazard information.

(iii) Stormwater master plan (2020) and the most recent underlying data layers including watercourse condition assessments and ecological monitoring.

(iv) 2021-2031 Long Term Plan specifically the recommended stormwater projects and programmes that are currently funded in the LTP.

9.1.9 To inform the water and wastewater assessment of each area, three temporal bands were considered and evaluated using available information:

(a) Band 1: Near term: based on 2031 modelling results in the 2021-31 Long Term Plan.

(b) Band 2: Medium term: based on 2061 modelling results and the scale of investment identified in masterplans in the past 10 years.

(c) Band 3: What is needed to service the proposed scale of intensity.

9.2 Assumptions & Key Inputs

9.2.1 The following assumptions and key inputs have been used to complete this assessment and prepare this report:

9.2.2 **Base Population Information**

(a) Population projections are a key input to the water and wastewater network models and to identifying future upgrades of the water and wastewater networks and plants.

(b) The population projections used to inform the current Master Plans and associated network models were developed in 2017. The population projections collated for each of the 19 areas used in this traffic light assessment are summarised below.

Table 2 – Population projections informing this Three Waters Performance Assessment

		POPULATION PROJECTIONS (2017)					
NAME	AREA	2021	2031	2041	2051	2061	% CHANGE BETWEEN 2061-2021
Flagstaff East	1	15098	17902	17002	16440	16176	7%
Huntington	2	17150	16033	15260	14769	14595	-18%
Chartwell	3	11104	11354	11405	11294	11203	1%
Pukete East	4	10306	10434	10526	10479	10653	3%
Enderley North	5	9425	9897	10602	11763	11824	20%
Claudelands	6	9585	10531	10509	10308	10205	6%
Hamilton East	7	7598	7890	7611	7424	7348	-3%
Beerescourt	8	10374	10033	11297	12486	13637	24%
Crawshae	9	14285	14144	14259	14337	14268	0%
Dinsdale North	10	14766	16551	16847	16653	16448	10%
Hamilton Lake	11	5412	5979	6089	5996	5933	9%
Bader	12	17634	18301	18887	19840	19632	10%
Hillcrest Easte	13	8860	9549	10895	10922	10804	18%
Greensboro	14	9341	9448	9391	9160	9074	-3%
Rotokauri - Waiwhakareke	15	738	5849	11560	14362	14239	95%
Te Rapa North	16	301	294	296	301	315	4%
Fairview Downs	17	5680	7626	9327	9246	9143	38%
Peacockes	18	535	6849	12389	17386	18053	97%
Temple View	19	1365	1404	1436	2809	8538	84%

(c) **Note that the population projections that inform the investigations used for this assessment do not:** reflect the current plan enabled capacity (i.e., Duplexing policy), the scale of intensification being contemplated in the NPS-UD or the MDRS. Also note in particular that in the brownfield's areas, the population projections used are largely static and, in some cases, decline over time.

(d) The water and wastewater model includes projections for both brownfield and greenfield development areas.

(e) Population and demand projections for greenfield development areas utilise the development densities (dwellings/ha) and occupancy rates (people /dwelling) detailed in the Regional Infrastructure Technical Standards (RITS) i.e. 16 dwellings per ha at an occupancy rate of 2.7 people per dwelling. The expected timing of development is based on population projections.

(f) Population and demand projections for brownfield areas used for water and wastewater modelling are based solely on the growth modelling provided at the time

(g) The population projections include some education and medical facilities as a population equivalent, but most business and business land uses are captured separately in the models. Existing large trade waste and high-water users are also captured separately in the models and are included in the following sub-sections.

(h) The considerations for the residential dwelling growth projections include population estimates, land use zoning, historical patterns of development based on an allocation of growth for brownfield and greenfield areas.

(i) The population projections consider a range of factors including:

- Dwelling projections
- District plan land use zoning
- Rating valuation
- Spatial distribution of unique address points
- Education
- Health

The approach establishes point features for actual population locations based initially on address points. The address points are an effective way of identifying population dwelling locations.

(j) In addition to the residential population projections, assessments of employment numbers are also produced to inform an estimation of the total number of people at any given location in the city. Employment numbers are taken from Stats NZ. The non-residential employment projections do not fully cover health and education sites, which are important for wastewater population modelling. The projections count the workers but not the patients or students. Specific areas will have population figures adjusted to address the presence of schools and/or hospitals where necessary.

(k) A major update of residential dwelling and population projections is done every three years to inform the Long-Term Plan workstream and is augmented annually for other council models. The workstream for the next LTP commences in July 2022 and will be completed in early 2023. HCC are currently undertaking an update of the growth models and population projections.

9.2.3 **Water supply**

(a) High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones. The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

(b) Hydraulic modelling with updated population projections has not been undertaken to identify or optimise future infrastructure needs.

(c) The infrastructure requirements identified in HCC's Water Master Plan Version 3 (2020) were used for this assessment.

(d) The potential additional costs for upgrades that may be needed to service additional development were taken directly from the Housing Acceleration Fund (HAF) Water Assessment Report which assumed a gross dwelling density of 50 dwellings/ha. All the assumptions for estimating costs for upgrades have been described in the HAF water assessment report.

(e) No out of district development areas (including those where strategic land agreements exist with neighbouring local authorities) were considered in this assessment. Servicing these areas will further impact on network performance issues and increase the level of investment needed to deliver appropriate servicing solutions and LOS.

(f) The modelled network performance results used for the assessment include the upgrades recommended in the master plan. It is important to note that not all of the upgrades recommended in years 2021 to 2031 were funded in the 2021-2031 LTP.

(g) The conditions of existing infrastructure and its renewal cost for brownfield areas were not considered as this information was not available at the time of writing this report.

9.2.4 Wastewater Conveyance Network

(a) The results from the Wastewater Network hydraulic model have been used as a basis for identifying existing constraints in network capacity. The 2031 modelling results were used as a proxy for "existing" to short-term (1 – 3 years) performance. This approach is considered reasonable, because the population data (over all time horizons) used in the existing modelling does not include for significant growth or infill development in brownfields areas.

(b) The level of service for the wastewater system to accommodate urban growth was assessed based on the existing hydraulic capacity of the wastewater conveyance network during a 2-year Average Recurrence Interval (ARI) rainfall event.

(c) The modelling uses population projections and assumed non-residential development projections (as population equivalents) available at that time. Trade waste discharges subject to specific trade waste agreements at the time of the modelling is also included in the modelling. Those projections do not reflect current plan enabled capacity and do not include significant increases in population in brownfields areas.

(d) Generally, the modelled network only includes the existing networks. No significant planned upgrades or interventions are included. The modelling results used for the assessment do not include the upgrades recommended in the Master Plan or funded in the LTP as those results were not readily available. However, the individual area assessments note where there are significant upgrades funded in the LTP that could influence the assessments.

(e) The existing modelling and investigations that inform this assessment exclude out of district development areas (including those where strategic land agreements exist with neighbouring local authorities). Servicing these areas would compound network performance issues and increase the level of investment needed to deliver appropriate servicing solutions.

(f) The future performance assessment was done based on the outcome of the HAF Wastewater Infrastructure Assessment . For greenfield areas, it is assumed that the network will have:

(i) No wastewater overflows during a wet weather event or the wet weather overflows comply with future consent conditions related to wastewater overflows.

(ii) The peak dry weather pipe utilisation is <50% in all the sewer mains.

(iii) No dry weather overflows.

(iv) No inflow and infiltration (I & I) as the pipelines will be new.

(g) The conditions of existing wastewater infrastructure and its renewal cost for the brownfield areas were not taken into consideration as this information was not available at the time of writing this report.

(h) The infrastructure requirements identified in HCC's Wastewater Master Plan version 3 were used in the assessment.

(i) The potential additional costs for upgrades that may be needed to service the additional development were taken directly from the Housing Acceleration Fund (HAF) Wastewater Assessment Report which assumed a dwelling density of 50 dwellings/ha. All the assumptions for estimating costs for upgrades have been described in the HAF wastewater assessment report.

(j) For new greenfield areas which were not considered for the HAF wastewater infrastructure assessment, a rough cost estimation was done based on the same assumptions as in HAF assessment.

(k) A detailed assessment of infrastructure requirements needed to service greenfield areas was not completed. However, an assessment similar to the "HAF Wastewater Infrastructure Assessment" was undertaken to inform the infrastructure needs.

(l) 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.

9.2.5 Stormwater

(a) City-wide rapid flood hazard modelling data (AECOM, 2013) has been used where detailed flooding data is not available.

(b) The dataset identifying buildings impacted by flooding was created for the Stormwater Masterplan Version 2 (SWMPv2) and does not include all currently available detailed flood hazard data (i.e., data created since

SWMPv2).

(c) Minimal stormwater network capacity data is available. Where frequent event flood hazard data (2 year and 10 year ARI) is available, this has been used to infer network capacity. No additional stormwater network modelling was undertaken as part of this work.

(d) The traffic light system of sediment quality and macroinvertebrate index ratings (WQ1, WQ2, WQ3) developed by Tonkin & Taylor as part of the SWMPv2 have used to classify sediment quality data. This system uses a red, orange & green colour rating to rank monitoring based on whether they exceed national guideline limits.

(e) It has been assumed that public realm-open space can be used to integrate stormwater treatment elements.

(f) A detailed assessment of infrastructure requirements or constructability of new stormwater assets required to service redevelopment areas has not been undertaken. Where high-level assessments such as the "HAF Stormwater Infrastructure Assessment" were available, these have been used. Otherwise, a similar level of assessment has been adopted.

(g) A number of the assessment areas span multiple stormwater catchments which would potentially have different assessment results if considered separately. Best-judgement has been applied to estimate a combined or overall assessment score in these situations.

9.3 Limitations

9.3.1 Limitations:

(a) Data quality and availability differs between asset classes and by area across the city. The data contained in this report is based on what HCC has available and has been interpreted to the best of our ability.

(b) The outcomes of this report are not directly transferable into District Plan planning provisions, and do not highlight 'go' and 'no-go' areas of the city.

(c) Population and growth data used to inform existing strategic three waters infrastructure assessments, modelling and master plans relied on for this assessment do not reflect current plan enabled capacity in the District Plan, MDRS or the densities proposed under the NPS-UD. The data that underpins the wastewater and water supply models are the population projections provided in 2017. HCC are currently undertaking an update of the growth models and population projections. These will consider updated capacity information and are expected to be delivered for the next LTP

(d) 'Gaps' in the data for an area or asset class have been accepted.

9.3.2 The following assessments are outside of the scope of this assessment:

(a) Updated growth projections for the city that reflect changing trends in development typology, location and uptake within both brownfields and greenfield areas.

(b) Updated growth projections for the city that reflect the proposed changes to land-use associated with MDRS and NPS-UD.

(c) Three waters system modelling to assess the impacts of changing development trends (density, rate of uptake), or MDRS on network performance in the short, medium or long-term.

(d) Detailed analysis of the impacts of MDRS and NPS-UD on HCC's water and wastewater treatment facilities and associated regional council consents (water abstraction and wastewater discharge).

(e) Development of potential servicing solutions required to respond specifically to accelerated and more extensive growth including those associated with the MDRS and NPS-UD.

(f) Detailed cost estimates of servicing solutions required to respond to accelerated and more extensive growth.

(g) Assessment of transport asset state.

(h) Granular analysis of network performance

(i) Planning provisions/policies/rules in response to the findings of this assessment necessary to give effect to Te Ture Whaimana

(j) Environmental and cultural impact assessments associated with predicted network performance

(k) Identification and development of programmes needed to give effect to Te Ture Whaimana in its broadest sense (such as improving access, restoring relationships, co-management, recognition and protection of sites of significance).

PART 10 - PERFORMANCE ASSESSMENT CRITERIA ALIGNMENT TO TE TURE WHAIMANA

10.1 General

10.1.1 The approach and key inputs used to develop the performance assessment criteria for the traffic light assessment are described in Part 9 of this report.

10.1.2 The criteria used to assess each water, their alignment and relevance to Te Ture Whaimana and the impact categorisation used for the traffic light assessments are described below.

10.2 Water Supply

Criteria	TTWM Objective linkages	Rationale for adopting
CURRENT / MEDIUM TERM	Strategies 1, 4, 6, 9, 11.	
2031 Head-loss	Objectives (a), (b), (d), (f), (g) and (m) and strategy 11.	Headloss provides an indicator of energy consumption. High headloss strains the network and reduces overall network resilience (i.e., reduced ability to manage changing demand). High headloss across the network, may result in parts of the network being over pressured to maintain minimum pressures at the network extremities. Over-pressurization can lead to pipe burst and increase network leakage.
2031 Minimum Pressure / Fire Fighting Standard Compliance	Objectives (a), (b), (d), (f), (g) and (m) and strategy 11.	Minimum water pressure and the ability to comply with firefighting standards are critical to supporting social and economic well-being of our communities.
Scale of funded interventions in the current LTP	Objectives (a), (e), (f), (g), (h), (i), (j), (k) and (m) and strategies 1, 4, 6, 9 and 11.	Making land use decisions that are supported by appropriate infrastructure investment aligns with the overarching objective of TTWM and the objectives and strategies noted. Land use decisions that are made without clear investment strategies and funding plans do not align with the objectives of TTWM.

		Investment in new and upgraded infrastructure (in addition to appropriate management, maintenance, and operation) is necessary to maintain and improve levels of services, service additional demand and minimize the potential for network performance to fail or degrade over time.
Long Term Impacts	Objectives (a), (e), (f), (g), (h), (i), (j), (k) and (m) and strategies 1, 4, 6, 9 and 11.	
Scale of investment to service "step change" in demand in long term	Objectives (a), (e), (f), (g), (h), (i), (j), (k) and (m) and strategies 1, 4, 6, 9 and 11.	Making land use decisions that are supported by appropriate infrastructure investment aligns with the overarching objective of TTWM and the objectives and strategies noted. Land use decisions that are made without clear investment strategies and funding plans do not align with the objectives of TTWM.

10.3 Wastewater Network

Criteria	TTWM Objective linkages	Rationale for Adoption
CURRENT-SHORT TERM (0 – 3 years) PERFORMANCE ASSESSMENT CRITERIA	Strategies 1, 4, 6, 9, 11.	Baseline network modelling results (2019) using projected growth to 2031 has been used for the assessment and is considered a reasonable representation of the current to short-term network performance. The modelling uses population projections and assumed non-residential development projections (as population equivalents) available at that time. Trade waste discharges subject to specific trade waste agreements at the time of the modelling is also included in the modelling. Those projections do not reflect current plan enabled capacity and do not include significant increases in population in brownfields areas. Generally, the modelled network only includes the existing networks. No significant planned upgrades or interventions are included.

2031 Modelled Local and Trunk pipeline Utilization under dry weather flow conditions (winter)	Objectives (a), (b), (e), (f), (g), (h), (i), (k) and (m) and strategies 1, 3, 4, 6, 7, 9, and 11.	This criterion looks at predicted performance of the local and trunk network within each geographic area. Pipe utilization under dry weather conditions provides an indication of available pipeline capacity; potential to meet greater demand; overall network resilience to wet weather events and the potential for the network to fail (i.e., overflow) and adversely impact on the health and well-being of the Waikato River. Where dry weather flow utilization of less than 50% pipe full flow the potential impact of addition growth in the short-term is considered to be low; 50% - 75% medium impact, 75 – 100% high impact, and >100% extreme. Wastewater overflows have the potential to directly impact on the health and wellbeing of people and the Waikato River. There are clear and obvious linkages between this criteria, and the overarching objective of TTWM. Direct discharges (overflows) to any waterbody, in particular untreated waste, is culturally offensive and not in accordance with the tikanga (protocols) of maaori.
2031 Modelled Local and Trunk Wet weather overflows	Objectives (a), (b), (e), (f), (g), (h), (i), (k) and (m) and strategies 1, 3, 4, 6, 7, 9, and 11.	This criterion looks at predicted performance of the local and trunk network within each geographic area. Predicted network overflows under wet weather conditions provide an indication of network performance and potential to adversely impact on the health and well-being of the Waikato River and potential to meet greater demand. Wastewater overflows have the potential to directly impact on the health and wellbeing of people and the Waikato River. There are clear and obvious linkages between this criteria, and the overarching objective of TTWM.

		Direct discharges (overflows) to any waterbody, in particular untreated waste, is culturally offensive and not in accordance with the tikanga (protocols) of Maaori. Overflows will potentially impact on public health, ecological health, cultural and recreational activities and adversely impact on people's relationships with the river.
2031 Modelled Strategic Interceptor pipeline utilization under dry weather flow conditions (winter) Predicted strategic network (interceptors & major pump stations) capacity in 2031.	Objectives (a), (b), (e), (f), (g), (h), (i), (k) and (m) and strategies 1, 3, 4, 6, 7, 9, and 11.	This criterion looks at predicted performance of the strategic wastewater network servicing each geographic area. While predicted performance of the strategic networks servicing each individual area is a result of the cumulative impact of all areas served by that infrastructure, this criterion provides an indication of any existing strategic network constraints that may already exist and require intervention.
Scale of funded interventions in the current LTP	Objectives (a), (e), (f), (g), (h), (i), (j), (k) and (m) and strategies 1, 4, 6, 9 and 11.	Investment in new and upgraded infrastructure (in addition to appropriate management, maintenance, and operation) is necessary to maintain and improve levels of services, service additional demand and minimize the potential for network performance to fail or degrade over time. This criterion considers funding allocated in the 2021 – 2031 LTP to improve the performance of the strategic and trunk network servicing the area. While the intervention currently planned, will not be capable of meeting the longer term needs that might arise from the proposed densification contemplated by the MDRS or indeed currently enabled by the District Plan, the provision of funding is considered to provide some network improvement to better cater for growth, than areas where there may be no funded interventions. The current LTP will be used as the info source for this assessment.

		Making land use decisions that are supported by appropriate infrastructure investment aligns with the overarching objective of TTWM and the specific objectives and strategies noted. Land use decisions that are made without clear investment strategies and funding plans do not align with the objectives of TTWM. Short term decisions relying on low cost, low resilience alternatives increase the overall risk of system failure and therefore the risk of adverse impacts on the awa.
Medium Term Impacts	Strategies 1, 4, 6, 9, 11.	
2061 Modelled Local and Trunk pipeline Utilization under dry weather flow conditions (winter)	As above	As for 2031 but using results from 2061 Baseline Hydraulic Modelling
2061 Modelled Local and Trunk Wet weather overflows		As for 2031 but using results from 2061 Baseline Hydraulic Modelling
2061 Modelled Strategic Interceptor pipeline utilization under dry weather flow conditions (winter)		As for 2031 but using results from 2061 Baseline Hydraulic Modelling
Scale of investments identified in current Master Plans to service historic 2061 growth.		This criterion is used to provide an indication of the potential costs associated with servicing additional growth in each area based on upgrades identified in Wastewater Master Plan (2020). This included funded and unfunded upgrades which were identified to be necessary for future population growth identified at that time. While not a direct measure of network performance, this criterion provides an indication of the costs potentially associated servicing 2061 growth as projected in 2019, while maintaining or improving network performance, and therefore giving effect to TTWM. The potential level of investment identified through the Wastewater Master Plan has been used for this assessment.
Long Term Impacts	Strategies 1, 4, 6, 9, 11.	

Scale of investment to service "step change" in demand in long term	Investment in new and upgraded infrastructure (in addition to appropriate management, maintenance, and operation) is necessary to maintain and improve levels of services, service additional demand and minimize the potential for network performance to degrade over time. Making land use decisions that are supported by appropriate infrastructure investment aligns with the overarching objective of TTWM and objectives (a), (e), (f), (g), (h), (i), (j), (k) and (m) and strategies 1, 4, 6, 9 and 11. Land use decisions that are made without clear investment strategies and funding plans do not align with the objectives of TTWM.	This criterion is used to provide an indication of the scale of investment that may be necessary to accommodate the "step change" in growth arising from the significant increase in density (i.e., 50 dwellings/ha for general residential areas). While not a direct measure of network performance, this criterion provides an indication of the costs potentially associated with servicing the level of densification that could be enabled through the MDRS and the NPS-UD and therefore how challenging it may be to give effect to TTWM. The high-level concepts and estimates developed to inform the Housing Acceleration Fund (2021) applications and Hamilton City Area Plans (2022) are the primary information sources. No development uptake assessments, hydraulic modelling investigations, pre-feasibility assessments, or optioneering has been completed at this stage to inform the high-level concepts. Further investigation and solution development is needed to optimize an investment programme to meet the step change in growth over time.

10.4 Stormwater System

Criteria	V&S Objective linkages	Rationale for Adoption
Supporting Stormwater Investigations Has an ICMP or supporting investigations been completed. Supporting Investigations: ○ Watercourse walkover assessment	All but in particular (a), (b), (d), (e), (f), (h), (i), (m)	The quality of information available to support appropriate land use decisions is an important factor in being able to realize the Vision and objectives of TTWM and to ultimately *restore and protect the health and wellbeing of the Waikato River.* If an ICMP or the relevant supporting technical investigations are available for an area or catchment this provides a much higher level of certainty around the sensitivity/condition of the receiving environment, flood hazards and the strategic infrastructure needed to service the catchment.

○ Ecological assessment ○ Stormwater modelling study ○ Maatauranga Maaori assessments ○ Cultural values assessments		The application of maatauranga Maaori will provide a depth of knowledge and understanding to stormwater spaces, minimize potential impacts on the Waikato River and its catchment and provide for a fuller expression of and implementation of TTWM and the principles of mana whakahaere.
Known flood hazard data **Brownfield:** Number of building footprints in area of flood hazard **Greenfield:** Extent of mapped flood hazards.	(a), (b), (e), (f), (g), (h), (m)	Increasing housing density is expected lead to an increase in impervious surfaces in most existing urban areas. While allowable impervious cover for the proposed MDRS is similar to that currently allowable under the District Plan, increased numbers of dwellings allowable per lot will result in more lots achieving maximum imperviousness. Areas which are significantly impacted by flood hazards will require a larger or more interventionist strategic infrastructure approach to ensure that any impacts of growth are mitigated (i.e., no increase in risk profile) and flood risks are reduced to a tolerable level.
Watercourse quality risks ○ Existing water quality ○ Watercourse ecological value	(a), (b), (e), (f), (g), (h), (i), (k), (m)	Increased population densities are expected to increase the volumes of stormwater contaminants running off into waterways through increased impervious surfaces and increased numbers of vehicles (and associated vehicle movements). Waterways with good existing water quality and high ecological value will be more susceptible to degradation from the expected increase in stormwater contaminants due to growth.
Watercourse erosion risk ○ Receiving watercourse erosion susceptibility ○ Increase in impervious cover	(a), (b), (e), (f), (g), (h), (i), (l), (m)	Similar to above, increased volumes of stormwater runoff will increase the risk of erosion in downstream watercourses. Effects of greater runoff volume will be most severe where erosion is present based on existing flow regimes. The speed and energy created by the increase in volume will further modify the natural flow and body of the Waikato River. This could alter spawning access to high value ecological gullies and sites and create unsafe swimming areas.
SW network capacity	(a), (b), (e), (f), (h), (i), (k), (l), (m)	Where existing capacity constraints exist, there will be limited ability for existing systems to take additional flows. This will create overflows and put assets and the Waikato River at risk.
Sites of cultural significance	(a), (b), (e), (f), (h), (i), (k), (l), (m)	Increased flow volumes and volumes of runoff contaminants can lead to increased watercourse erosion and reduced water quality. This will impact

		sites of cultural significance structurally (erosion) or impact on the use of that site through reduced water quality (e.g., Mahinga Kai sites) as well as recreation values (waka ama, swimming). An increase in impervious surfaces limits the natural cycle of wai to pass through the soils of Papa-tuu-aa-nuku which recharge puna (springs) and create natural corridors to the Waikato River.

PART 11 - PERFORMANCE ASSESSMENT CRITERIA & IMPACT CATEGORIES

11.1 Water Supply criteria and impacts

11.1.1 Six criteria have been applied to each city area for this assessment. The relevance of these criteria to Te Ture Whaimana and the rationale for adopting them for this assessment is described in Section 10.2 of this report. Each criterion has been assigned one of four categories of "levels of significance" (low, medium, high and extreme) with parameters contributing to each. The significance levels are colour coded using a "traffic light system" approach as below:

Impact	Colour	Score
Low	Green	1
Medium	Yellow	2
High	Orange	3
Extreme	Red	4

11.1.2 Several assumptions were made when assessing the areas against each criterion due to the limitation on available information. Key assumptions are described in Part 9 of this report.

#	Criterion		Low	Medium	High	Extreme
1	Predicted local and trunk (250 mm only) network capacity at 2031	2020 Water Master Plan System Performance	No Design Pressure Issues, 20m or less	1 Design Pressure Issues less than 10m and/or Up to 10 Design Pressure Issues between 10-20m	2 to 5 Design Pressure Issues less than 10m and/or 11 to 20 Design Pressure Issues between 10-20m	More than 5 Design Pressure Issues less than 10m and/or More than 20 Design Pressure Issues between 10-20m
			Pipe Head Loss of 5m/km or less. More than 95%	Pipe Head Loss of 5m/km or less.	Pipe Head Loss of 5m/km or less.	Pipe Head Loss more than 5m/km

			Compliance of all pipes in Diam category	80% to 95% of all pipes in Diam category	less than 80% of all pipes in Diam category	20% or more of all pipes in Diam category
		Assessment of fire cover for commercial/industrial zoning is removed from this assessment	No general residential zoned hydrant less than FW2 Classification	1 general residential zoned hydrant less than FW2 Classification	2 to 5 general residential zoned hydrants less than FW2 Classification	More than 5 general residential zoned hydrants less than FW2 Classification
2	Predicted strategic network (trunk mains above 250 mm & bulk mains) capacity at 2031	Max of 3m/km (251mm - 599mm Diam Pipe)	Pipe Head Loss of 3m/km or less. More than 95% Compliance of all pipes in Diam category	Pipe Head Loss of 3m/km or less. 80% to 95% of all pipes in Diam category	Pipe Head Loss of 3m/km or less. less than 80% of all pipes in Diam category	Pipe Head Loss more than 3m/km 20% or more of all pipes in Diam category
		Max of 2m/km (600mm Diam and above)	Pipe Head Loss of 2m/km or less. More than 95% Compliance of all pipes in Diam category	Pipe Head Loss of 3m/km or less. 80% to 95% of all pipes in Diam category	Pipe Head Loss of 3m/km or less. less than 80% of all pipes in Diam category	Pipe Head Loss more than 2m/km 20% or more of all pipes in Diam category
3	Scale (cost) of funded upgrades that will improve network performance	2021-2031 Long Term Plan and 2021 Master Plan	Significant Capacity upgrades (Strategic and Trunk) have been funded which is appropriate for the proposed population growth projections and LOS at that time.	Major capacity upgrades (Trunk) have been funded which is appropriate for the proposed population growth projections and LOS at that time.	Minor upgrades have been funded but not sufficient to serve for the proposed population growth projections and LOS at that time.	Significant upgrades recommended in order to service proposed population growth projections and LOS at that time but not funded or deferred beyond 10 year plan.
4	Scale (cost) of already planned upgrades 2061. What's the scale of investment needed to service the area (based on Master Plans).	2020 Water Master Plan System Performance	No Design Pressure Issues, 20m or less	1 Design Pressure Issues less than 10m and/or Up to 10 Design Pressure Issues between 10-20m	2 to 5 Design Pressure Issues less than 10m and/or 11 to 20 Design Pressure Issues between 10-20m	More than 5 Design Pressure Issues less than 10m and/or More than 20 Design Pressure Issues between 10-20m

		2020 Master Plans	Some capacity upgrades have been planned till 2061 based on 2019 population growth projections. <$10M	Major capacity upgrades have been planned till 2061 based on 2019 population growth projections. $10M - $50M	Significant Capacity upgrade have been planned till 2061 based on 2019 population growth projections. $50m - $100M	Significant Capacity upgrade have been planned till 2061 based on 2019 population growth projections. >$100M+
5	Step change growth: Future possible performance with "extra" unplanned growth (e.g., NPS-UD)	Assessment of 2031 fire cover, changing from existing General Residential to proposed High Density Housing	No proposed High Density hydrant less than FW3 Classification	1 proposed High Density hydrant less than FW3 Classification	2 to 5 proposed High Density zoned hydrant less than FW3 Classification	More than 5 proposed High Density hydrant less than FW3 Classification
		REEP results – investigations HAF investigations City full scenarios	No or minor network issues Most design parameters are reached. Local infrastructure layout (e.g. mains both sides of the road) already set out to support Medium to High Density housing and proposed "Extra" density levels.	Local and /or broader network LOS issues Numerous locations below design LOS in local and trunk mains Local infrastructure layout (e.g. mains both sides of the road) already set out to support Medium to High Density housing but not designed for proposed "Extra" density level demands.	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing

					storage and/or pumping capacity	treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)
6	Step change growth: Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs.		The infrastructure will have capacity and infrastructure condition is generally "good". Only a minor capacity upgrades will be required. Additional cost for upgrade would be less than $10M	The infrastructure will have capacity however the condition of some infrastructure (both local and strategic) will be "moderate" for future land use. Some capacity improvements with major renewals will be required. Additional cost for upgrade would be in the $10M - $50M	The infrastructure will not have capacity to maintain the current LOS. The condition of the infrastructure in general is considered "poor". Major capacity improvements in the strategic infrastructure is required. Some renewals are required both in the local and strategic infrastructure. Additional cost for upgrade would be (renewals not considered) in the rage of $50-$100M.	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than $100M.

11.2 Wastewater criteria and impacts

11.2.1 Nine criteria have been applied to each city area for this assessment. The relevance of these criteria to Te Ture Whaimana and the rationale for adopting them for this assessment is described in Section 10.3. Each criterion has been assigned one of four categories of "levels of significance" (low, medium, high and extreme) with parameters contributing to each. The significance levels are colour coded using a "traffic light system" approach as below:

Impact	Colour	Score
Low	Green	1
Medium	Yellow	2
High	Orange	3
Extreme	Red	4

11.2.2 Several assumptions were made when assessing the areas against each criterion due to the limitation on available information. Key assumptions are described in Part 9 of this report.

#	Criterion	Low	Medium	High	Extreme
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	All / majority <50% peak dry weather pipe utilisation	Majority of pipelines < 50%; small pockets of trunk and local pipelines 50-75 % peak dry weather pipe utilisation	Majority of local pipelines < 50%; moderate level of pipelines 50%-75%; pockets of trunk sewer >75% dry weather pipe utilisation	Moderate level of pipelines 50%-75%; moderate level of trunk pipelines >100% peak dry weather pipe utilisation
2	2031 Modelled Local and Trunk Wet weather overflows.	No wet weather overflows or several low frequency/low volume overflows in the area	Medium level low frequency/low to medium volume overflows in the area	Extensive Low frequency/low volume overflows and/or 2 to 5 high volume wet weather	More than 5 high volume wet weather overflows and/or > 10,000 m³

	In addition to the thresholds shown for this criterion the potential for adverse impacts was also considered where med - high volume overflows were predicted, and a higher impact rating given based on judgement.			overflows and/or between 1,000m³ - 10,000m³ annual overflow volume in a given area	annual overflow volume in a given area
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	All / majority of interceptor flowing through or servicing the area <50% peak dry weather pipe utilisation	Majority of interceptor flowing through or servicing the area < 50%; moderate sections 50% - 75 % peak dry weather pipe utilisation	Majority of interceptor flowing through or servicing the area 50%-75% peak dry weather pipe utilisation with small sections >75%	Majority of interceptor flowing through or servicing the area >75 % peak dry weather pipe utilisation or known capacity constraints on interceptor.
4	Scale of funded interventions in the current LTP	No interventions identified through the master plan for years 1 - 10 (as the network capacity is adequate) or significant capacity upgrades (strategic and trunk) as recommended in Master Plan are funded in the LTP	Minor upgrades <$1m recommended in Master Plan but not funded	Moderate upgrades $1m - $10m recommended in Master Plan but not funded	Major ($10m - $50m) or significant upgrades ($50m +) recommended in master plan for years 1 - 10 but not funded or deferred beyond 10-year plan.
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	All / majority <50% peak dry weather pipe utilisation	Majority of pipelines < 50%; small pockets of trunk and local pipelines 50-75 % peak dry weather pipe utilisation	Majority of local pipelines < 50%; moderate level of pipelines 50%-75%; pockets of trunk sewer 75% - 100% dry weather pipe utilisation	Moderate level of pipelines 50%-75%; moderate level of trunk pipelines >100% peak dry weather pipe utilisation
6	2061 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	No wet weather overflows or several low frequency/low volume overflows in the area	Medium level low frequency/low to medium volume overflows in the area	Extensive Low frequency/low volume overflows and/or 2 to 5 high volume wet weather	More than 5 high volume wet weather overflows of 10,000 m³ /annum in a given area

				overflows of between 1,000m³ - 10,000m³ /annum in a given area	
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	All / majority of interceptor flowing through or servicing the area <50% peak dry weather pipe utilisation	Majority of interceptor flowing through or servicing the area < 50%; moderate sections 50% - 75 % peak dry weather pipe utilisation	Majority of interceptor flowing through or servicing the area 50%-75% peak dry weather pipe utilisation with small sections >75%	Majority of interceptor flowing through or servicing the area >75 % peak dry weather pipe utilisation or known capacity constraints on interceptor.
8	Scale of investments identified in current Master Plans to service historic 2061 growth	<$1m capacity upgrades identified for the area (or significantly impacting the area) in Master Plan between 2031 - 2061	$1m - $10m capacity upgrades identified for the area (or significantly impacting the area) in Master Plan between 2031 - 2061	$10m - $50m capacity upgrades identified for the area (or significantly impacting the area) in Master Plan between 2031 - 2061	$50m+ capacity upgrades identified for the area (or significantly impacting the area) in Master Plan between 2031 - 2061
9	Scale of investment to service "step change" in demand in long term. Excludes treatment plants	Additional investment to upgrade local, trunk and strategic network <$10m	Additional investment to upgrade local, trunk and strategic network $10m - $50m	Additional investment to upgrade local, trunk and strategic network $50m - $100m	Additional investment to upgrade local, trunk and strategic network >$100m

11.2.3 To support the evaluation of wastewater overflow criterion, a matrix was developed that considered the average annual overflow volume and overflow frequency and the number of modelled overflows in or adjacent to each area. Professional judgement was used alongside this matrix to evaluate the network overflow criteria.

11.3 Stormwater criteria and impacts

11.3.1 Seven criteria, described in the table overleaf, have been applied to each city area for this assessment. The relevance of these criteria to Te Ture Whaimana and the rationale for adopting them for this assessment is described in Section 10.4. Each criterion has been assigned one of four categories of "levels of significance" (low, medium, high and extreme) with parameters contributing to each. The significance levels are colour coded using a "traffic light system" approach as below:

Impact	Colour	Score
Low	Green	1
Medium	Yellow	2
High	Orange	3
Extreme	Red	4

11.3.2 Several assumptions were made when assessing the areas against each criterion due to the limitation on available information. Key assumptions are described in Part 9 of this report.

#	Criterion	Low	Medium	High	Extreme
1	**Supporting Stormwater Investigations** Has an ICMP or supporting investigations been completed. Supporting Investigations: • Watercourse walkover assessment • Ecological assessment • Natural wetland assessment • Stormwater model (flooding/capacity)	ICMP completed or 3 to 4 assessments available.	Some technical investigations needed to support ICMP undertaken, i.e. 2 assessments available, or similar level of confidence.	Limited assessment data available (e.g., CSDC monitoring data only).	No data available.
2	**Known flood hazard data** Brownfield: Number of building footprints in area of flood hazard Greenfield: Extent of mapped flood hazards.	Brownfield: Less than 500 building footprints within mapped hazard areas. or Greenfield development area.	Brownfield: 500-1000 building footprints within mapped hazard areas. or More than 20 properties within high hazard zone.	Brownfield: 1000-1500 building footprints within mapped hazard areas. or More than 100 properties within high hazard zone.	Brownfield: More than 1500 building footprints within mapped hazard areas. or More than 150 properties within high hazard zone.
3	**Existing treatment devices or treatment opportunities**	Greenfield catchment with opportunity to apply best	No (or little) known treatment infrastructure.	No (or little) known treatment infrastructure.	No (or little) known treatment infrastructure.

		practice SW quality management. Developed areas of the catchment generally have high coverage of treatment devices that meet requirements or could be reset.	Opportunities to implement centralized treatment devices are good – i.e., areas of open space aligning with existing pipe networks, or existing devices.	Some opportunities to implement centralized treatment devices.	Opportunities to implement centralized treatment devices are poor – i.e., no available public domain space.
4	**Watercourse quality risks** • Existing water quality • Watercourse ecological value	Sediment quality data is poor (WQ3). or MCI data is poor (WQ3).	Sediment quality data is fair. and MCI data is fair.	Sediment and MCI monitoring data is 'good'. or MCI data is good. or No data available.	Sediment and MCI monitoring data is 'good'. MCI data is good. Other indicators of high-quality habitat present (e.g., SNA).
5	**Watercourse erosion risk** • Receiving watercourse erosion susceptibility • Increase in impervious cover	Existing watercourse of generally low erosion susceptibility increase in impervious cover is expected to be low (i.e., high impervious brownfield).	Existing watercourse of generally moderate erosion susceptibility Low to moderate change in impervious cover expected (i.e., residential brownfield). or Existing watercourse of generally low erosion susceptibility within greenfield area.	Existing watercourse moderate to high erosion susceptibility or no data available. Moderate (or greater) change in impervious cover expected (i.e., residential brownfield).	Existing watercourse of generally high erosion susceptibility. Large change in impervious cover expected (i.e., greenfield).
6	**Stormwater network capacity**	Greenfield catchment or Piped network with adequate capacity for the 10 year ARI event.	Limited identified pipe capacity issues (less than 75% of pipes above capacity in 10 year event).	Pipe capacity issues (More than 75% of pipes above capacity) and limited impacts on private properties in 2 year / 10 year event. or No data.	Pipe capacity issues (More than 80% of pipes above capacity). Known flooding issues in frequent events (2 year / 10 year ARI) or other known issues relating to capacity.

7	**Sites of cultural significance**	No known historic or contemporary sites of significance or customary activity areas in the sub-catchment area.	Known historic or contemporary sites of significance or customary activity areas in the vicinity of waterways in the sub-catchment, but unaffected by development. or No recorded data.	Known historic or contemporary sites of significance or customary activity areas in the vicinity of waterways in the sub-catchment, likely to be moderately impacted by development.	Known historic or contemporary sites of significance or customary activity areas in the vicinity of waterways in the sub-catchment, likely to be significantly impacted by development.

PART 12 - TRAFFIC LIGHT ASSESSMENTS

12.1 Assessed Areas

12.1.1 The city was divided into 19 discrete areas in order to complete the traffic light performance assessment (Figure 6). The areas were defined by the Hamilton City Planning Unit based generally on consolidating adjacent Statistics New Zealand *Statistical areas based on land use zoning*.

12.1.2 This approach was considered appropriate given that the purpose of this assessment is to support the development of new planning provisions and given that defining the areas based on hydrologic catchment, water demand management area, or wastewater servicing catchments would result in different areas for each water.

12.1.3 In addition, to the 19 areas identified in the map, an assessment of "Area 20" has also been undertaken for completeness. Area 20 is located between Areas 8, 10 and 11 is predominantly employment/business uses and includes a significant portion of the CBD.

12.1.4 Figure 6 includes the projected 2031 and 2061 population equivalents for each of the 19 discrete areas that have been used for the modelling assessments and master planning used to inform the water and wastewater traffic light assessments. The trend in growth projections is also included with the arrows indicating increases, decreases or largely no change in the population projections. Low rates of growth are shown for most brownfields areas.

12.1.5 Planned greenfield areas show a significant increase in population (e.g. Rotokauri, Peacock and Temple View) however the projections are not based on MDRS or NPS-UD and so are likely to be too low. In addition, areas such as Te Rapa North were not planned to commence development before 2061 in the previous projections but have now been approved for development or are about to undergo a plan change to enable development of those areas earlier.

12.1.6 The MDRS and NPS-UD will represent a significant increase in development capacity from that currently enabled by the district plan, and the projections used to inform this assessment.

12.2 Traffic Light Assessments

12.2.1 The traffic light assessments comprise of a weighted multi-criteria analysis. Each of the discrete areas of the city were evaluated and scored between 1 and 4 against the criteria and impact categories described in Part 11 of this report.

12.2.2 The criteria used for the water and wastewater assessments were grouped into three temporal bands (near, medium and long term). The criteria within each band are weighted equally and the average of all of the scores adopted for each temporal band.

12.2.3 For the water and wastewater assessments sensitivity scenarios which applied different weightings to each of the temporal bands tested:

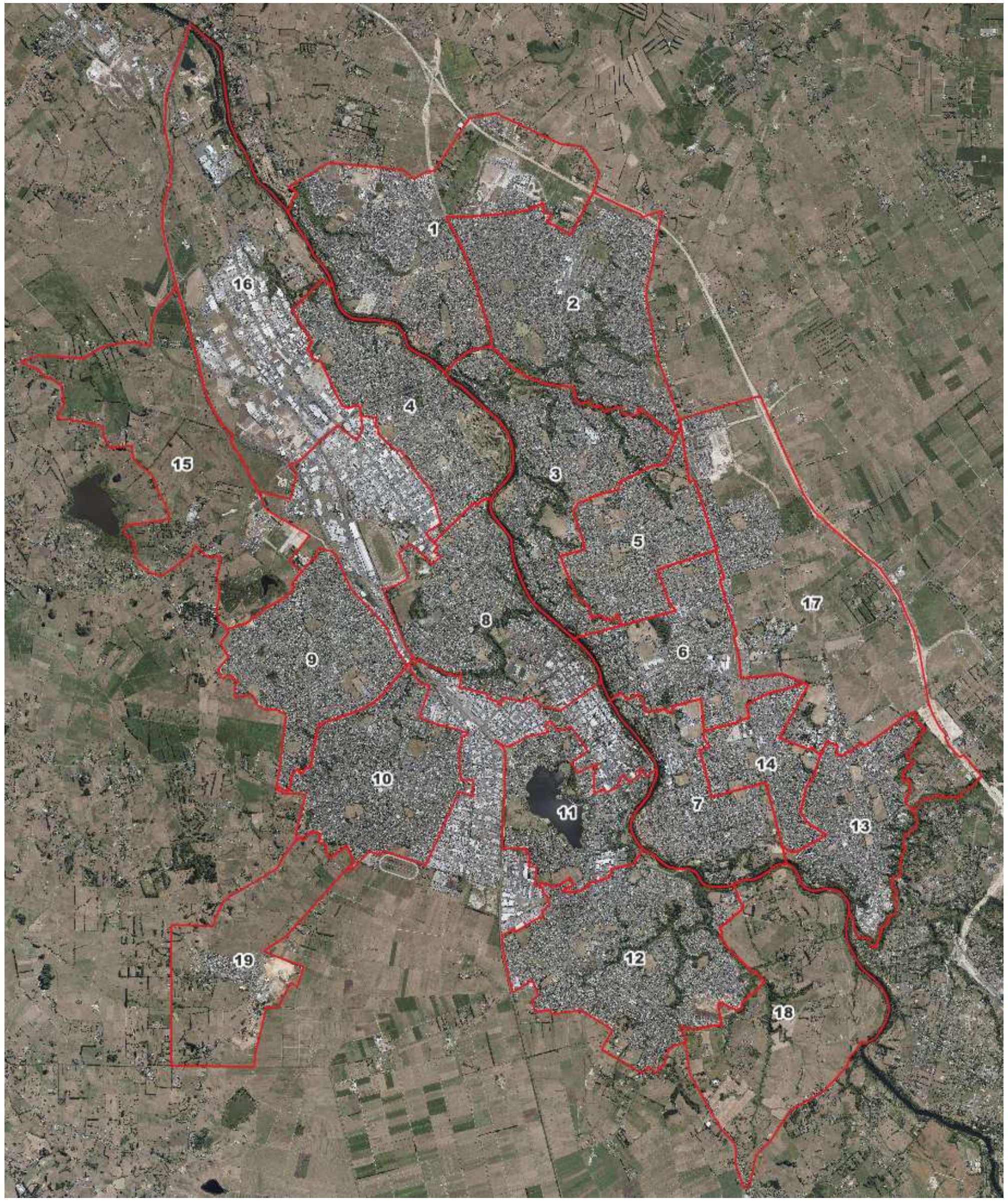
(a) Scenario 1: Applied equal weighting to the scores from the three temporal bands (33% each)

(b) Scenario 2: Applied 60% weighting to the near term temporal band 30% to the medium term and 10% to the long term.

(c) Scenario 3: Applied 70% weighting to the near term temporal band 30% to the medium term. Scoring against the long term criteria was excluded.

12.2.4 For stormwater equal weighting was applied to all of the criteria to determine an overall 'traffic light' assessment for each discrete area.

12.2.5 Summaries of the key findings of the assessments are included in the body of this report. Individual area reports for each of the waters are appended and provide some of the evidence used to inform the assessments.



		POPULATION PROJECTIONS (2017)		
NAME	AREA	2031	2061	% CHANGE BETWEEN 2061-2021
Flagstaff East	1	17902	16176	7%
Huntington	2	16033	14595	-18%
Chartwell	3	11354	11203	1%
Pukete East	4	10434	10653	3%
Enderley North	5	9897	11824	20%
Claudelands	6	10531	10205	6%
Hamilton East	7	7890	7348	-3%
Beerescourt	8	10033	13637	24%
Crawshae	9	14144	14268	0%
Dinsdale North	10	16551	16448	10%
Hamilton Lake	11	5979	5933	9%
Bader	12	18301	19632	10%
Hillcrest Easte	13	9549	10804	18%
Greensboro	14	9448	9074	-3%
Rotokauri - Waiwhakareke	15	5849	14239	95%
Te Rapa North	16	294	315	4%
Fairview Downs	17	7626	9143	38%
Peacockes	18	6849	18053	97%
Temple View	19	1404	8538	84%

NOTE: The above population projections inform the water and wastewater modelling and master plan results used for the traffic light assessment. They **do not** reflect the NPS-UD and MDRS

Figure 6 - Traffic Light Assessment Areas and Population Projections

12.3 Overall traffic light assessment

The overall traffic light assessments (by area, water and scenario) are based on the weighted average score for each scenario. These scores have been rounded to the nearest whole number and the resulting colour adopted:

Impact	Colour	Score	Range
Low	Green	1	<1.5
Medium	Yellow	2	>1.5-<2.5
High	Orange	3	>2.5 - <3.5
Extreme	Red	4	>3.5

#	Area	Water supply	Wastewater	Stormwater
1	**Flagstaff East**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
2	**Huntington**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
3	**Chartwell**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
4	**Pukete East**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	Scenario 2	
		Scenario 3	Scenario 3	

5	**Enderley North**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
6	**Claudelands**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
7	**Hamilton East**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
8	**Beerescourt**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
9	**Crawshaw**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
10	**Dinsdale North**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
11	**Hamilton Lake**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
12	**Mangakotukutuku / Bader**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
13	**Hillcrest East**	*Scenario 1*	*Scenario 1*	*Scenario 1*

		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
14	**Greensboro**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
15	**Rotokauri**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
16	**Te Rapa**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
17	**Ruakura**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
18	**Peacock**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
19	**Temple View**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	
20	**Other - Overall**	*Scenario 1*	*Scenario 1*	*Scenario 1*
		Scenario 2	*Scenario 2*	
		Scenario 3	*Scenario 3*	

12.4 Water Supply Traffic Light Assessment

Please note that to maintain legibility, the table has been split in two, with the final three criteria traffic light assessments found on page 74.

# on map	Area	Predicted local and trunk (250 mm only) network capacity at 2031			Predicted strategic network (trunk mains >250 mm & bulk mains) capacity at 2031		Scale (cost) of funded upgrades that will improve network performance
		Network pressure	***Pipe head loss***	***Fire hydrant performance (General Residential Zones only)***	***Pipe Head loss (251 mm - 599 mm Diam Pipe)***	***Pipe Head loss (600mm Diam and above)***	***2021-2031 Long Term Plan and 2020 Master Plan***
1	**Flagstaff East**	1 pressure point between 10-20m	98% of all pipes have head loss of 5m/km or less	1 Hydrant Fails FW2 classification	88% of all pipes have head loss of 3m/km or less	100% of all pipes have head loss of 2m/km or less	Funding mostly for upsizing local pipes to 250 mm trunk mains within development or roading projects $22M
2	**Huntington**	3 pressure points between 10-20m	97% of all pipes have head loss of 5m/km or less	3 Hydrants Fail FW2 classification	100% of all pipes have head loss of 3m/km or less	100% of all pipes have head loss of 2m/km or less	
3	**Chartwell**	No Design Pressure Issues, 20m or less	97% of all pipes have head loss of 5m/km or less	5 Hydrants Fail FW2 classification	100% of all pipes have head loss of 3m/km or less	87% of all pipes have head loss of 2m/km or less	Only partial funding provided for 2nd reservoir. Also timing was pushed back, not matching intended operational date. Proposed Fairfield reservoir pump station upgrade was not funded in LTP
4	**Pukete East**	5 pressure points less than 10m	95% of all pipes have head loss of 5m/km or less	3 Hydrants Fail FW2 classification	89% of all pipes have head loss of 3m/km or less	94% of all pipes have head loss of 2m/km or less	Proposed Pukete pump station upgrade to create reservoir Zone, along with other strategic pipelines are unfunded.
5	**Enderley North**	3 pressure points less than 10m & 1 between 10-20m	94% of all pipes have head loss of 5m/km or less	2 Hydrants Fail FW2 classification	42% of all pipes have head loss of 3m/km or less	84% of all pipes have head loss of 2m/km or less	Only partial funding provided for 2nd reservoir. Also timing was pushed back, not matching intended operational date $13.5M
6	**Claudelands**	No Design Pressure Issues, 20m or less	98% of all pipes have head loss of 5m/km or less	1 Hydrant Fails FW2 classification	100% of all pipes have head loss of 3m/km or less	100% of all pipes have head loss of 2m/km or less	
7	**Hamilton East**	No Design Pressure Issues, 20m or less	97% of all pipes have head loss of 5m/km or less	No hydrant less than FW2 Classification	81% of all pipes have head loss of 3m/km or less	100% of all pipes have head loss of 2m/km or less	
8	**Beerescourt**	3 pressure points less than 10m & 9 between 10-20m	97% of all pipes have head loss of 5m/km or less	1 Hydrant Fails FW2 classification	93% of all pipes have head loss of 3m/km or less	100% of all pipes have head loss of 2m/km or less	Proposed Pukete pump station upgrade to create reservoir Zone, Maeroa pump station upgrade and new Ruakiwi reservoir and pump station are unfunded.
9	**Crawshaw**	7 pressure points less than 10m & 7 between 10-20m	97% of all pipes have head loss of 5m/km or less	3 Hydrants Fail FW2 classification	97% of all pipes have head loss of 3m/km or less	100% of all pipes have head loss of 2m/km or less	Significant Capacity upgrades (Strategic and Trunk) have been funded which is appropriate for the proposed population growth projections and LOS at that time.
10	**Dinsdale North**	3 pressure points less than 10m &	93% of all pipes have head loss of 5m/km or less	7 Hydrants Fail FW2 classification	97% of all pipes have head loss of 3m/km or less	93% of all pipes have head loss of 2m/km or less	

		67 between 10-20m					
11	**Hamilton Lake**	7 pressure points less than 10m & 3 between 10-20m	95% of all pipes have head loss of 5m/km or less	5 Hydrants Fail FW2 classification	27% of all pipes have head loss greater than 3m/km	100% of all pipes have head loss of 2m/km or less	Minor upgrades have been funded but not sufficient to serve for the proposed population growth projections and LOS at that time.
12	**Mangakotukutuk**	1 pressure point less than 10m & 2 between 10-20m	90% of all pipes have head loss of 5m/km or less	7 Hydrants Fail FW2 classification	88% of all pipes have head loss of 3m/km or less	92% of all pipes have head loss of 2m/km or less	
13	**Hillcrest East**	3 pressure points less than 10m	90% of all pipes have head loss of 5m/km or less	5 Hydrants Fail FW2 classification	100% of all pipes have head loss of 3m/km or less	100% of all pipes have head loss of 2m/km or less	Significant upgrades recommended in order to service proposed population growth projections and LOS at that time but not funded or deferred beyond 10 year plan.
14	**Greensboro**	No Design Pressure Issues, 20m or less	97% of all pipes have head loss of 5m/km or less	No hydrant less than FW2 Classification	100% of all pipes have head loss of 3m/km or less	32% of all pipes have head loss greater than 2m/km	Only partial funding provided for 2nd reservoir. Also, timing was pushed back, not matching intended operational date $13.5M
15	**Rotokauri**	3 pressure points between 10-20m	100% of all pipes have head loss of 5m/km or less	1 Hydrant Fails FW2 classification *Must be noted area is only partially developed in this timeline*	100% of all pipes have head loss of 3m/km or less	No pipes in this Diam Category	Proposed Pukete pump station upgrade to create reservoir Zone, along with other strategic pipelines were unfunded in the LTP.
16	**Te Rapa**	No Design Pressure Issues, 20m or less	99% of all pipes have head loss of 5m/km or less	No hydrant less than FW2 Classification *Must be noted some areas are only partially developed in this timeline.*	100% of all pipes have head loss of 3m/km or less	No pipes in this Diam Category	
17	**Ruakura**	6 pressure points less than 10m & 2 between 10-20m	97% of all pipes have head loss of 5m/km or less	No hydrant less than FW2 Classification	100% of all pipes have head loss of 3m/km or less	94% of all pipes have head loss of 2 metres or less	Only partial funding provided for 2nd reservoir. Also timing was pushed back, not matching intended operational date $13.5M Strategic pipes along the spine road keep getting pushed back $25M
18	**Peacock**	1 pressure point less than 10m & 3 between 10-20m	100% of all pipes have head loss of 5m/km or less	No hydrant less than FW2 Classification *Must be noted some areas are only partially developed in this timeline.*	100% of all pipes have head loss of 3m/km or less	100% of all pipes have head loss of 2m/km or less	Significant Capacity upgrades (Strategic and Trunk) have been funded which is appropriate for the proposed population growth projections and LOS at that time.
19	**Temple View**	No Design Pressure Issues, 20m or less	100% of all pipes have head loss of 5m/km or less	No hydrant less than FW2 Classification	100% of all pipes have head loss of 3m/km or less	No pipes in this Diam Category	

20	**Other**	2 pressure points between 10-20m	Pipe Head Loss of 5 metres or less.	More than 95% Compliance of all pipes in Diam category. Must be noted area has 31 commercial hydrants below FW3	Pipe head loss of 3 metres or less. More than 95% compliance of all pipes in Diam category.	Pipe head loss of 2 metres or less. More than 95% compliance of all pipes in Diam category.	Significant upgrades fully funded for Newcastle zone. However, no funding was provided for Ruakiwi zone to install new pumping station, change operating philosophy of current reservoir and install new reservoir.

# on map	Area	Scale (cost) of already planned upgrades 2061. What's the scale of investment needed to service the area.		Step change growth: Future possible performance with "extra" unplanned growth (e.g. NPS-UD)		Step change growth: Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs.
		Network Pressure	***2032-2061 (30 year) Long Term Plan and 2020 Master Plan***	***Assessment of 2031 fire cover, changing from existing General Residential to proposed High Density Housing***	**HAF Investigations** **RITS - Comparing design standards for general residential versus high density (NPS-UD)** **REEP results – investigations** **City full scenarios**	
1	**Flagstaff East**	1 pressure point between 10-20m	Some capacity upgrades have been planned till 2061 based on 2019 population growth projections. $8.5M	Assessment of 2031 fire cover, changing from FW2 to FW3 has 11 Fail FW3 (also insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas. Widespread locations below design LOS in local and trunk mains including bulk supply mains. Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity for Rototuna Zones for the unplanned growth. Demand exceeds bulk ring main capacity including reservoir filling mains.	Significant local and strategic infrastructure upgrades and renewals are required. Complete replacement of local infrastructure is likely in some areas. Additional reservoir storage required with bigger pumps. Additional cost for upgrade would be (renewals not considered) greater than $100M.
2	**Huntington**	1 pressure point between 10-20m	Some capacity upgrades have been planned till 2061 based on 2019 population growth projections. $8.5M	Assessment of 2031 fire cover, changing from FW2 to FW3 has 51 Fail FW3 (also insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas. Widespread locations below design LOS in local and trunk mains including bulk supply mains. Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity for Rototuna Zones for the unplanned growth. Demand exceeds bulk ring main capacity including reservoir filling mains.	Significant local and strategic infrastructure upgrades and renewals are required. Complete replacement of local infrastructure is likely in some areas. Additional reservoir storage required with bigger pumps. Additional cost for upgrade would be (renewals not considered) greater than $100M.
3	**Chartwell**	No Design Pressure Issues, 20m or less	No major capacity upgrades were planned till 2061 based on 2019	Assessment of 2031 fire cover, changing from FW2	Wide spread network LOS issues across the area of interest and/ impacts across other areas.	Significant local and strategic infrastructure upgrades and renewals are required.

			population growth projections. However timing of the 2nd Ruakura reservoir is currently later than desired.	to FW3 has 259 Failing FW3 performance (also insufficient hydrants to meet spacing requirements)	Widespread locations below design LOS in local and trunk mains including bulk supply mains. Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity for Fairfield and Ruakura Zones in particular for the unplanned growth. Demand exceeds bulk ring main capacity including reservoir filling mains.	Complete replacement of local infrastructure is likely in some areas. Additional reservoir storage required with bigger pumps. Additional cost for upgrade would be (renewals not considered) greater than $100M.
4	**Pukete East**	5 pressure points less than 10m	Some capacity upgrades have been planned till 2061 based on 2019 population growth projections. (Roading Projects)	Assessment of 2031 fire cover, changing from FW2 to FW3 has 101 Fail FW3 (also insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) more greater than $100M.
5	**Enderley North**	3 pressure points less than 10m & 1 between 10-20m	Major capacity upgrades have been planned till 2061 based on 2019 population growth projections. $13.5M	Assessment of 2031 fire cover, changing from FW2 to FW3 has 140 Fail FW3 (also insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) more greater than $100M.
6	**Claudelands**	No Design Pressure Issues, 20m or less	Major capacity upgrades have been planned till 2061 based on 2019 population growth projections. $13.5M	Assessment of 2031 fire cover, changing from FW2 to FW3 has 33 Fail FW3 (also, insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely).

					Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)	Additional cost for upgrade would be (renewals not considered) greater than $100M.
7	**Hamilton East**	No Design Pressure Issues, 20m or less	Major capacity upgrades have been planned till 2061 based on 2019 population growth projections. $13.5M	Assessment of 2031 fire cover, changing from FW2 to FW3 has 22 Fail FW3 (also, insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than $100M.
8	**Beerescourt**	3 pressure points less than 10m & 18 between 10-20m	No capacity upgrades were planned till 2061 based on 2019 population growth projections.	Assessment of 2031 fire cover, changing from FW2 to FW3 has 59 Fail FW3 (also, insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)	Refer to HAF Phase 1 work by Mott MacDonald
9	**Crawshaw**	10 pressure points less than 10m & 4 between 10-20m	Major capacity upgrades have been planned till 2061 based on 2019 population growth projections. $25M	Assessment of 2031 fire cover, changing from FW2 to FW3 has 165 Fail FW3 (also, insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)	Refer to HAF Phase 1 work by Mott MacDonald
10	**Dinsdale North**	3 pressure points less than 10m & 47 between 10-20m	Major capacity upgrades have been planned till 2061 based on 2019	Assessment of 2031 fire cover, changing from FW2 to FW3 has 249 Fail FW3	Wide spread network LOS issues across the area of interest and/ impacts across other areas	Refer to HAF Phase 1 work by Mott MacDonald

			population growth projections. $25M	(also, insufficient hydrants to meet spacing requirements)	Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)	
11	**Hamilton Lake**	6 pressure points less than 10m & 3 between 10-20m	No capacity upgrades were planned till 2061 based on 2019 population growth projections.	Assessment of 2031 fire cover, changing from FW2 to FW3 has 89 Fail FW3 (also, insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)	Refer to HAF Phase 1 work by Mott MacDonald
12	**Mangakootukutuku / Bader**	1 pressure point less than 10m & 2 between 10-20m	Significant Capacity upgrade have been planned till 2061 based on 2019 population growth projections. Reservoir $32M	Assessment of 2031 fire cover, changing from FW2 to FW3 has 199 Fail FW3 (also, insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)	Refer to HAF Phase 1 work by Mott MacDonald
13	**Hillcrest East**	3 pressure points less than 10m	No capacity upgrades were planned till 2061 based on 2019 population growth projections.	Assessment of 2031 fire cover, changing from FW2 to FW3 has 121 Fail FW3 (also, insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity	Refer to HAF Phase 1 work by Mott MacDonald

					Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)	
14	**Greensboro**	No Design Pressure Issues, 20m or less	$13.5M	Assessment of 2031 fire cover, changing from FW2 to FW3 has 30 Fail FW3 (also, insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)	Refer to HAF Phase 1 work by Mott MacDonald
15	**Rotokauri**	No Design Pressure Issues, 20m or less	Significant Capacity upgrade have been planned till 2061 based on 2019 population growth projections above $50M (plus roading projects)	Assessment of 2031 fire cover, changing from FW2 to FW3 has 1 Failing FW3 performance (also, insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas. Widespread locations below design LOS in local and trunk mains including bulk supply mains. Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential" in brownfield areas. Insufficient reservoir storage and/or pumping capacity at the Pukete reservoir for the unplanned growth. Pukete reservoir site is also not well located hydraulically & has no space for more storage. Demand exceeds bulk ring main capacity.	Significant local and strategic infrastructure upgrades and renewals are required in existing brownfield areas. A new reservoir, Pump Station, Bulk mains and Trunk mains are required to create a new Rotokauri zone.. Additional cost for upgrade would be (renewals not considered) greater than $100M.
16	**Te Rapa**	No Design Pressure Issues, 20m or less	No capacity upgrades were planned till 2061 based on 2019 population growth projections.	Assessment of 2031 fire cover, changing from FW2 to FW3 has 4 Fail FW3 (also insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than $100M.
17	**Ru aku**					Refer to HAF Phase 1 work by Mott

		6 pressure points less than 10m & 2 between 10-20m	Major capacity upgrades have been planned till 2061 based on 2019 population growth projections. $13.5M	Assessment of 2031 fire cover, changing from FW2 to FW3 has Fail FW3 (also insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)	MacDonald
18	Peacocke	1 pressure point less than 10m & 2 between 10-20m	Significant Capacity upgrade have been planned till 2061 based on 2019 population growth projections. Strategic Pipes $24M Reservoir $32M	Assessment of 2031 fire cover, changing from FW2 to FW3 has 2 Fail FW3 (also insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)	Refer to HAF Phase 1 work by Mott MacDonald
19	Temple View	3 pressure points less than 10m	Major capacity upgrades have been planned till 2061 based on 2019 population growth projections. $24M	Assessment of 2031 fire cover, changing from FW2 to FW3 has 8 Fail FW3 (also insufficient hydrants to meet spacing requirements)	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)	Refer to HAF Phase 1 work by Mott MacDonald
20	Other - CBD	2 pressure points between 10-20m	Significant capacity upgrades have been planned till 2061 based on 2019 population/growth projections. Strategic Pipes $50M Reservoir $32M	Assessment of 2031 fire cover, changing from FW2 to FW3 mostly complies in mixed use areas. Also, insufficient hydrants to meet spacing requirements for FW3. Must be noted that area has 31 commercial hydrants below FW3.	Wide spread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunk mains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)s.	Refer to HAF Phase 1 work by Mott MacDonald

12.5 Wastewater Traffic Light Assessment

# on map	Area	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	2031 Modelled Local and Trunk Wet weather overflows	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Scale of funded interventions in the current LTP	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	2061 Modelled Local and Trunk Wet weather overflows	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Scale of investments identified in current Master Plans to service historic 2061 growth	Scale of investment to service "step change" in demand in long term. Excludes treatment plants
1	Flagstaff East	Majority of local and trunk network < 50% pipe full under dry weather conditions.	5 low frequency/low volume overflow locations predicted across the area. Total modelled average annual overflow volume <50m3.	Far Eastern Interceptor flowing through and servicing the area is < 50% pipe full under dry weather conditions	No interventions identified in Master Plan	Majority of local and trunk network < 50% pipe full under dry weather conditions.	Note that the modelled network in this area may not be accurate and needs to be updated to reflect the as-built system. These results should be considered with caution. 9 low frequency/low volume overflow locations predicted across the area. Additional low frequency/med volume overflows upstream of North City PS. Total modelled average annual overflow volume near North City SPS 1,000m3.	Additional flow from overall catchment results in ~400m length of interceptor flowing between 50 - 75% full. However, no overflows in the vicinity of the area created.	No interventions identified in Master Plan	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely
2	Huntington	Majority of local and trunk network < 50% pipe full under dry weather conditions. ~600m of 300 mm dia trunk pipeline along Barrington/ St James Drive between 50-75% full. ~200m section of 600mm dia pipeline	No predicted wastewater overflows	Far Eastern Interceptor flowing through and servicing the area is < 50% pipe full under dry weather conditions	No interventions identified in Master Plan	Majority of local and trunk network < 50% pipe full under dry weather conditions, however ~600m of 300 mm dia trunk pipeline along Barrington/ St James Drive between 50-75% full. ~200m section of	No predicted wastewater overflows	Additional flow from overall upstream catchment results in ~600m length of 1050 mm dia far eastern interceptor located downstream of Chapel Hill flowing between 50 - 75% full. However, no overflows the area created.	Current master plan recommends a new staged bulk wastewater storage facility to manage additional flows into FEI. ~$16m for Stage 1.	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely

		through Cranmar Cl between 50-75% full. This 600mm dia section of the trunk main is located between two 675 mm dia pipelines.				600 mm dia pipeline through Cranmar Cl also between 50-75% full. This section of the trunk main is constricted as it is located between two 675 mm dia pipelines				
3	**Chartwell**	Majority of local and trunk network < 50% pipe full under dry weather conditions. ~1,000m of 160 mm dia service main (installed in 1985) located in Ranfurly Gully 50-75% pipe full under dry weather conditions. This pipeline is on the boundary with Area 5 but flows into Ranfurly SPS so is accounted for in Area 3 assessment.	5 low frequency/low volume overflow locations predicted across the area. Predicted overflow volume where Ranfurly SPS discharges to the local network >1000m3/annum. Overflow from Fairfield SPS ~400m3/annum. There are 3 further overflows on the boundary with Area 5. The overflows are from manholes and spill between 1 - 5 times per year with a total combined overflow volume of >4000m3/annum. Service line through Ranfurly Gully predicted to overflow infrequently with combined volume of <500m3/annum.	Majority of interceptor servicing the area is between 50 - 75% full in dry weather conditions	Current master plan recommends two new staged bulk wastewater storage facilities to alleviate pressure on the Eastern Interceptor. One storage facility is located in Area 3, the other is located upstream of Area 3. Investigation, planning and construction of these bulk storage facilities are funded in the current LTP. The gravity trunk mains immediately downstream of the Ranfurly pump station rising main are predicted to be under-capacity and causing manhole overflows. The preferred capacity upgrade is to upsize approximately 100 m of the downstream trunk main from DN225 to DN300 to reduce overflows. The upgrade is funded in the LTP. These investments will have an improvement on the overall network performance.	Majority of local and trunk network < 50% pipe full under dry weather conditions. Small isolated pockets of pipelines between 50 - 75% to >100% pipe full under dry weather conditions ~1,000m long service main located in Ranfurly Gully 50-75% pipe full under dry weather conditions. This pipeline is on the boundary with Area 5 but flows into Ranfurly SPS so is accounted for in Area 3 assessment.	6 predicted wet weather overflow locations in the area. All within close proximity to receiving waterways and main stem of the river. Increased frequency and overflow volumes predicted downstream of Ranfurly SPS without infrastructure investment. Increased overflow volume predicted from Fairfield SPS.	Majority of central interceptor servicing the area is between 50 - 75% full in dry weather conditions	Second stage of bulk storage facility identified in current master plan. ~$8m for Stage 2.	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely

4	Pukete East	Majority of local network < 50% pipe full under dry weather conditions. ~1500m of dia 300 - 375 mm dia trunk main 50 - 75% full, and ~300m of 300 mm dia >100% full	6 low frequency/ low volume overflow locations predicted across the area. One high frequency overflow at Sycamore SPS (located on bank of main river stem). Average annual overflow volume ~300m3. One low frequency moderate volume overflow at St Andrews SPS (<200m3)	Interceptors that service the area both <50% full.	No interventions identified in Master Plan	Majority of local network < 50% pipe full under dry weather conditions. ~1500m of dia 300 - 375 mm dia trunk main 50 - 75% full, and ~300m of 300 mm dia >100% full	7 low frequency/ low volume overflow locations predicted across the area. One high frequency overflow at Sycamore SPS (located on bank of main river stem). Average annual overflow volume ~300m3. One low frequency moderate volume overflow at St Andrews SPS (<200m3)	Interceptors that service the area both <50% full.	No interventions identified in Master Plan	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely
5	Enderley North	Majority of local network < 50% pipe full under dry weather conditions. ~1500 of dia 450 mm dia trunk main 50 - 75% full, and ~400m 75% -100% full. ~100m 100% full.	AREA COULD BE RATED LOW IMPACT (DESPITE OVERFLOW PERFORMANCE) FOR THE PURPOSE OF THIS ASSESSMENT BECAUSE ALL OF THE RECOMMENDED UPGRADES IN THE CURRENT MASTER PLAN ARE FUNDED. 9 low frequency/ low volume overflow locations predicted across the area. 1 high frequency high volume overflow at receiving manhole downstream of Snells SPS discharge (~6,000m3). 1 mod frequency/ mod volume overflow further downstream on same trunk line (~500m3) Works currently	Majority of interceptor servicing the area is between 50 - 75% full in dry weather conditions	Snells SPS funded and under construction. Upstream and downstream bulk storage facilities in design investigation phase. Construction of both storage facilities are funded in current LTP. These investments will have an improvement on the overall network performance. Enderley/Fifth Ave Pipeline Diversion funded. These investments will have an improvement on the overall network performance.	Majority of local network < 50% pipe full under dry weather conditions. ~1500 of dia 450 mm dia trunk main 50 - 75% full, and ~400m 75% -100% full. ~100m 100% full.	AREA COULD BE RATED LOW IMPACT (DESPITE OVERFLOW PERFORMANCE) FOR THE PURPOSE OF THIS ASSESSMENT BECAUSE ALL OF THE RECOMMENDED UPGRADES IN THE CURRENT MASTER PLAN ARE FUNDED. 11 low frequency/ low volume overflow locations predicted across the area. 1 high frequency high volume location overflows/year. ~8000m/year at receiving manhole downstream of Snells SPS discharge. 1 mod frequency/ mod volume overflow further downstream on same trunk line (~600m3)	Majority of interceptor servicing the area is between 50 - 75% full in dry weather conditions	Second stage of bulk storage facility identified in current master plan. ~$8m for Stage 2.	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely

			underway will alleviate the high frequency, high volume overflow. Refer to comments on Area 3 for discussion on overflows along the eastern area boundary.				Works currently underway will alleviate the high frequency, high volume overflow. Refer to comments on Area 3 for discussion on overflows along the eastern area boundary.			
6	**Claudelands**	Majority of local network < 50% pipe full under dry weather conditions. ~1300m long 225 mm dia trunk main along Tennyson Rd, through private property to East Street varies. ~400m 100% full, ~800m between 50% - 100% full	AREA COULD BE RATED LOW IMPACT (DESPITE OVERFLOW PERFORMANCE) FOR THE PURPOSE OF THIS ASSESSMENT BECAUSE ALL OF THE RECOMMENDED UPGRADES IN THE CURRENT MASTER PLAN ARE FUNDED. Large number (28) of overflow locations throughout the area. Majority are infrequent and low volume overflows from local reticulation as a result of capacity constraints downstream. 13 overflows associated with Tennyson Trunk main with total volume > ~4,000m3/annum ~500m3/annum overflows in the vicinity of Wairere Dr local reticulation.	Majority of interceptor servicing the area is between 50 - 75% full in dry weather conditions	Snells SPS funded and under construction. Upstream and downstream bulk storage facilities in design investigation phase. Construction of both storage facilities are funded in current LTP. These investments will have an improvement on the overall network performance. Enderley/Fifth Ave Pipeline Diversion funded. These investments will have an improvement on the overall network performance.	Local network < 50% pipe full under dry weather conditions. ~1300m long 225 mm dia trunk main along Tennyson Rd, through private property to East Street varies. ~400m 100% full, ~800m between 50% - 100% full	AREA COULD BE RATED LOW IMPACT (DESPITE OVERFLOW PERFORMANCE) FOR THE PURPOSE OF THIS ASSESSMENT BECAUSE ALL OF THE RECOMMENDED UPGRADES IN THE CURRENT MASTER PLAN ARE FUNDED. Large number (30) of overflow locations throughout the area. Significant increase in overflow volumes from local reticulation and Tennyson Trunk Main as a result of capacity constraints downstream. 15 overflows associated with Tennyson Trunk main with total volume > ~5500m3/annum ~900m3/annum overflows in the vicinity of Wairere Dr local reticulation.	Majority of interceptor servicing the area is between 50 - 75% full in dry weather conditions	Second stage of bulk storage facility identified in current master plan. ~$8m for Stage 2.	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely

7	**Hamilton East**	Majority of local and trunk network < 50% pipe full under dry weather conditions. ~450m of 300 mm dia trunk main along Riverside walk is between 50% - 100% full, however not surcharging. ~200m of local pipeline to Opoia SPS >100% full.	Frequent (>5) and high volume ~1,700m3/annum overflows from manholes on Clyde St and Kelvin Place. Overflows are on the 600mm dia Interceptor. Several low volume/low frequency overflows shown in vicinity of Firth/Albert Street. Bridge St SPS shown as an overflow location, but SPS has been decommissioned and Hillsborough SPS recently upgraded so disregard this location.	Majority of upper Eastern Interceptor flowing through the area is between 50 - 75% full.	Bulk storage facility to be located in this area to alleviate Eastern Interceptor capacity constraints in design investigation phase. Construction of is funded in current LTP. These investments will have an improvement on the overall network performance.	Majority of local and trunk network < 50% pipe full under dry weather conditions. ~450m of 300 mm dia trunk main along Riverside walk is between 50% - 100% full, however not surcharging. ~200m of local pipeline to Opoia SPS >100% full.	Frequent (>5) and high volume ~2900m3/annum overflows from manholes on Clyde St and Kelvin Place. Overflows are on the 600mm dia Interceptor. Several low volume/low frequency overflows shown in vicinity of Firth/Albert Street. Bridge St SPS shown as an overflow location, but SPS has been decommissioned and Hillsborough SPS recently upgraded so disregard this location.	Additional flow from overall catchment increases the length of interceptor flowing between 5. - 75% full. However, not overflows in the vicinity of the area created.	Upgrade to ~700m to 300/375 mm trunk main in vicinity of Firth Street identified in the Master Plan.. ~$1.7m	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely
8	**Beerescourt**	Majority of local network < 50% pipe full under dry weather conditions. ~500m of 300mm-375mm dia trunk main upstream of Gwynne SPS >100% full. ~600m of 300 mm dia trunk main upstream of Seddon SPS >100% full. ~300m of 225 mm dia trunk main on Cunningham 50 - 75% full. ~150m of 150 mm local main along Maeroa Rd from Victoria Street to central interceptor >100%	11 predicted low frequency/low volume overflows throughout the area. All less than 0.2 OF/yr. >5 overflows/annum from Seddon SPS and trunk main with total annual overflow volume of ~2,500m3. 4 overflows/annum from manhole on Forest Lake Rd upstream of western interceptor. With total annual overflow volume ~1500m3. This predicted overflow needs to be verified with connection to recently installed	~50% (1000m) of 525 mm dia central interceptor flowing through and servicing the majority of the area between 50 - 75% full.	No interventions identified in Master Plan	Majority of local network < 50% pipe full under dry weather conditions. ~500m of 300mm-375mm dia trunk main upstream of Gwynne SPS >100% full. ~600m of 300 mm dia trunk main upstream of Seddon SPS >100% full. ~300m of 225 mm dia trunk main on Cunningham 50 - 75% full. ~350m of 150 mm local main along Maeroa Rd from Victoria Street to central interceptor >100%	11 predicted low frequency/low volume overflows throughout the area. All less than 0.2 OF/yr. >5 overflows/annum from Seddon SPS and trunk main with total annual overflow volume of ~2800m3. >5 overflows/annum from manhole on Forest Lake Rd upstream of western interceptor. With total annual overflow volume ~2700m3. This predicted overflow needs to be verified with connection to recently installed mid- western duplication.	~50% (1000m) of 525 mm dia central interceptor between 50 - 75% full.	Seddon SPS Upgrade recommended to accommodate growth $3m	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely

		~500m of 150 mm local main from Storey Ave, Garnett Ave, Dalgleish Ave to Central interceptor between 50% to >100% full	mid- western duplication.			~500m of 150 mm local main from Storey Ave, Garnett Ave, Dalgleish Ave to Central interceptor between 50% to >100% full				
9	**Crawshaw**	Majority of local network < 50% pipe full under dry weather conditions. ~1,100m long 300/375 mm dia trunk main down Grandview Rd is between 50% - >100% full ~500m of 300/375 mm dia trunk main along Breckon's Ave between 50- 75% full.	7 predicted low frequency/low volume overflows through the area as a result of trunk main constraints.	Area is serviced by the mid-section of the Western Interceptor which has recently been duplicated. The modelling results do not include this new pipeline which was installed to alleviate capacity constraints in the area.	Mid-section western interceptor duplicated in 2020.	Majority of local network < 50% pipe full under dry weather conditions. ~1,100m long 300/375 mm dia trunk main down Grandview Rd is between 50% - >100% full ~500m of 300/375 mm dia trunk main along Breckon's Ave between 50- 75% full.	7 predicted low frequency/low volume overflows through the area as a result of trunk main constraints.	Area is serviced by the mid-section of the Western Interceptor which has recently been duplicated. The modelling results do not include this new pipeline which was installed to alleviate capacity constraints in the area.	Significant investment is required in the upper section of the western interceptor to minimise overflows and accommodate growth upstream of Dinsdale.	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely
10	**Dinsdale North**	Majority of local network <50% pipe full under dry weather conditions. Majority of trunk network between 50 - 75% pipe full. These pipelines include 1,000m of 300 mm dia trunk main along Bremworth and 1,100m long 225/300 mm pipeline from Aberdeen Dr to Aberfoyle and along the Waitaawhiriwhiri Stream. 900m long 225/300 mm dia trunk main connecting to Western Interceptor at Karen Cres 50-75% pipe full.	Several overflows in the vicinity of Bremworth Ave trunk main. ~1,600m3/annum. Frequent overflow upstream of Frederick SPS. ~600m3/annum directly adjacent to Waitawhiriwhiri Stream. Cluster of low frequency overflows in vicinity of Karen Cres	The majority of the 600/675 mm diameter Western Interceptor is >100% pipe full under dry weather conditions. Dinsdale SPS upgrade has been put on hold, but previously identified as being necessary. The (dual) western interceptor downstream of Dinsdale is shown as between 50-75% full, however the modelling results need to include the recently completed mid -section duplication.	Bulk storage facility to be located in this area to alleviate pressure on Western Interceptor and reduce overflows. The facility is funded in the current LTP.	Majority of local network <50% pipe full under dry weather conditions. Majority of trunk network between 50 - 75% pipe full. These pipelines include 1,000m of 300 mm dia trunk main along Bremworth and 1,100m long 225/300 mm pipeline from Aberdeen Dr to Aberfoyle and along the Waitaawhiriwhiri Stream. 900m long 225/300 mm dia trunk main connecting to Western Interceptor at Karen Cres 50-75% pipe full.	Significant increase in the frequency and volumes of overflows in the area. In particular along the Bremworth trunk mainly, Karen SPS and the trunk network near Karen Cres.	The majority of the 600/675 mm diameter Western Interceptor is >100% pipe full under dry weather conditions. Dinsdale SPS upgrade has been put on hold, but previously identified as being necessary. The (dual) western interceptor downstream of Dinsdale is shown as between 50-75% full, however the modelling results need to include the recently completed mid -section duplication.	Upgrade to Frederick SPS is identified in current master plan $2.3m Upgrade of Karen SPS identified in current master plan $2.3m	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely

11	**Hamilton Lake**	Majority of local and trunk network < 50% pipe full under dry weather conditions. ~300m of 225 mm dia is 50-75% pipe full under dry weather conditions	12 low frequency/low volume overflows in vicinity of Lake Rotoroa and Hillsborough. 2 low frequency overflows ~100m3/annum in vicinity of Lake Rotoroa. Low frequency overflows ~500m3/annum on pipeline upstream of Hillsborough SPS. Hillsborough SPS has recently been upgraded which will alleviate overflows and capacity challenges shown in modelling results.	Area is serviced by upper western interceptor which is known to have significant capacity constraints. ~50,000m3/annum overflow from the upper western interceptor immediately upstream of Area 11 .	Upper Western Interceptor duplication identified in the most recent Wastewater Master plan but not funded in the current LTP ($50m+)	Majority of local and trunk network < 50% pipe full under dry weather conditions. ~300m of 225 mm dia is 50-75% pipe full under dry weather conditions	12 low frequency/low volume overflows in vicinity of Lake Rotoroa and Hillsborough. 2 low frequency overflows ~100m3/annum in vicinity of Lake Rotoroa. Low frequency overflows ~500m3/annum on pipeline upstream of Hillsborough SPS.	Area is serviced by upper western interceptor which is known to have significant capacity constraints. ~7500m3/annum overflow from the upper western interceptor immediately upstream of Area 11 .	Upper Western Interceptor duplication identified in the most recent Wastewater Master plan but not funded in the current LTP. ($50m+) Upgrades to local network near lake identified in current master plan $4.1m	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely
12	**Mangakootukutuku / Bader**	Majority of local network <50% pipe full but with several pockets where local network is 50 - >100% pipe full. Around half of the trunk network in the area is 50 - >100% pipe full.	Extensive low frequency/low volume overflows throughout the area. 4 high volume/high frequency overflows locations on trunk main along Collins Rd/Prisk St/Yvonne St ~4,500m³/annum overflow volume. High frequency/high volume (~7, 000 m3/annum) at Fitzroy SPS. High frequency/high volume (~2500 m3/annum) at Normandy SPS. High frequency/high volume (~6500 m3/annum) at Lorne SPS.	Area is serviced by upper western interceptor which is known to have significant capacity constraints. ~50,000m3/annum overflow from the upper western interceptor immediately upstream of Area 11.	Fitzroy SPS upgrade and diversion funded in current LTP ($9m) Colins Rd bulk storage facility funded in current LTP ($13m) Upper western capacity upgrades not funded in the current LTP ($50m +) Other SPS and trunk main upgrades identified in current master plan but not funded ($10m)	Majority of local network <50% pipe full but with several pockets where local network is 50 - >100% pipe full. Around half of the trunk network in the area is 50 - >100% pipe full.	Extensive low frequency/low volume overflows throughout the area. 4 high volume/high frequency overflows locations on trunk main along Collins Rd/Prisk St/Yvonne St ~6200 m3/annum overflow volume. High frequency/high volume (~8300 m3/annum) at Fitzroy SPS. High frequency/high volume (~3300 m3/annum) at Normandy SPS. High frequency/high volume (~7500 m3/annum) at Lorne SPS.	Area is serviced by upper western interceptor which is known to have significant capacity constraints. ~5000m3/annum overflow from the upper western interceptor immediately upstream of Area 11.	Upper Western Interceptor duplication identified in the most recent Wastewater Master plan but not funded in the current LTP.	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely

			High frequency/high volume (~2000 m3/annum) at Te Anau SPS.				High frequency/high volume (~4000 m3/annum) at Te Anau SPS.			
13	**Hillcrest East**	Majority of local network <50% pipe full but with several pockets where local network is 50 - >100% pipe full. Around half of the trunk network in the area is 50 - >100% pipe full.	16 low frequency/low volume overflows throughout the area. 3 med frequency/volume overflows at Barry Cres, Morris Cres and Howell Ave. Total of ~1700 m3/annum	Area discharges into the upper section of Eastern Interceptor. Majority of upper Eastern Interceptor flowing through the area is between 50 - 75% full.	Stage 1 of Morris and Howell SPS recommended in master plan.	Majority of local network <50% pipe full but with several pockets where local network is 50 - >100% pipe full. Around half of the trunk network in the area is 50 - >100% pipe full.	16 low frequency/low volume overflows throughout the area. 3 med frequency/volume overflows at Barry Cres, Morris Cres and Howell Ave. Total of ~3500 m3/annum	Area discharges into the upper section of Eastern Interceptor. Majority of upper Eastern Interceptor flowing through the area is between 50 - 75% full.	Stage 2 of Morris and Howell SPS recommended in master plan.	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely
14	**Greensboro**	Majority of local network <50% pipe full but with several pockets where local network is 50 - >100% pipe full. Around half of the trunk network in the area is 50 - >100% pipe full.	20 low frequency/low volume overflows throughout the area. High frequency/high volume overflow near Flynn SPS (~1800 m3/annum) and Somme Cres (2300m3/annum). Low freq/med volume overflows at Edinburgh Rd, Clyde St, Wairere Dr, Beaumont St.	Area discharges into the upper section of Eastern Interceptor. Majority of upper Eastern Interceptor flowing through the area is between 50 - 75% full.	Two bulk storage facilities recommended in master plan ($13m)	Majority of local network <50% pipe full but with several pockets where local network is 50 - >100% pipe full. Around half of the trunk network in the area is 50 - >100% pipe full.	20 low frequency/low volume overflows throughout the area. High frequency/high volume overflow near Flynn SPS (~2800 m3/annum) and Somme Cres (2800m3/annum). Low freq/med volume overflows at Edinburgh Rd, Clyde St, Wairere Dr, Beaumont St.	Area discharges into the upper section of Eastern Interceptor. Majority of upper Eastern Interceptor flowing through the area is between 50 - 75% full.	Flynn SPS upgrade recommended in master plan $2m	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely
15	**Rotokauri**	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Area is serviced by Far Western Interceptor <50% pipe full.	No strategic interventions identified in Master Plan	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Area is serviced by Far Western Interceptor <50% pipe full.	No strategic interventions identified in Master Plan	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely
16	**Te Rapa**	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Area is serviced by Far Western Interceptor <50% pipe full. Also, relatively close to the Pukete WWTP	No strategic interventions identified in Master Plan. However strategic and trunk infrastructure needed to service the area. Currently unfunded.	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Area is serviced by Far Western Interceptor <50% pipe full. Also, relatively close to the Pukete WWTP	No strategic interventions identified in Master Plan. However strategic and trunk infrastructure needed to service the area. Currently unfunded.	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely

17	**Ruakura**	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure. Powells Rd area flows to Eastern Interceptor through Area 5. Extensive low frequency/low volume overflows in the Powells Rd area.	Far Eastern Interceptor and infrastructure designed for density proposed in 2018. Pipeline is under construction and is potentially too small for densities being contemplated now. Far Eastern Interceptor has flows <50% pipe full in dry weather conditions. Peacock Rising Mains and Snells SPS will discharge into the Far Eastern Interceptor and trigger the need for Darjon Storage.	No strategic interventions identified in Master Plan. HCC contribution to Far Eastern Interceptor extension funded in LTP	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure. Powells Rd area flows to Eastern Interceptor through Area 5. Extensive low frequency/low volume overflows in the Powells Rd area.	Far Eastern Interceptor and infrastructure designed for density proposed in 2018. Pipeline is under construction and is potentially too small for densities being contemplated now. Far Eastern Interceptor has flows <50% pipe full in dry weather conditions. Peacock Rising Mains and Snells SPS will discharge into the Far Eastern Interceptor and trigger the need for Darjon Storage.	Current master plan recommends a new staged bulk wastewater storage facility to manage additional flows into FEI. ~$16m for Stage 1.	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely
18	**Peacocke**	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Strategic Infrastructure funded in LTP	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	Strategic Infrastructure funded in LTP	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely
19	**Temple View**	Majority of developed area has flows <50% pipe full in dry weather conditions. Remainder is largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.	No modelled overflows	Temple view discharges into constrained western network at Karen SPS	Upper Western Interceptor duplication identified in the most recent Wastewater Master plan but not funded in the current LTP.				Bulk Storage, pump station, rising main from Temple View $20m+	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely
20	**OTHER**	Refer below	Refer below	Refer below	Refer below	Refer below	Refer below	Refer below	Refer below	Refer below
20a	**Other - Between railway and river**	Majority of local and trunk networks <50% pipe full in dry weather with sections of trunk main 100%+ full.	3 low volume/low frequency overflows. Overflows at Hillsborough alleviated by recently completed SPS upgrade.	Majority of area discharges to central interceptor via Seddon SPS	Hillsborough SPS Upgrade complete. Bulk Storage in Area 7 will alleviate receiving interceptor capacity	Majority of local and trunk networks <50% pipe full in dry weather with sections of trunk main 100%+ full.	3 low volume/low frequency overflows. Overflows at Hillsborough alleviated by recently completed SPS upgrade.	Majority of area discharges to central interceptor via Seddon SPS	Seddon SPS Upgrade recommended to accommodate growth $3m	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely

			Area discharges to Seddon SPS which has capacity constraints				Area discharges to Seddon SPS which has capacity constraints			
20b	**Other - North of Killarney Rd**	Majority of developed area has flows <50% pipe full in dry weather conditions.	1 low frequency overflow. But alleviated through western mid-section duplication	Recently completed western mid-section duplication will alleviate interceptor capacity constraints	Western mid-section duplication recently completed.	Majority of developed area has flows <50% pipe full in dry weather conditions.	1 low frequency overflow. But alleviated through western mid-section duplication	Recently completed western mid-section duplication will alleviate interceptor capacity constraints	Western mid-section duplication recently completed.	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely
20c	**Other - South of Killarney Rd**	Majority of local and trunk network < 50% pipe full under dry weather conditions.	Several low flow/low volume overflows. Several mid frequency/volume overflows and two high frequency/high volume overflows	Discharges into constrained upper western interceptor	Upper Western Interceptor duplication identified in the most recent Wastewater Master plan but not funded in the current LTP.	Majority of local and trunk network < 50% pipe full under dry weather conditions.	Several low flow/low volume overflows. Several mid frequency/volume overflows and two high frequency/high volume overflows	Discharges into constrained upper western interceptor	Upper Western Interceptor duplication identified in the most recent Wastewater Master plan but not funded in the current LTP.	

12.6 Stormwater traffic light assessments

# on map	Area	Supporting Stormwater Investigations	Known flood hazard data	Existing treatment devices or opportunities	Watercourse quality risks	Watercourse erosion risk	SW network capacity	Sites of cultural significance
1	**Flagstaff East**	Te Awa O Katapaki (TAOK) ICMP in final draft. Otamangenge catchment has ICMP, however is now out of date. 20% of catchment not covered by any ICMP.	Detailed flood hazard modelling available for most of area (~75%). 156 buildings affected by some level of hazard (low hazard or greater). 2 buildings affected by high hazard.	Large percentage of area drains to centralised devices. Most do not meet current SW requirements. Opportunities to implement centralised devices are generally good, mostly through reset of existing devices.	5 available monitoring sites within area. Sediment data is good to fair. MCI data is fair to poor.	Low to moderate erosion susceptibility watercourse. Mix of high-impervious brownfield and greenfield areas. Moderate change in impervious cover expected.	No individual pipe data, however available modelling report that supports the TAOK ICMP suggests minimal capacity issues.	Known cultural sites – not located within watercourse or location not considered to be at risk.
2	**Huntington**	No ICMP currently available for most (75%) of area. Watercourse walkover data available for the majority of stream reaches. Partial coverage of flood hazard modelling.	Detailed flood hazard modelling available for less than 50% of area. 716 buildings affected by some level of hazard (low hazard or greater). 47 buildings affected by high hazard.	Approximately 50% of catchment drains to centralised devices. Most do not meet current SW requirements. Opportunities to implement centralised devices are generally good, mostly through reset of existing devices.	2 available monitoring sites within area. Insufficient data to assess.	Moderate erosion susceptibility watercourse. Mix of high-impervious brownfield and greenfield areas. Moderate change in impervious cover expected.	No SW network capacity data. Approximately 20% of area drains north to TAOK stream and is covered by ICMP modelling which reports minimal capacity issues.	Known cultural sites – not located within watercourse or location not considered to be at risk.

3	**Chartwell**	No ICMP currently undertaken for the Chartwell area. One area specific investigation undertaken to date - watercourse walkover (for Kirikiriroa stream). Some sediment quality and ecological data available through CSDC monitoring, but not sufficient to support ICMP.	Rapid flood hazard data available for the Chartwell area. 649 buildings affected by some level of hazard (low hazard or greater). 74 buildings affected by high hazard.	Limited existing stormwater devices – will not be meeting current stormwater requirements. Opportunities to implement centralised devices are generally good, with open space aligned with piped networks and adjacent to watercourses.	8 available monitoring sites within area. Sediment quality data is poor. MCI data varies from good to poor. On average data is fair.	High erosion susceptibility watercourse. Some increase in impervious cover expected through redevelopment. Currently brownfield, but typical lot cover is less than allowed for under NPS-UD.	No known SW network capacity data.	Known cultural sites – not located within watercourse or location not considered to be at risk.
4	**Pukete East**	No ICMP currently available. No area specific investigations undertaken to date.	Only rapid flood hazard data available for this area. 1327 buildings affected by some level of hazard (low hazard or greater). 291 buildings affected by high hazard.	No know existing central treatment measures. Opportunities to implement centralised devices are limited.	No watercourses within area – short flow paths discharging directly to river.	No watercourses within area.	No SW network capacity data.	Known cultural sites – not located within watercourse or location not considered to be at risk.
5	**Enderley North**	No ICMP currently available. Partial coverage of one area specific investigation – watercourse walkover.	Only rapid flood hazard data available for this area. 1352 buildings affected by some level of hazard (low hazard or greater). 218 buildings affected by high hazard.	No know existing treatment measures. Opportunities to implement centralised devices are limited. Construction of centralised treatment would require resumption of private properties.	1 available monitoring site within area. Insufficient data to assess.	Drains to three watercourses – Kirikiriroa and 2 Hamilton East gullies. Erosion susceptibility data is high to moderate erosion susceptibility. Moderate change in impervious cover expected.	No SW network capacity data.	Known cultural sites – not located within watercourse or location not considered to be at risk.
6	**Claudelands**	No ICMP currently available. No area specific investigations undertaken to date.	Only rapid flood hazard data available for this area. 1351 buildings affected by some level of hazard (low hazard or greater). 105 buildings affected by high hazard.	No know existing treatment devices. Some opportunity to implement centralised devices – particularly around Claudelands Park.	No data.	No data	No SW network capacity data.	Known cultural sites – not located within watercourse or location not considered to be at risk.
7	**Hamilton East**	No ICMP currently undertaken for the Hamilton East area.	Detailed flood hazard modelling available for approximately 50% of area.	Minimal existing stormwater devices – will not be meeting current stormwater requirements.	5 CSDC monitoring sites within area.	No watercourse assessment data available.	No SW network capacity data. Known issues with secondary flow paths	Known cultural sites – not located within watercourse or location not considered to be at risk.

		Some stormwater modelling (hazard modelling only) available for part of area.	Remainder covered by rapid. 861 buildings affected by some level of hazard (low hazard or greater). 140 buildings affected by high hazard.	Some opportunity to implement centralised devices with open space along watercourse.	Sediment data varies from good to poor. On average data is poor. MCI data varies from good to poor. On average data is fair.		based on rapid flooding data – i.e., lack of engineered flow paths causing significant inundation of private properties.	
8	**Beerescourt**	No ICMP currently available. Two investigations available - flood hazard data and watercourse walkover.	Detailed flood hazard modelling available for most of area. 1364 buildings affected by some level of hazard (low hazard or greater). 240 buildings affected by high hazard.	No known existing treatment devices. Opportunities to implement centralised devices are generally good, with open space aligned with piped networks and adjacent to watercourses.	2 CSDC monitoring sites within area. Sediment data is poor. MCI data is poor.	Moderate erosion susceptibility watercourse. Limited change in impervious cover expected as current land use is highly impervious.	No SW network capacity data. Results of frequent flood events (2 year, 10 year ARI) from detailed flood study shows impacts on properties in multiple locations. Known lack of engineered secondary flow paths.	Known cultural sites – PA site appears to be located in gully downstream of Te Rapa Road.
9	**Crawshaw**	No ICMP currently available. Downstream SW investigations undertaken for Rotokauri ICMP or District Plan (flood modelling).	Detailed flood hazard modelling available for most of area. 1890 buildings affected by some level of hazard (low hazard or greater). 67 buildings affected by high hazard.	No know existing treatment measures. Opportunities to implement centralised devices are limited. Construction of centralised treatment would require resumption of private properties.	No watercourses within area. Downstream watercourse is Rotokauri Greenway.	No watercourses within area. Downstream watercourse is Rotokauri Greenway.	No SW network capacity data.	Known cultural sites – not located within watercourse or location not considered to be at risk.
10	**Dinsdale North**	No ICMP currently available. Two investigations available - flood hazard data and watercourse walkover.	Detailed flood hazard modelling available for most of area. 2088 buildings affected by some level of hazard (low hazard or greater). 80 buildings affected by high hazard.	No know existing treatment devices. Some opportunity to implement centralised devices with open space along watercourse.	3-4 available monitoring sites within area. Sediment data is poor. MCI data is poor.	Low erosion susceptibility watercourse. Limited change in impervious cover expected as catchment is already developed at a high impervious cover level.	No SW network capacity data. Available FHM study (Waitawhiriwhiri catchment) indicates limited flooding impacts in frequent events.	Known cultural sites – not located within watercourse or location not considered to be at risk.
11	**Hamilton Lake**	No ICMP currently available. A number of SW investigations available - flood hazard data,	Detailed flood hazard modelling available for most of area.	No know existing treatment devices. Opportunities to implement centralised devices are generally good,	Several sediment quality available monitoring site within Lake. Issues with SW contaminants identified.	No data – limited waterways within or downstream of this catchment.	No SW network capacity data. Available FHM study indicates flooding impacts on properties in frequent	Known cultural sites – PA site appears to be located adjacent to Graham Park. May be at risk form increased SW flows.

		quality/ecology and brownfield stormwater investigation underway.	405 buildings affected by some level of hazard (low hazard or greater). 26 buildings affected by high hazard.	with open space aligned with piped networks and adjacent to watercourses.	No monitoring for catchments draining away from the Lake. No MCI data available.		events, indicating capacity issues.	
12	**Mangakootukutuku / Bader**	ICMP and supporting investigations practically completed. ICMP focused on greenfield portion of catchment.	Detailed flood hazard modelling available for most of area. 1580 buildings affected by some level of hazard (low hazard or greater). 75 buildings affected by high hazard.	No know existing treatment devices. Some opportunity to implement centralised devices	7 available monitoring sites within area. Sediment data is mostly poor. MCI data varies from good to poor. On average data is good – fair.	Overall moderate erosion susceptibility watercourse. Limited change in impervious cover expected as catchment is already developed at a high impervious cover level.	SW network capacity information available in ICMP. Less than 75% of pipes at or over capacity in 10 year event.	Known cultural sites – flour mill and PA site appears to be located adjacent gully/stream. May be at risk form increased SW flows.
13	**Hillcrest East**	No ICMP currently available. No area specific investigations undertaken to date.	Only rapid flood hazard data available for this area. 810 buildings affected by some level of hazard (low hazard or greater). 110 buildings affected by high hazard.	No know existing treatment devices. Opportunities to implement centralised devices are limited. Construction of centralised treatment would require resumption of private properties.	4 available monitoring sites within area. Sediment data is poor. MCI data varies from good to poor. On average data is good – fair.	Only partial coverage of walk-over data (approximately 40% of waterway). Where walkover is available, erosion/restoration project underway (Mangonua Gully) Limited change in impervious cover expected as catchment is already developed at a high impervious cover level.	No SW network capacity data.	Known cultural sites – several PA sites appears to be located adjacent gully/stream. May be at risk form increased SW flows.
14	**Greensboro**	No ICMP currently available. Limited area of detailed flood hazard information available.	Detailed flood hazard modelling available for most of area. 1147 buildings affected by some level of hazard (low hazard or greater). 110 buildings affected by high hazard.	Some treatment along Wairere Drive upgrade corridor, none outside of this. Central green corridor provides some opportunity to implement centralised devices.	Discharges to two watercourses south/north. 1-3 monitoring locations at northern outlet of area, none in south. Sediment data varies but is poor immediately at outlet. MCI data is generally good.	No watercourse assessment data.	No SW network capacity data.	Known cultural sites – not located within watercourse or location not considered to be at risk.

15	**Rotokauri**	ICMP and subsequent infrastructure planning undertaken in 2013-15.	Greenfield development area.	Greenfield development area.	4 MCI sites within southern central drainage channel. MCI is fair – poor. Sediment monitoring within Lake Rotokauri. Sediment quality is fair. Three monitoring sites in Rotokauri north. Both sediment quality and MCI are 'good'. Discharges to Lake Rotokauri, which is significantly degraded.	Watercourse is a farm drain and will be re-developed in Greenway project.	Greenfield development area.	Known cultural sites – not located within watercourse or location not considered to be at risk.
16	**Te Rapa**	ICMP and subsequent infrastructure planning drafted (or completed) for greenfield and most of the brownfield area.	Only rapid flood hazard data available for this area (for building footprint assessment). 215 buildings affected by some level of hazard (low hazard or greater). 50 buildings affected by high hazard.	Mixture of brownfield and greenfield areas. Opportunities to implement centralised devices (in brownfield) are generally good.	7 available monitoring sites within area. Sediment data is mostly poor. MCI data varies from fair to poor.	Area discharges to three streams. Te Rapa stream is generally high erosion susceptibility watercourse. Te Otamanui / Mangaheka stream is generally low erosion susceptibility watercourse. No watercourse data for Pukete Stream.	SW network capacity data available for Te Rapa Boulevard, but not other areas. No capacity issues for Te Rapa Boulevard. Significant capacity issues identified for sections of Te Otamanui/Mangaheka.	Known cultural sites – not located within watercourse or location not considered to be at risk.
17	**Ruakura**	No Council-led ICMP, however developer-led ICMPs in development for all greenfield parts of the study area.	Only rapid flood hazard data available for this area. 806 buildings affected by some level of hazard (low hazard or greater). 32 buildings affected by high hazard.	Mixture of brownfield and greenfield areas. Opportunities to implement centralised devices (in brownfield) are limited, however this represents a small portion of the area.	Limited monitoring available immediately downstream of study area.	Significant proportion of the study area drains into the Kirikiriroa which is highly susceptible to erosion. Significant change in impervious cover expected.	No SW network capacity data. Significant proportion of the area drains to existing Council network which is unlikely to have capacity due to catchment area or low-capacity farm drain network on western side of WEX.	Known cultural sites – not located within watercourse or location not considered to be at risk.
18	**Peacocke**	ICMP and subsequent infrastructure planning undertaken.	Greenfield development area.	Greenfield development area.	7 available monitoring sites within area. Sediment data is good. MCI data varies from good to poor. On average data is good – fair.	Low to Moderate erosion susceptibility watercourse. Significant change in impervious cover expected.	Greenfield development area.	Known cultural sites – several PA sites appears to be located adjacent gully/stream. May be at risk form increased SW flows.

19	**Temple View**	No ICMP. Detailed flood hazard modelling completed. Partial monitoring data available in Waitawhiriwhiri stream.	Only rapid flood hazard data available for this area. 135 buildings affected by some level of hazard (low hazard or greater). 6 buildings affected by high hazard.	Mixture of brownfield and greenfield areas. Opportunities to implement centralised devices (in brownfield) are generally good – land constraints are minimal.	Limited monitoring available immediately downstream of study area.	Limited data on downstream watercourse condition.	Mostly greenfield. Significant proportion of area drains to farm drain system outside of HCC jurisdiction which is expected to have limited capacity.	Known cultural sites – not located within watercourse or location not considered to be at risk.
20	**City Centre**	No ICMP prepared for this area. Detailed flood hazard modelling completed. No receiving environment studies undertaken, however no watercourses within the study area.	Detailed flood modelling undertaken as part of Waitawhiriwhiri catchment. 606 buildings affected by some level of hazard (low hazard or greater). 21 buildings affected by high hazard. The building intersection results are skewed by large building footprints in this area.	City Centre area is fully developed, no known treatment devices/interventions. Opportunities to implement centralised devices (in brownfield) are poor – however, development will likely be large-scale with treatment able to be integrated into development.	No watercourses remaining in City Centre area.	No watercourses remaining in City Centre area.	Network capacity mapping not available for City Centre. Detailed stormwater modelling undertaken for the City Centre show limited ponding or flooding in the 2 year and 10 year ARI events.	Known cultural sites – not located within watercourse or location not considered to be at risk.

PART 13 - CONCLUSIONS AND NEXT STEPS

13.1 Conclusions

13.1.1 This system performance assessment has been completed in a constrained timeframe using existing available information, modelling assessments, master plans and planned infrastructure investment programmes.

13.1.2 Hamilton City's existing 3 waters systems were designed and constructed to service densities and provide levels of service considered appropriate at the time they were developed. These densities and levels of service do not reflect current requirements or those anticipated through the NPS-UD and MDRS.

13.1.3 Today's environmental, social and cultural expectations and regulatory obligations require levels of service and performance that are significantly higher than delivered historically.

13.1.4 Te Ture Whaimana sets out obligations to deliver 'betterment' to the Waikato River, and not simply to avoid, remedy or mitigate environmental effects. 'Betterment' could relate to environmental health (e.g. water quality, ecological), social outcomes (e.g. the communities' relationship and interaction with the River and catchment), cultural outcomes (e.g. strengthening of whakapapa with the Awa (including the catchment and metaphysical being); the ability to exercise mana whakahaere including the conducting customary activities and having decision making authority around the management of the Awa).

13.1.5 The assessment demonstrates that HCC's existing 3 waters systems have challenges with respect to meeting relevant obligations under Te Ture Whaimana to varying degrees across the city already.

13.1.6 These challenges will be exacerbated by continued infill development currently enabled by Councils existing duplexing policies, and further compounded by the development densities contemplated by the NPS-UD and MDRS.

13.1.7 The existing information used in this assessment is underpinned by 2017 population projections (Refer Figure 6). These projections anticipated low (and in some cases declining) population growth in most brownfields areas, and for greenfield development areas adopted the RITS standards of (16 dwellings per ha (gross) and a 2.7 people per dwelling occupancy rate). The population assessments do not reflect the current plan enabled capacity, or the level of development expected to be enabled by the NPS-UD and MDRS. Consequently, the current planned infrastructure response will not include for the investment needed to service this level of growth and maintain the necessary levels of service.

13.1.8 The most recent three waters master plans have utilised the 2017 and 2019 population projections. Significant three waters system investments are recommended in the most recent Master Plans (2020) and many of the recommendations are funded in the 2021-2031 Long Term Plan. However, not all of the recommended upgrades are funded creating a shortfall in the investment needed to service the levels growth anticipated in the 2017 population projections.

13.1.9 A step change in investment from that previously identified will be needed to provide the necessary infrastructure capacity and performance needed to respond to the densities contemplated by the NPS-UD and MDRS and contribute toward restoring the health and wellbeing of the Waikato River in its fullest sense as required by Te Ture Whaimana.

13.1.10 The assessment criteria focus largely on network performance, impacts and investment needs each of the discrete areas. It is however important to acknowledge other strategically important system wide challenges facing the city. These challenges have not been specifically included in the performance assessments as they are largely independent of the geographic locations of development and intensification. They include:

(a) Water allocation constraints. i.e. recognising the finite water resources available from the Waikato River to service growth

(b) Environmental limits of the Waikato River to receive contaminants arising from urban land uses (wastewater and stormwater discharges) and the need to reduce the contaminant discharge loads and address the impacts of residual contaminant discharges.

(c) Climate change impacts on the city's water systems including reduced source security, and increased flood hazard risks, erosion and wastewater network overflows.

(d) Water supply intake, headworks and treatment system capacity.

(e) Wastewater treatment plant and discharge system capacity.

(f) Impacts of intensification on local network capacity performance and the upgrades needed to ensure compliance with technical specifications and design standards (e.g. pipe sizes and methods of network connections). Generally speaking, the proposed NPS-UD density will treble the previously utilised demands in Master Planning for Strategic Infrastructure. These density increases applied to an existing built-up environment trigger a number of design requirements which require upsizing at the local infrastructure level and a step change in trunk and strategic conveyance network investment.

(g) Satisfying the city's obligations under Te Ture Whaimana with respect to network performance.

13.1.11 These strategic servicing challenges have not been specifically included in the traffic light assessment but are significant and exacerbate the scale and costs of future investments needed to service the growing city and restore and protect the

Awa.

13.1.12 The work highlights that without significant investment, the city's infrastructure cannot accommodate higher levels of urban intensification as required through the Act. To deliver the intensification contemplated without significant investment would result in worsening the effects on the Waikato River and its tributaries which will create conflict with Te Ture Whaimana.

13.1.13 The detailed costs to upgrade the networks, treatment plants and headworks to provide for NPS-UD and MDRS across the city have not been quantified at this stage. It is clear however that the cost and practical challenges with doing so across the city, all at once will be prohibitive. There is a significant infrastructure investment deficit already from that recommended to respond to the 2017 population projections and what has been funded in the 2021-2031 LTP.

13.1.14 Retrofitting strategic upgrades within the brownfield's environment (such as water reservoirs, bulk wastewater storage facilities, stormwater treatment devices will require suitable sites which may be difficult and costly to secure.

13.1.15 Major upgrades to networks in brownfields areas will also be disruptive and will need to be carefully co-ordinated across all waters and other utilities to deliver an efficient upgrade programme.

13.1.16 It is important to note that the traffic light colours in this report is not directly transferable into District Plan planning provisions. "Green " does not highlight 'go' areas of the city.

13.1.17 Although this report does not identify specific areas of the city to intensify, it highlights that the costs to provide infrastructure necessary to respond to MDRS everywhere all at once is prohibitive and confirms the need to prioritise where MDRS and higher-density residential development is enabled.

13.1.18 Just adopting MDRS as per the Enabling Act without a clear and committed infrastructure investment and delivery programme will increase network failures and adversely affect the Awa and communities. Accordingly, a targeted approach to increased densities is required to ensure that the necessary investment needed to service the increased densities is in place at the right time.

13.1.19 Prioritising specific areas of the city for high density development would provide the ability to prioritise infrastructure investment in strategic locations, contribute toward Te Ture Whaimana, and provide for growth.

13.2 Next Steps

13.2.1 Further work is needed to consider updated growth projections for the city; identify potential three waters infrastructure investment and delivery programmes; and achieve appropriate levels of service. This work includes:

(a) Updating the city's waters models with updated growth projections to better understand the impacts planned and enabled growth will have on the urban water systems and to inform investment programmes.

(b) Review sizing of upgrades funded in current LTP to ensure investments are appropriately sized or future proofed to meet future demand.

(c) Engage with iwi and mana whenua to embed and incorporate maatauranga maaori further into urban water system planning, delivery and management in and beyond the City boundaries.

(d) Complete a more detailed effects-based assessment on wastewater overflows, looking more closely at potential impacts on receiving environment including sites of cultural significance to mana whenua (historic, customary and contemporary) and cultural and social activities (i.e. hauanga kai/mahinga kai, wai tapu and wahi tapu, swimming locations). Use this assessment to help prioritise investments.

(e) Review and qualify the implications of additional growth and demand on resource availability, WTP and WWTP upgrade programmes, funding and regional consents.

(f) Complete master planning for strategic three waters infrastructure required to support both brownfield and greenfield forecast growths inside the city and in some cases at a sub-regional scale.

(g) Carry out detailed network planning at the local/street level to understand future investments needed to respond to growth and intensification over time. The assessment will need co-ordination with all 3 waters infrastructure and other utilities.

(h) Review critical renewals programmes and seek funding to enable growth related upsizing to accommodate more intensification.

(i) Undertake detailed brownfield stormwater network planning to understand future investments needed to respond to growth and intensification over time. This should include both conveyance and quality network infrastructure and consider best practice approaches to integrating the two, e.g., through establishing blue-green corridor networks.

(j) Prioritise investigations into feasibility of on-lot stormwater

(k) Prioritise completing detailed technical assessments required to support ICMPs for all catchments, i.e. watercourse walk-overs, ecological assessments and flood modelling studies.

(l) Develop city-wide stormwater network capacity mapping

(m) Review available funding programmes for brownfield stormwater quality and quality infrastructure in the current LTP against expected growth and seek additional funding stream for the shortfall.

(n) Develop three waters connection approval decision making criteria and triaging tool to manage future connection requests within available network capacity.

(o) Further consideration of the impacts of climate change on the city's urban water systems.

(p) Evaluating the impacts of predicted network performance on public health, safety and prosperity.

(q) Revise this traffic light assessment based on updated supporting technical evidence.

PART 14 - BIBLIOGRAPHY

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APPENDICES

APPENDIX A – CATCHMENT MAPS

A1 – Traffic Light Assessment Areas

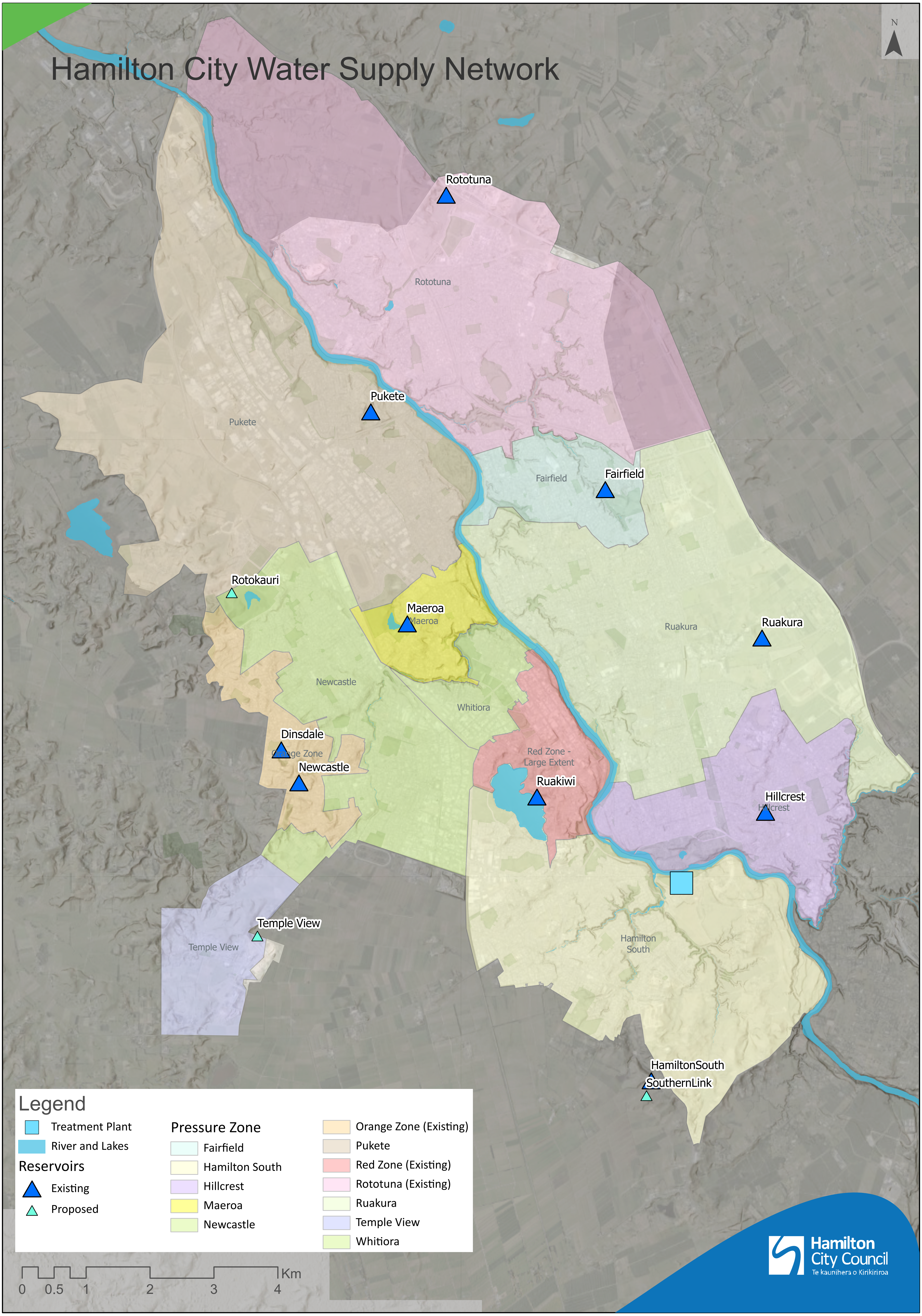
A2 – Water Supply Network

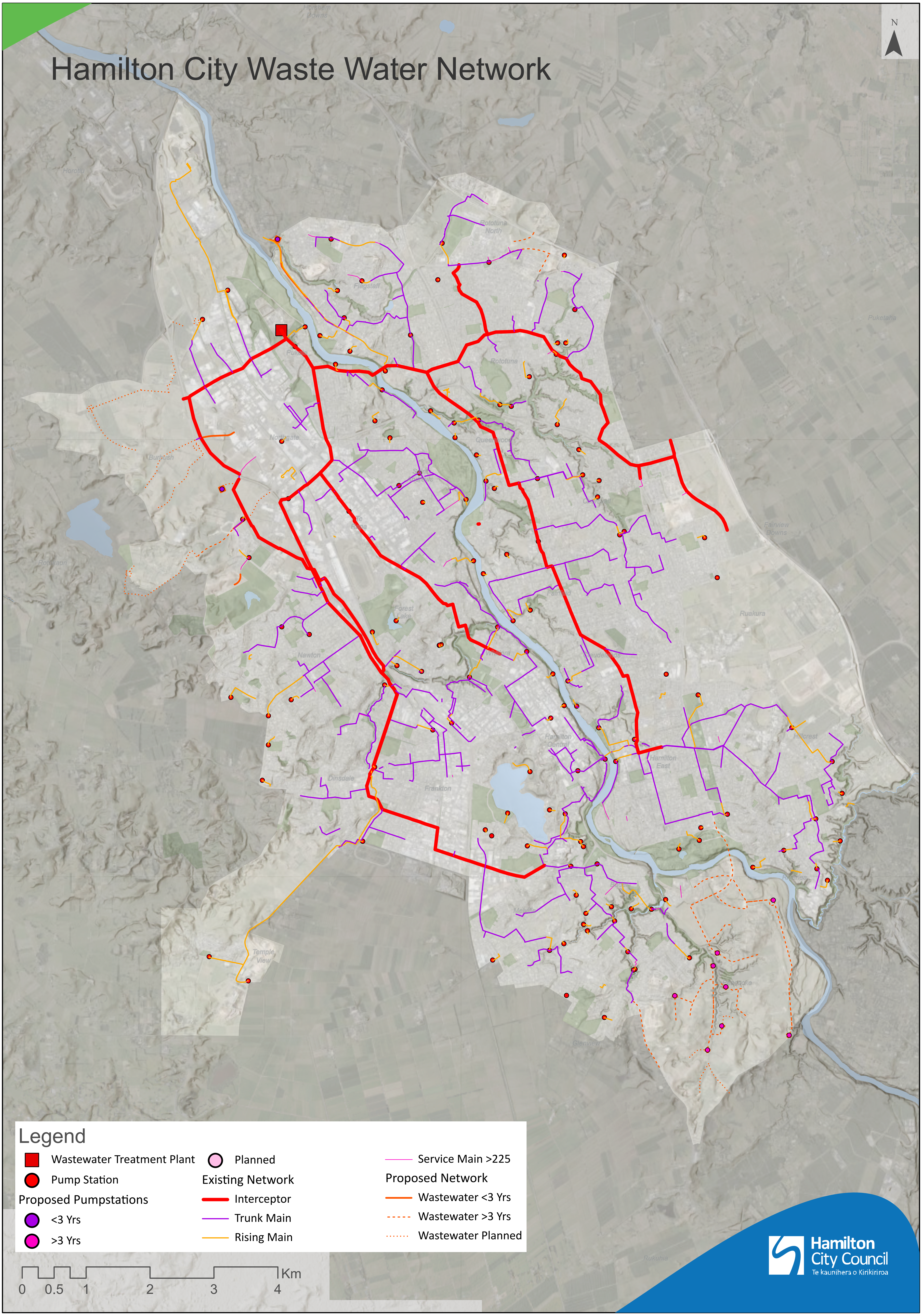
A3 – Wastewater System

A4 – Stormwater Catchments

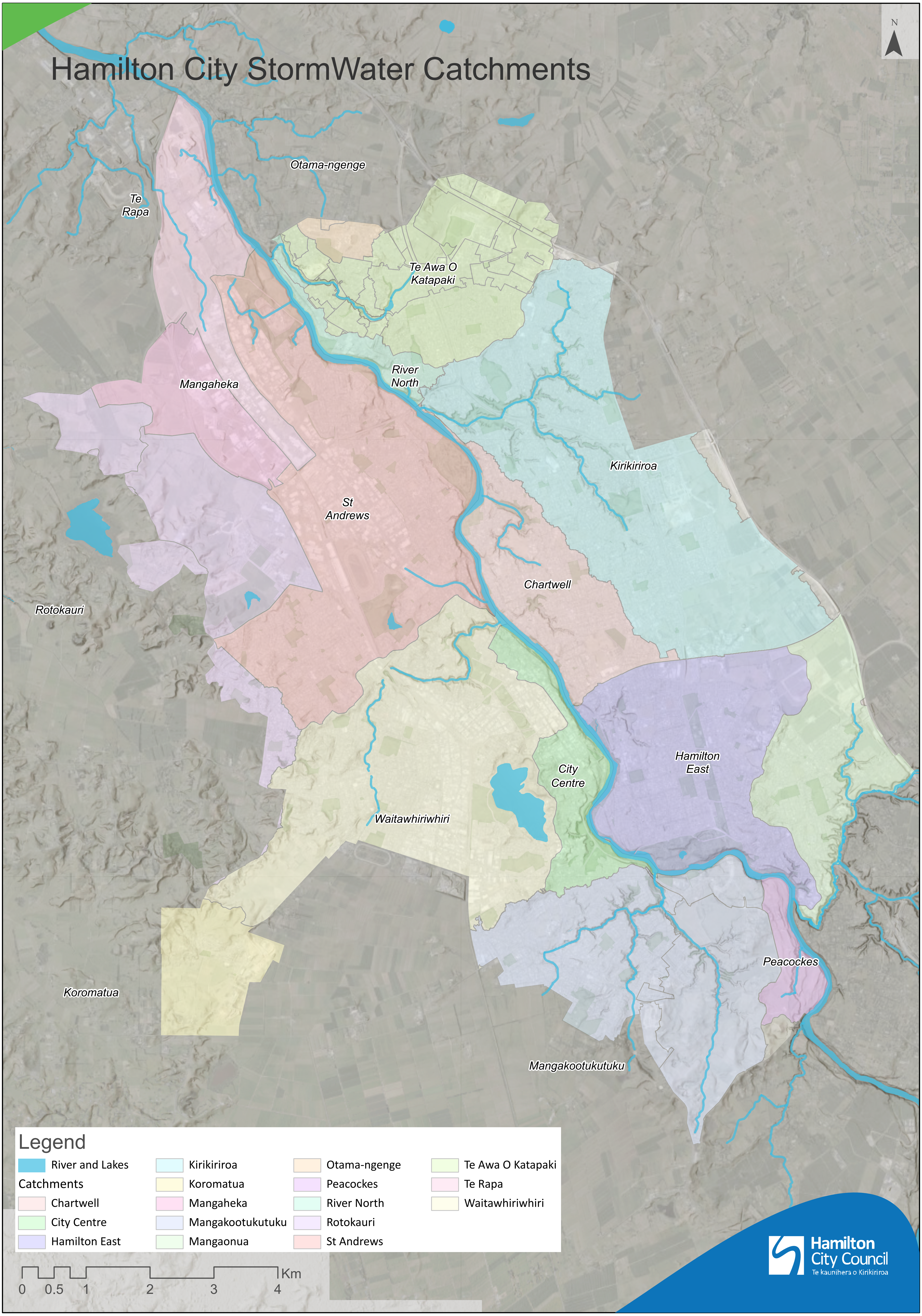
A5 – Sites of Cultural Significance and Recreation

Hamilton City Traffic Light Assessment Areas

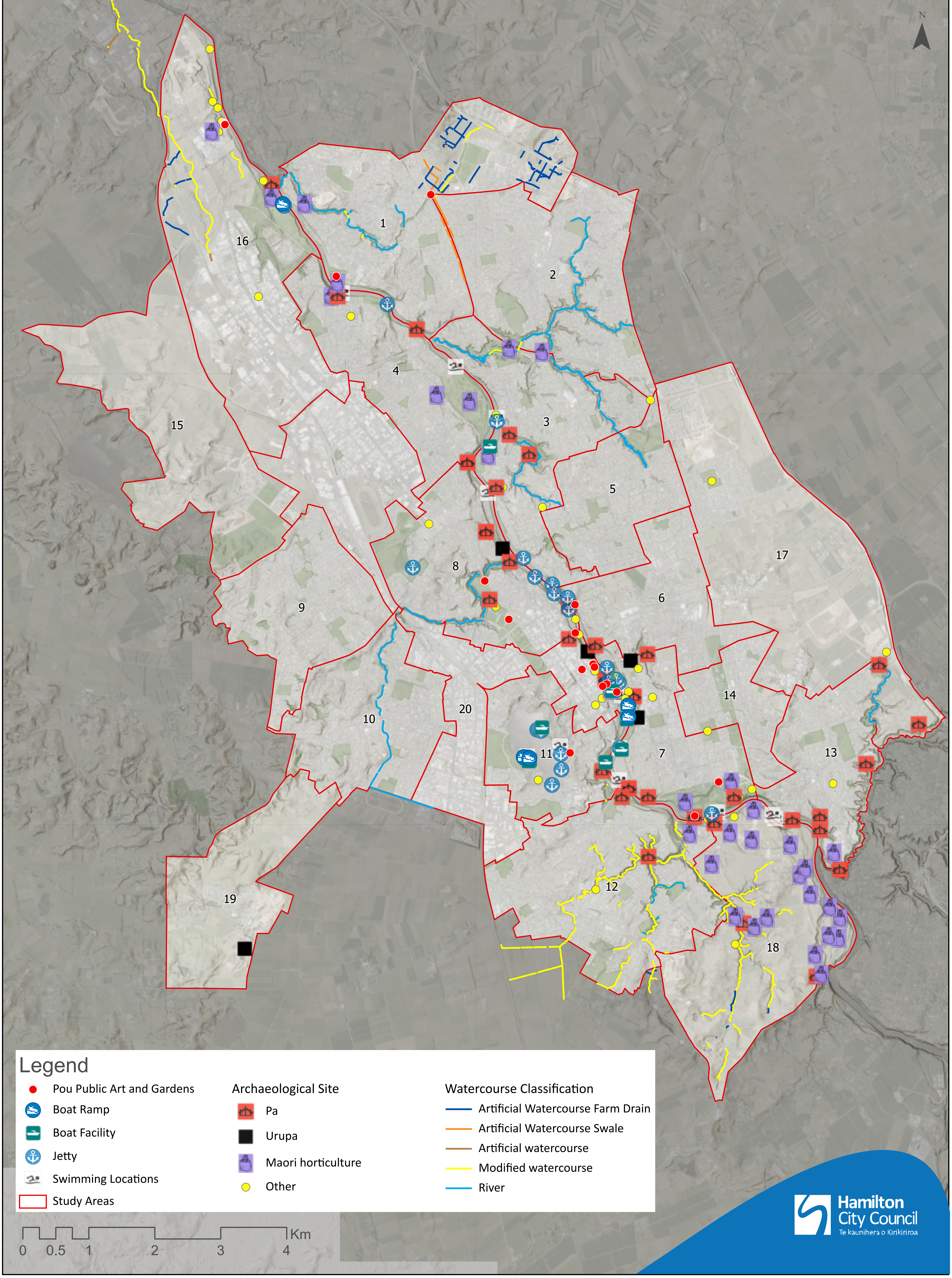

Hamilton City Water Supply Network
N
Rototuna
Rototuna
Pukete
Pukete
Fairfield
Fairfield
Rotokauri
Maeroa
Maeroa
Ruakura
Ruakura
Newcastle
Whitiora
Dinsdale
Orange Zone
Newcastle
Red Zone -
Large Extent
Ruakiwi
Hillcrest
Hillcrest
Temple View
Temple View
Hamilton
South
HamiltonSouth
SouthernLink
Legend
Treatment Plant
River and Lakes
Reservoirs
Existing
Proposed
Pressure Zone
Fairfield
Hamilton South
Hillcrest
Maeroa
Newcastle
Orange Zone (Existing)
Pukete
Red Zone (Existing)
Rototuna (Existing)
Ruakura
Temple View
Whitiora
0 0.5 1 2 3 4 Km
Hamilton City Council
Te kaunihera o Kirikiriroa


Hamilton City Waste Water Network
N
Legend
Wastewater Treatment Plant
Pump Station
Proposed Pumpstations
<3 Yrs
>3 Yrs
Planned
Existing Network
Interceptor
Trunk Main
Rising Main
Service Main >225
Proposed Network
Wastewater <3 Yrs
Wastewater >3 Yrs
Wastewater Planned
0 0.5 1 2 3 4 Km
Hamilton City Council
Te kaunihera o Kirikiriroa

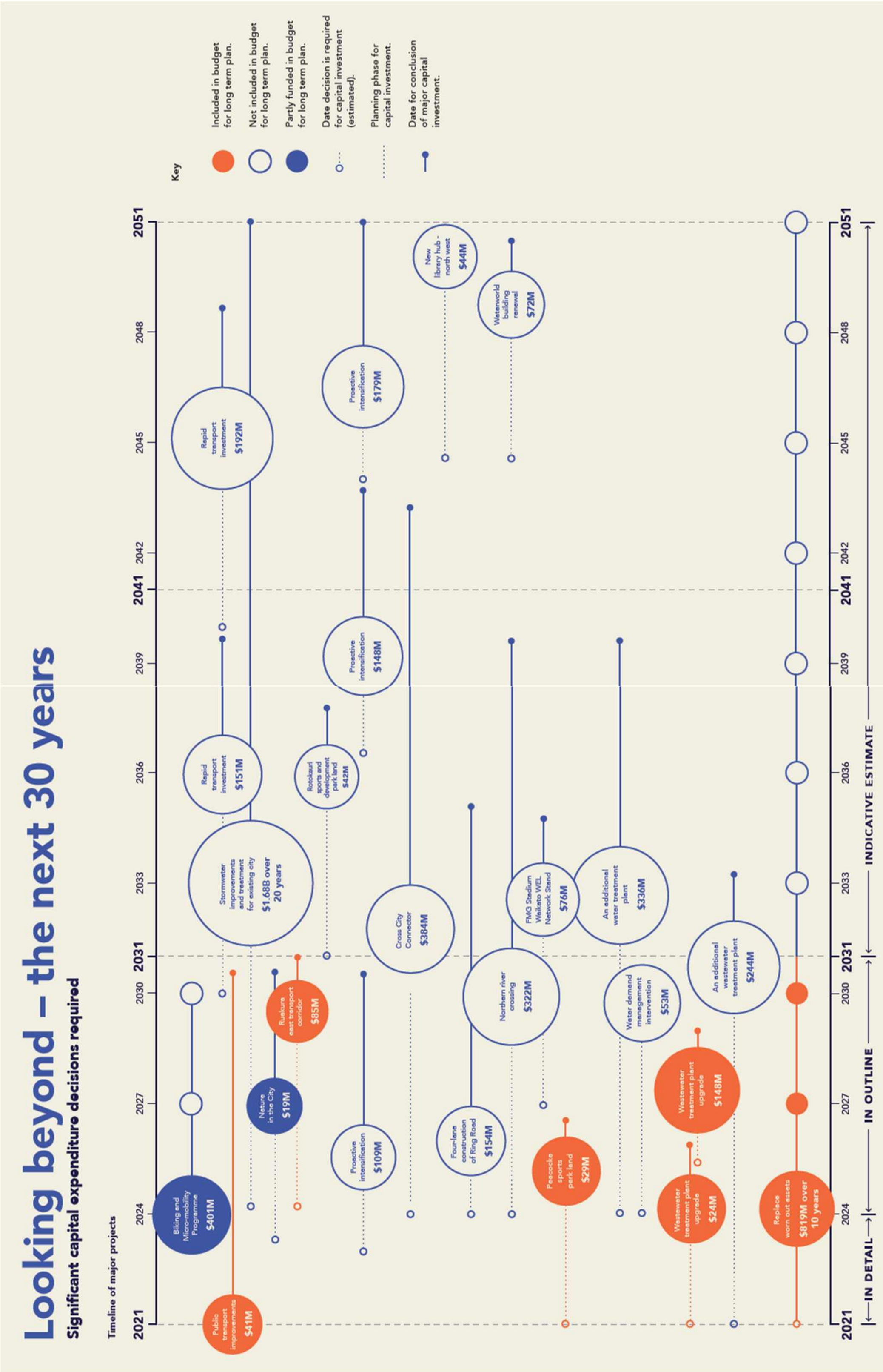
Hamilton City StormWater Catchments



KNOWN CULTURAL SITES OF SIGNIFICANCE AND RIVER RECREATIONAL SITES



APPENDIX B – SUMMARY OF 2021 – 2051 INFRASTRUCTURE STRATEGY CAPITAL INVESTMENT



APPENDIX C – WATER ASSESSMENT SUMMARY REPORTS

Area 1 – Flagstaff: Water Supply Assessment

1.1 Description

Study area size is 787.41ha and is mostly dominated by rolling hills, and a ridge line along parts of Horsham Downs Road that goes from 16m (near the Waikato River), up to 60m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.

The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.37	2
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	1.94	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.58	2

1.3 Key Area Features

Flagstaff is located within an existing water demand management area (DMA) called Rototuna that became operational in 2018. This zone has its own reservoir and pump station that supplies flow and pressure to meet the DMA demands.

The reservoir is filled via the Eastern Bulk Ring Main traversing along the Wairere Dr and Resolution Dr roading corridors.

1.4 Summary of key considerations against each criteria

	Criteria	**Level of significance /Impact**
1	*Predicted local and trunk (250mm only) network capacity at 2031*	1 pressure point between 10-20m
		98% of all pipes have head loss of 5m/km or less
		1 Hydrants Fail FW2 classification (General Residential Zone)
2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 88% of all pipes have head loss of 3m/km or less
		600mm Diam and above - 100% of all pipes have head loss of 2m/km or less

3	*Scale (cost) of funded upgrades that will improve network performance- 2021-2031 LTP & 2020 Master Plans*	Funding mostly for upsizing local pipes to 250mm trunkmains within development or roading projects
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans) (based on Master Plans)*	1 pressure point between 10-20m Some capacity upgrades have been planned till 2061 based on 2019 population growth projections.
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 11 Fail FW3 (also insufficient hydrants to meet spacing requirements) Widespread network LOS issues across the area of interest in local and trunkmains including bulk supply mains. Elevated areas effected the most for pressure and fire cover. Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity for the Rototuna Zone for the unplanned growth. Demand exceeds bulk ring main capacity including reservoir filling mains.
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	Significant local and strategic infrastructure upgrades and renewals are required. Complete replacement of local ridermains & additional trunkmains are likely in some areas. Additional reservoir storage required with bigger pumps. Additional cost for upgrade would be (renewals not considered) greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

Figure 1. – 2031 Pressure Nodes

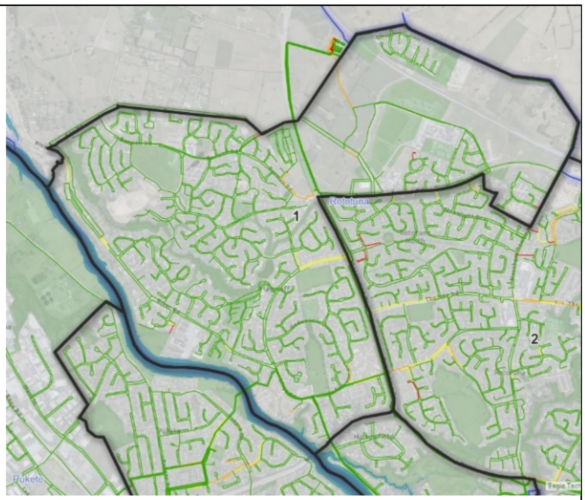


Figure 2. – 2031 Headloss 40mm and above diameter pipes

Figure 3. – 2031 Fire Fighting Cover

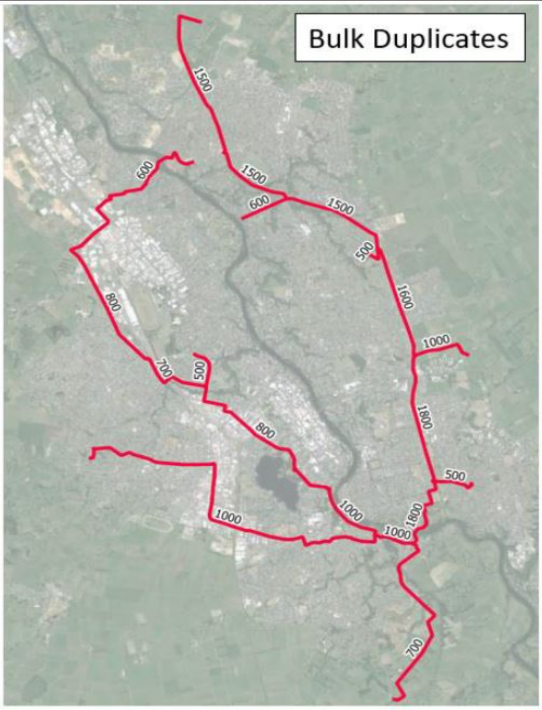


Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The Rototuna reservoir will be too small and sits on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Eastern side of the city will trigger the need for significant bulk ring main upsizing.

Area 2 – Huntington: Water Supply Assessment

1.1 Description

Study area size is 674.37ha has rolling land that goes from 30m, up to 60m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.

The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.43	2
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.06	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.	2

1.3 Key Area Features

Huntington is located within an existing water demand management area (DMA) called Rototuna that became operational in 2018. This zone has its own reservoir and pump station that supplies flow and pressure to meet the DMA demands.

The reservoir is filled via the Eastern Bulk Ring Main traversing along the Wairere Dr and Resolution Dr roading corridors.

1.4 Summary of key considerations against each criteria

	Criteria	Level of significance /Impact
1	*Predicted local and trunk (250mm only) network capacity at 2031*	3 pressure points between 10-20m
		97% of all pipes have head loss of 5m/km or less
		3 Hydrants Fail FW2 classification (General Residential Zone)
2		251mm - 599mm Dia Pipe - 100% of all pipes have head loss of 3m/km or less

	Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031	600mm Dia and above - 100% of all pipes have head loss of 2m/km or less
3	*Scale (cost) of funded upgrades that will improve network performance- 2021-2031 LTP & 2020 Master Plans*	Funding mostly for upsizing local pipes to 250mm trunkmains within development or roading projects
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans) (based on Master Plans)*	1 pressure point between 10-20m Some capacity upgrades have been planned till 2061 based on 2019 population growth projections.
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 51 Fail FW3 (also insufficient hydrants to meet spacing requirements) Widespread network LOS issues across the area of interest in local and trunkmains including bulk supply mains. Elevated areas effected the most for pressure and fire cover. Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity for the Rototuna Zone for the unplanned growth. Demand exceeds bulk ring main capacity including reservoir filling mains.
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	Significant local and strategic infrastructure upgrades and renewals are required. Complete replacement of local ridermains & additional trunkmains are likely in some areas. Additional reservoir storage required with bigger pumps. Additional cost for upgrade would be (renewals not considered) greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

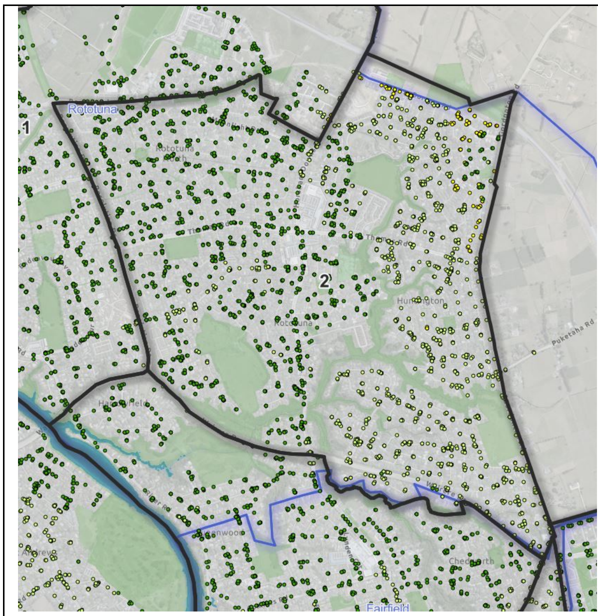
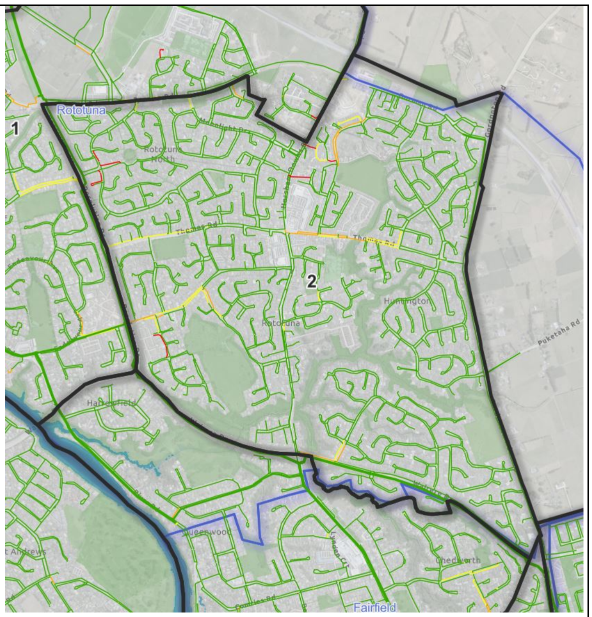
	

Figure 1. – 2031 Pressure Nodes	Figure 2. – 2031 Headloss 40mm and above diameter pipes

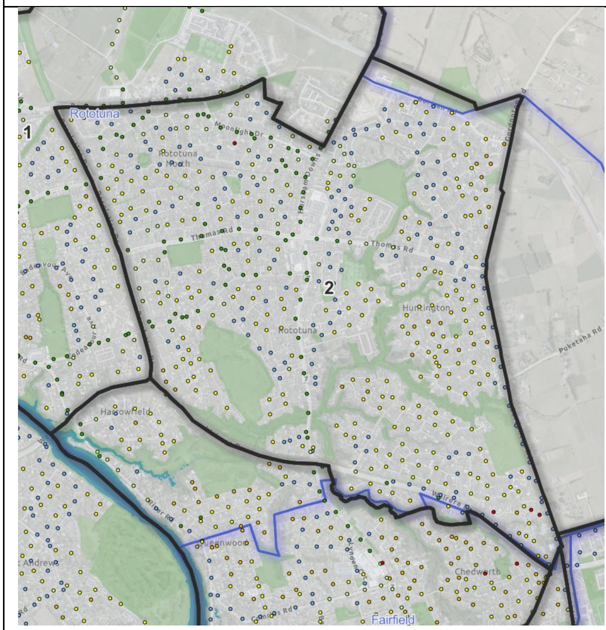
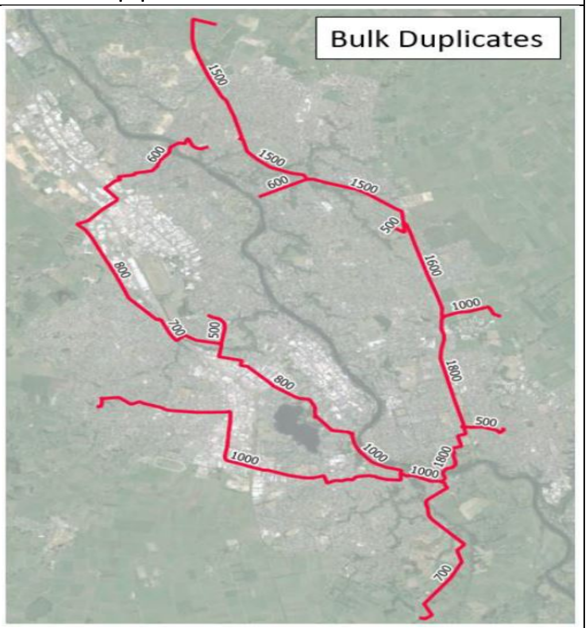

	

Figure 3. – 2031 Fire Fighting Cover	Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The Rototuna reservoir will be too small and sits on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Eastern side of the city will trigger the need for significant bulk ring main upsizing.

Area 3 – Chartwell: Water Supply Assessment

1.1 Description

Study area size is 534.14ha and is mostly flat with just a ridgeline of higher land near Porritt Stadium. Elevations range from 20m, up to 48m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.

The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.56	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.30	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.06	2

1.3 Key Area Features

Located within 3 existing water demand management areas (DMA) called Fairfield, Rototuna and Ruakura. Each zone has its own reservoir and pump station that supplies flow and pressure to meet the DMA demands.

All reservoirs are filled via the Eastern Bulk Ring Main traversing along the Wairere Dr roading corridor. Numerous locations/roads within the Fairfield and Ruakura zones have existing local infrastructure built many decades ago and therefore isn't up to date with the current Regional Infrastructure Technical Specifications (RITS) standards.

1.4 Summary of key considerations against each criteria

	Criteria	**Level of significance /Impact**
1	*Predicted local and trunk (250mm only) network capacity in 2031*	No Design Pressure Issues, 20m or less
		97% of all pipes have head loss of 5m/km or less
		5 Hydrants Fail FW2 classification (General Residential Zone)

2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 100% of all pipes have head loss of 3m/km or less
		600mm Dia and above - 87% of all pipes have head loss of 2m/km or less
3	*Scale (cost) of funded upgrades that will improve network performance- 2021-2031 LTP & 2020 Master Plans*	Only partial funding provided for 2nd reservoir. Also, timing was pushed back, not matching intended operational date. Proposed Fairfield reservoir pump station upgrade was not funded in LTP
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans) (based on Master Plans)*	No Design Pressure Issues, 20m or less
		No major capacity upgrades were planned till 2061 based on 2019 population growth projections. However, timing of the 2nd Ruakura reservoir is currently later than desired.
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 259 Failing FW3 performance (also insufficient hydrants to meet spacing requirements)
		Widespread network LOS issues across the area of interest and/ impacts across other areas. Widespread locations below design LOS in local and trunkmains including bulk supply mains. Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage & pumping capacity for Fairfield and Ruakura Zones in particular for the unplanned growth. Demand exceeds bulk ring main capacity including reservoir filling mains.
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	Significant local and strategic infrastructure upgrades and renewals are required. Complete replacement of local infrastructure is likely in some areas. Additional reservoir storage required with bigger pumps. Additional cost for upgrade would be (renewals not considered) greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

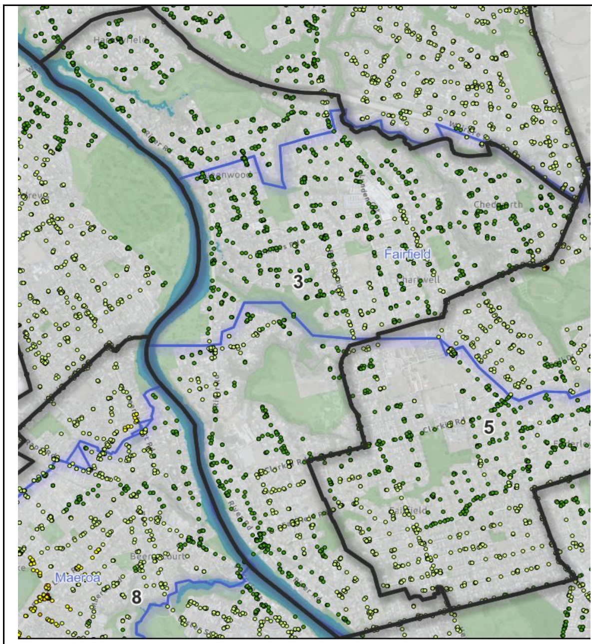


Figure 1. – 2031 Pressure Nodes

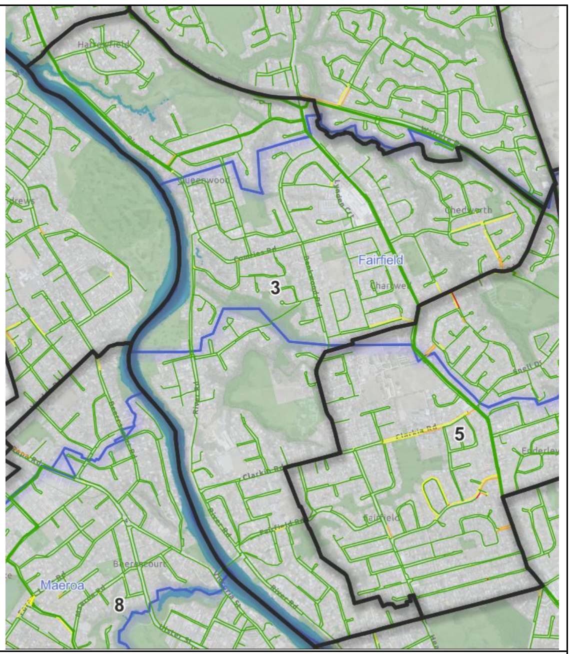


Figure 2. – 2031 Headloss 40mm and above diameter pipes

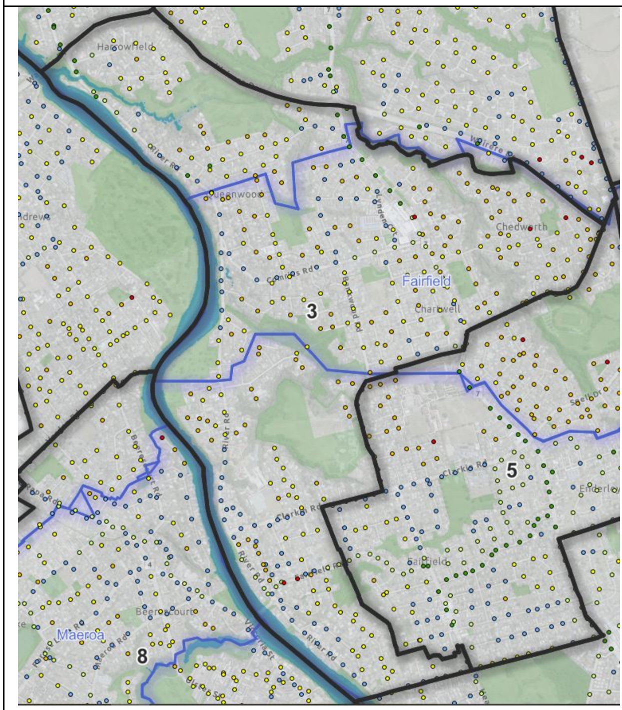


Figure 3. – 2031 Fire Fighting Cover

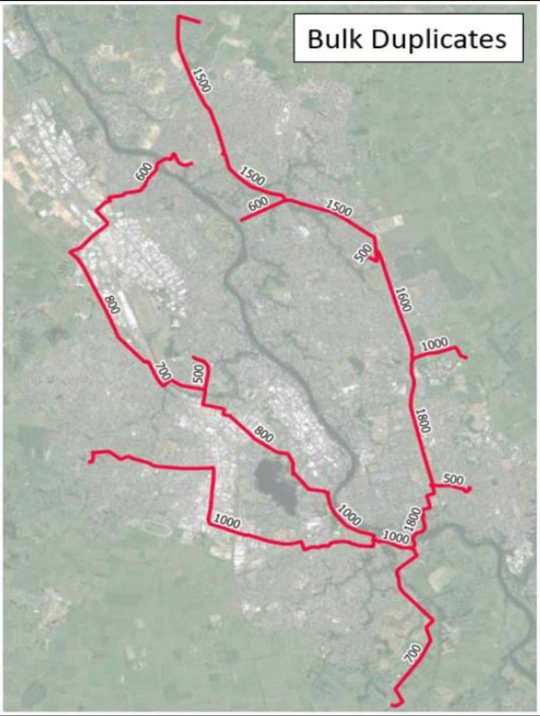


Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- All 3 existing reservoirs and pumping stations will be too small and sit on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Note. Ruakura has another planned reservoir but is not sized (or budgeted) for the population increases and a 3rd reservoir would not fit on the current designated reservoir(s) site.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Eastern side of the city will trigger the need for significant bulk ring main upsizing.

Area 4 – Pukete East: Water Supply Assessment

1.1 Description

Study area size is 453.1ha and is mostly flat land that goes from 18m, up to 37m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.

The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.23	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	3.15	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	3.06	3

1.3 Key Area Features

Pukete East is located within a future water demand management area (DMA) called the Pukete Zone utilising the existing Pukete reservoir and an upgraded pump station. However, the pump station was not funded in the 2021 LTP so there is a delay on zone creation.

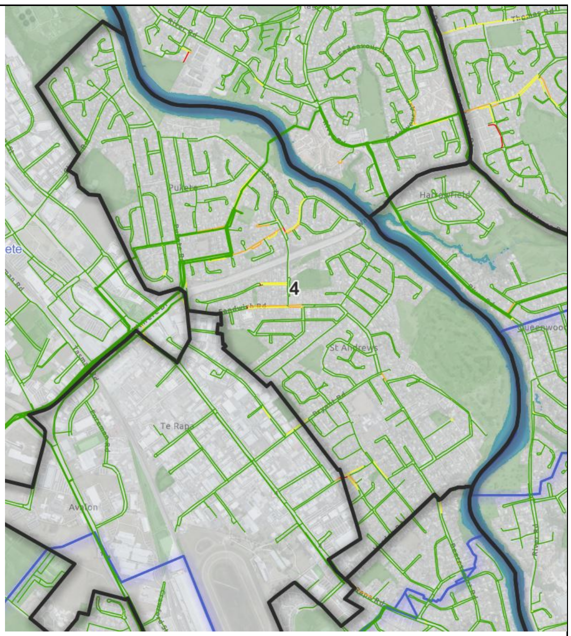
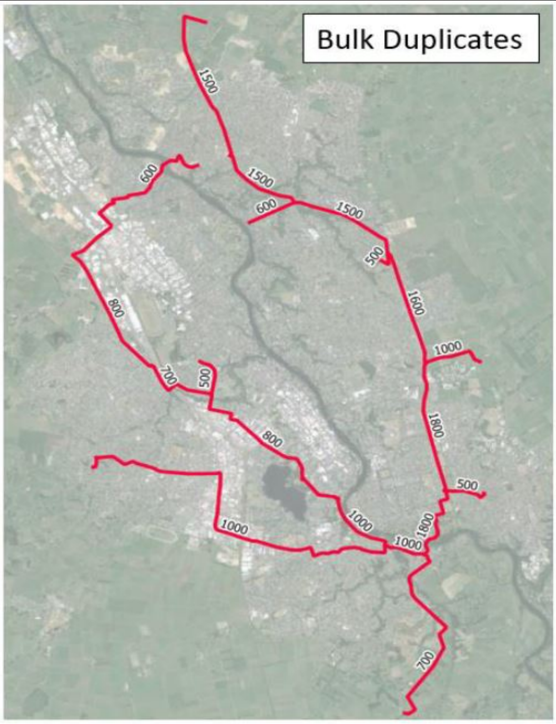
All of the existing and proposed reservoirs get filled via the Western Bulk Ring Main traversing along the Avalon Dr/SH1 roading corridor.

1.4 Summary of key considerations against each criteria

	Criteria	**Level of significance /Impact**
1	*Predicted local and trunk (250mm only) network capacity at 2031*	5 pressure points less than 10m
		95% of all pipes have head loss of 5m/km or less
		3 Hydrants Fail FW2 classification (General Residential Zone)
2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 89% of all pipes have head loss of 3m/km or less
		600mm Dia and above - 94% of all pipes have head loss of 2m/km or less

3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Proposed Pukete pump station upgrade to create reservoir Zone, along with other strategic pipelines were unfunded.
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans)* *(based on Master Plans)*	5 pressure points less than 10m
		Some capacity upgrades have been planned till 2061 based on 2019 population growth projections. (Roading Projects)
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 101 Fail FW3 (also insufficient hydrants to meet spacing requirements)
		Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

	
Figure 1. – 2031 Pressure Nodes	Figure 2. – 2031 Headloss 40mm and above diameter pipes
	
Figure 3. – 2031 Fire Fighting Cover	Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The Pukete reservoir will be too small and its sits on designated land that cannot accommodate additional reservoirs. Additionally, the current site is also not placed on suitably elevated land to attempt neighbouring land purchase. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Western side of the city will trigger the need for significant bulk ring main upsizing.

Area 5 – Enderley North: Water Supply Assessment

1.1 Description

Study area size is 332.82ha and is mostly flat land that goes from 30m to 38m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.

The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.23	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	3.15	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	3.06	3

1.3 Key Area Features

Located within 2 existing water demand management areas (DMA) called Fairfield and Ruakura. Each zone has its own reservoir and pump station that supplies flow and pressure to meet the DMA demands.

All reservoirs are filled via the Eastern Bulk Ring Main traversing along the Wairere Dr roading corridor.

Numerous locations/roads within the Fairfield and Ruakura zones have existing local infrastructure built many decades ago and therefore isn't up to date with the current Regional Infrastructure Technical Specifications (RITS) standards.

1.4 Summary of key considerations against each criteria

	Criteria	**Level of significance /Impact**
1	*Predicted local and trunk (250mm only) network capacity at 2031*	3 pressure points less than 10m & 1 between 10-20m
		94% of all pipes have head loss of 5m/km or less
		2 Hydrants Fail FW2 classification (General Residential Zone)

2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 42% of all pipes have head loss of 3m/km or less 84% 600mm Dia and above - 84% of all pipes have head loss of 2m/km or less
3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Only partial funding provided for 2nd reservoir. Also, timing was pushed back, not matching intended operational date $13.5M
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans) (based on Master Plans)*	3 pressure points less than 10m & 1 between 10-20m Major capacity upgrades have been planned till 2061 based on 2019 population growth projections. 13.5M
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 140 Fail FW3 (also insufficient hydrants to meet spacing requirements) Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than 100M.

7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

Figure 1. – 2031 Pressure Nodes

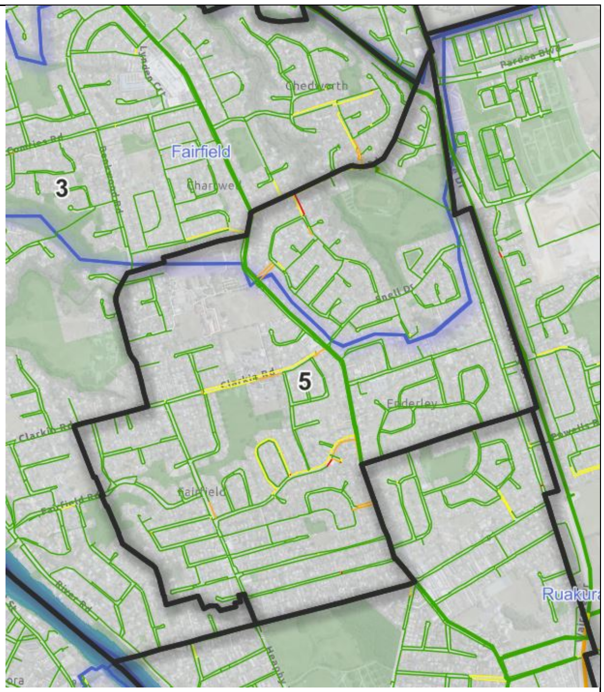
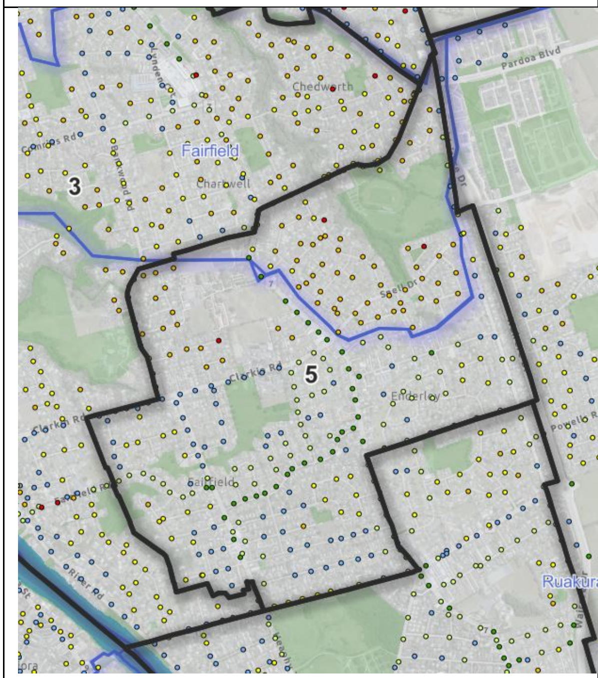


Figure 2. – 2031 Headloss 40mm and above diameter pipes



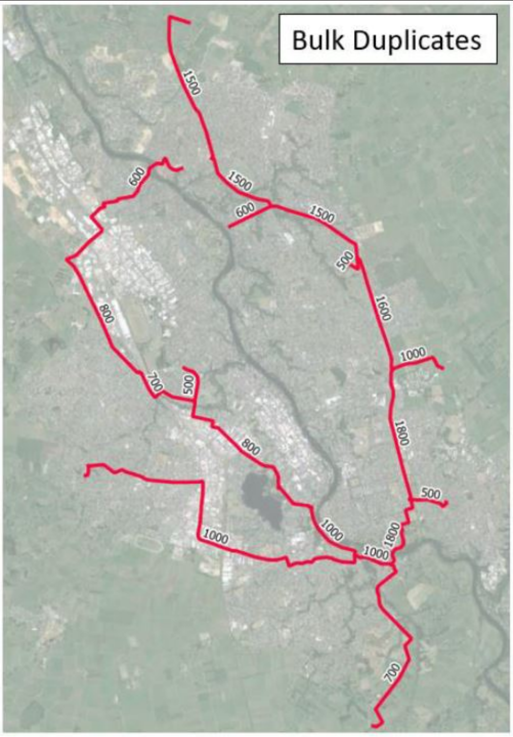


Figure 3. – 2031 Fire Fighting Cover	Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare, or maybe even higher in some isolated pockets.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- Both existing reservoirs and pumping stations will be too small and sit on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Note. Ruakura has another planned reservoir but is not sized (or budgeted) for the population increases and a 3rd reservoir would not fit on the current designated reservoir(s) site.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Eastern side of the city will trigger the need for significant bulk ring main upsizing.

Area 6 – Claudelands: Water Supply Assessment

1.1 Description

Study area size is 358.52ha and is mostly flat land that goes from 30m to 40m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.

The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.43	2
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.06	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.74	2

1.3 Key Area Features

Located within the recently created water demand management area (DMA) Ruakura. This zone has its own reservoir and pump station that supplies flow and pressure to meet the DMA demands.

The Ruakura reservoir is filled via the Eastern Bulk Ring Main traversing along the Wairere Dr roading corridor.

Numerous locations/roads within the brownfield area of the Ruakura zone have existing local infrastructure built many decades ago and therefore isn't up to date with the current Regional Infrastructure Technical Specifications (RITS) standards.

1.4 Summary of key considerations against each criteria

	Criteria	**Level of significance /Impact**
1	*Predicted local and trunk (250mm only) network capacity at 2031*	No Design Pressure Issues, 20m or less
		98% of all pipes have head loss of 5m/km or less
		1 Hydrants Fail FW2 classification (General Residential Zone)
2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 100% of all pipes have head loss of 3m/km or less
		600mm Dia and above - 100% of all pipes have head loss of 2m/km or less

3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Only partial funding provided for 2nd reservoir. Also, timing was pushed back, not matching intended operational date $13.5M
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans) (based on Master Plans)*	No Design Pressure Issues, 20m or less Major capacity upgrades have been planned till 2061 based on 2019 population growth projections. 13.5M
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 33 Fail FW3 (also insufficient hydrants to meet spacing requirements) Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

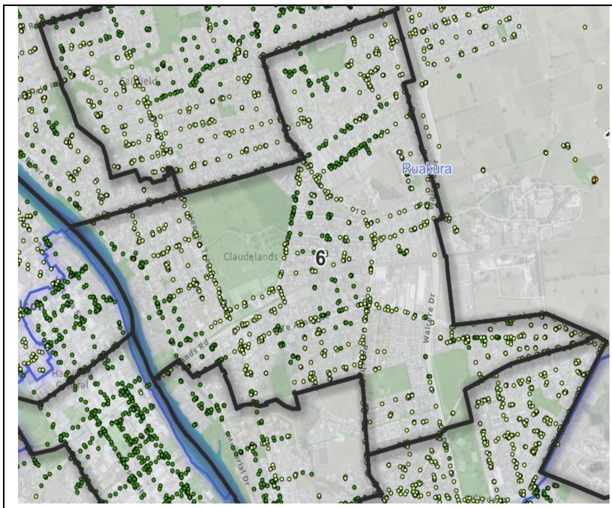
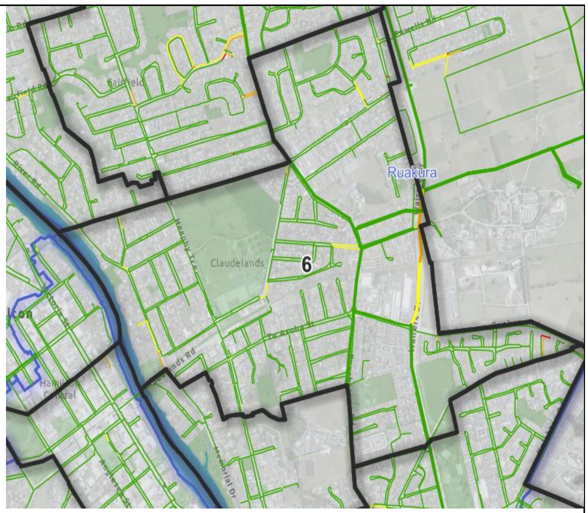
	

Figure 1. – 2031 Pressure Nodes	Figure 2. – 2031 Headloss 40mm and above diameter pipes

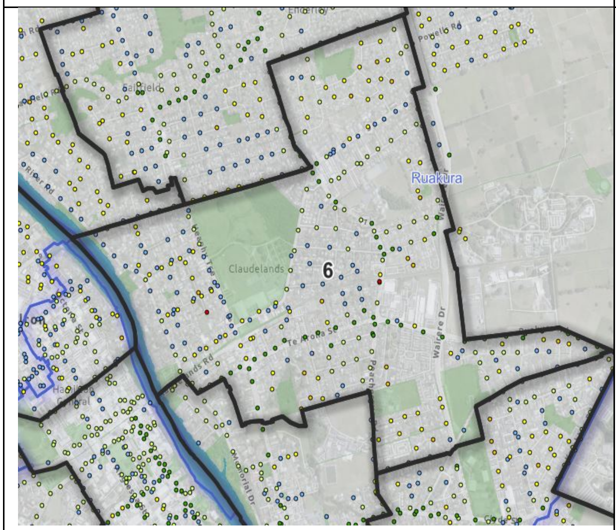



Figure 3. – 2031 Fire Fighting Cover	Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The existing reservoir and pumping station will be too small and sit on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Note. Ruakura has another planned reservoir but is not sized (or budgeted) for the population increases and a 3rd reservoir would not fit on the current designated reservoir(s) site.
- Whilst we are just mentioning impacts around this study area, it should be pointed out that the cumulative effects of additional growth on the Eastern side of the city will trigger the need for significant bulk ring main upsizing

Area 7 – Hamilton East: Water Supply Assessment

1.1 Description

Study area size is 354.24ha and is mostly flat land apart from around the Hamilton gardens that goes from 20m, up to 54m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.

The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.43	2
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.06	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.74	2

1.3 Key Area Features

Located within the recently created water demand management area (DMA) called Ruakura zone and the proposed Hillcrest zone.

The Ruakura zone has its own reservoir and pump station that supplies flow and pressure to meet the DMA demands, whereas the Water Treatment Plant is currently providing levels of service to a temporary Hillcrest zone. In the future a reservoir and pump station will be installed for the Hillcrest zone.

The existing and future reservoirs will be filled via the Eastern Bulk Ring Main traversing along the Wairere Dr and Resolution Dr roading corridors.

Numerous locations/roads within the brownfield areas have existing local infrastructure built many decades ago and therefore isn't up to date with the current Regional Infrastructure Technical Specifications (RITS) standards.

1.4 Summary of key considerations against each criteria

	Criteria	**Level of significance /Impact**
1	*Predicted local and trunk (250mm only) network capacity at 2031*	No Design Pressure Issues, 20m or less
		97% of all pipes have head loss of 5m/km or less

		No general residential zoned hydrant less than FW2 Classification
2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 81% of all pipes have head loss of 3m/km or less 600mm Dia and above - 100% of all pipes have head loss of 2m/km or less
3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Only partial funding provided for 2nd reservoir. Also, timing was pushed back, not matching intended operational date $13.5M
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans)* *(based on Master Plans)*	No Design Pressure Issues, 20m or less Major capacity upgrades have been planned till 2061 based on 2019 population growth projections. 13.5M
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 22 Fail FW3 (also insufficient hydrants to meet spacing requirements) Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

Figure 1. – 2031 Pressure Nodes

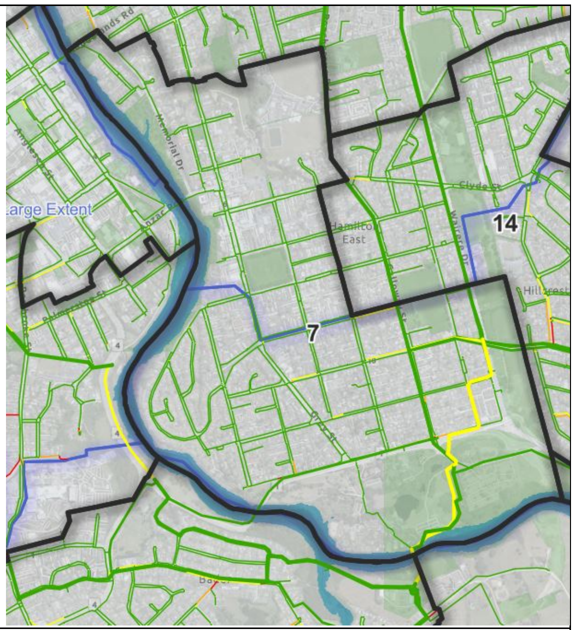


Figure 2. – 2031 Headloss 40mm and above diameter pipes

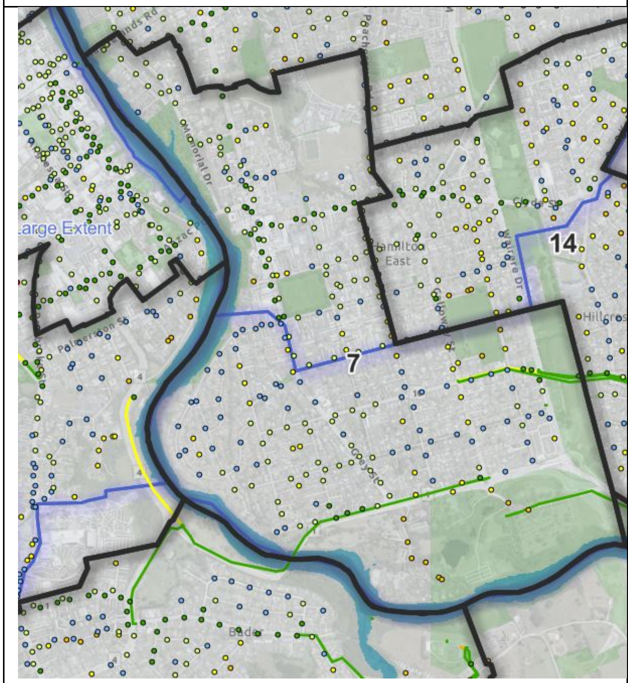


Figure 3. – 2031 Fire Fighting Cover

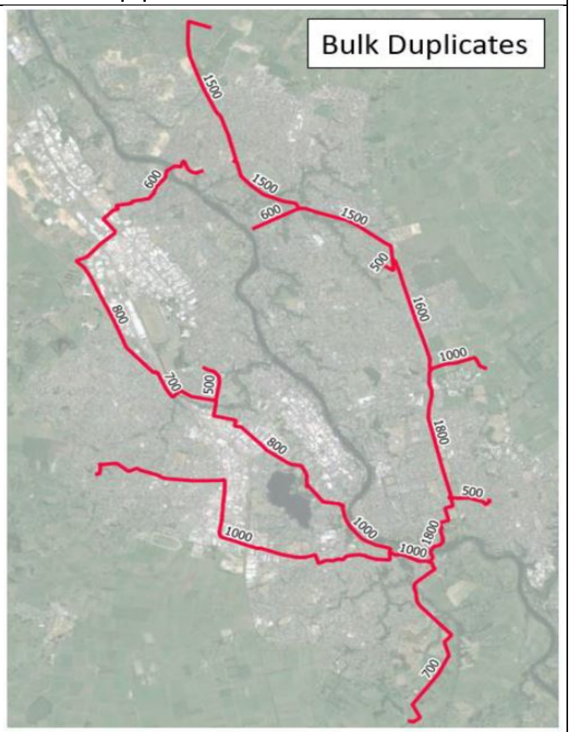


Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The existing Ruakura reservoir and pumping station will be too small and sit on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Ruakura has another planned reservoir but is not sized (or budgeted) for the population increases and a 3rd reservoir would not fit on the current designated reservoir(s) site.
- Hillcrest has a planned reservoir, but it also isn't not sized (or budgeted) for the population increases and would not fit on the current proposed reservoir (Hillcrest bowling green) site without acquiring neighbouring land.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Eastern side of the city will trigger the need for significant bulk ring main upsizing.

Area 8 – Beerescourt: Water Supply Assessment

1.1 Description

Study area size is 494.34ha and is mostly dominated sloping land associated by the Forest Lake hill and then flat land through Whitiora and CBD areas. Elevations range from 16m, up to 55m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.

The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.87	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.66	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.48	2

1.3 Key Area Features

This area sits inside a mixture of 2 existing and 2 proposed DMA areas.

There is the existing Ruakiwi DMA called the 'Red' Zone which supplies levels of service to the CBD part of this zone via gravity from the Ruakiwi reservoir on Lake Road.

Then we have the Maeroa DMA which supplies levels of service to the Forest Lake /Maeroa area via pumps at the reservoir located on the corner of Forest Lake Rd and Ridout St.

Both these reservoirs are filled from the Central Bulk main.

The Proposed Pukete Zone utilising the existing Pukete reservoir, and an upgraded pump station will service a small area at the Northern ned of the study area. However, the pump station was not funded in the 2021 LTP so there is a delay on zone creation.

The Whitiora part of the study area is currently serviced via a temporary zone directly off the central Bulk main. However, a proposed DMA called 'Newcastle' which is in the process of being created around the existing Newcastle reservoir will become the permanent zone and is due to be operational in approx. 2 years' time.

The Pukete and Newcastle reservoirs are filled from the Western Bulk Ring main.

1.4 Summary of key considerations against each criteria

	Criteria	Level of significance /Impact
1	*Predicted local and trunk (250mm only) network capacity at 2031*	3 pressure points less than 10m & 9 between 10-20m
		97% of all pipes have head loss of 5m/km or less
		1 Hydrants Fail FW2 classification (General Residential Zone)
2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 93% of all pipes have head loss of 3m/km or less
		600mm Dia and above - 100% of all pipes have head loss of 2m/km or less
3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Proposed Pukete PS upgrade to create reservoir Zone, Maeroa PS upgrade and new Ruakiwi reservoir and PS were unfunded.
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans) (based on Master Plans)*	3 pressure points less than 10m & 18 between 10-20m
		No capacity upgrades were planned till 2061 based on 2019 population growth projections.
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 59 Fail FW3 (also insufficient hydrants to meet spacing requirements)
		Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)

6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

Figure 1. – 2031 Pressure Nodes

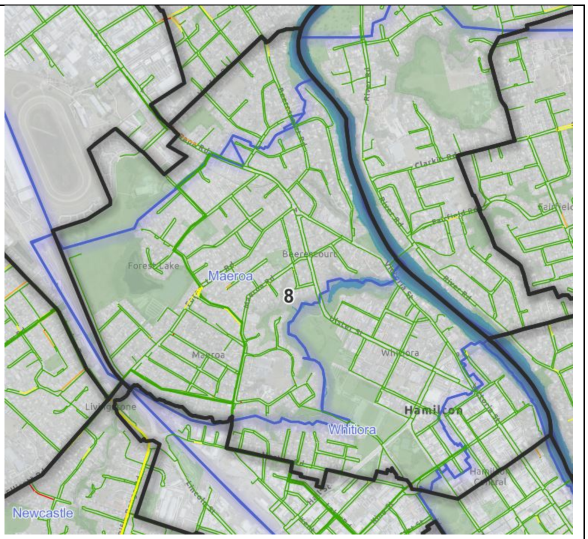


Figure 2. – 2031 Headloss 40mm and above diameter pipes

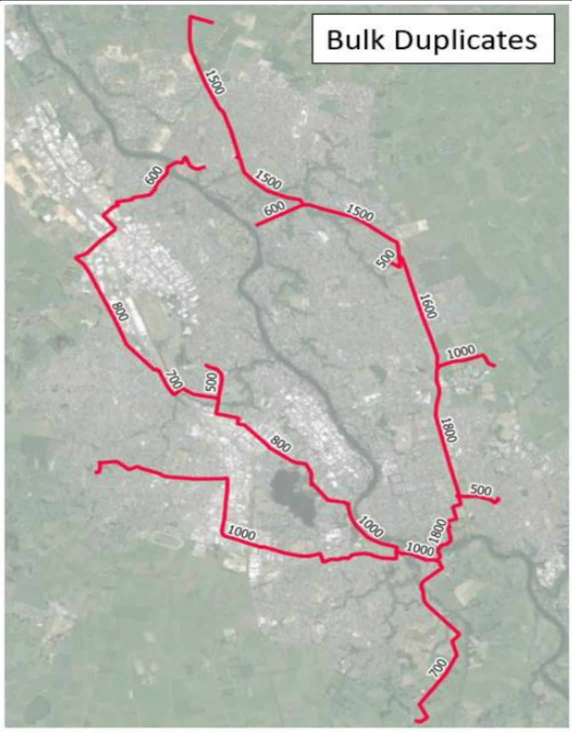


Figure 3. – 2031 Fire Fighting Cover	Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The current upgrades in terms of the new Trunkmains and pump station pump sizes happening to create the Newcastle reservoir zone are now undersized.
- Both the Pukete, Maeroa and Newcastle reservoirs will be too small and sit on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Western side of the city will trigger the need for significant bulk ring main upsizing.

Area 9 – Crawshaw: Water Supply Assessment

1.1 Description

Study area size is 434.39ha and is mostly dominated by an elevated ridgeline and associated sloping land that goes from 30m, up to 76m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.

The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.07	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.67	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.36	2

1.3 Key Area Features

Dinsdale North is located within an existing water demand management area (DMA) called the 'Orange' (Dinsdale reservoir) Zone and within a proposed DMA called 'Newcastle' which is in the process of being created around the existing Newcastle reservoir and due to be operational in approx. 2 years' time.

Both DMA's will ultimately have areas of separated boosted pressure and gravity pressure. Each of the existing reservoirs are filled from the Western Bulk Ring main.

Both zones have been recently approved with a design pressure minimum of just 15m, whereas this typically meant to be 20m. As such elevated areas within the study area have hydraulic results below the Regional Infrastructure Technical Specifications for minimum pressure. This has a flow on effect that makes the network less resilient to accommodating the proposed density changes requiring high demands and elevated firefighting cover.

1.4 Summary of key considerations against each criteria

	Criteria	Level of significance /Impact
1	*Predicted local and trunk (250mm only) network capacity at 2031*	7 pressure points less than 10m & 7 between 10-20m
		97% of all pipes have head loss of 5m/km or less

		3 Hydrants Fail FW2 classification (General Residential Zone)
2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 97% of all pipes have head loss of 3m/km or less
		600mm Dia and above - 100% of all pipes have head loss of 2m/km or less
3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Significant Capacity upgrades (Strategic and Trunk) have been funded which is appropriate for the proposed population growth projections and LOS at that time.
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans) (based on Master Plans)*	10 pressure points less than 10m & 4 between 10-20m
		Major capacity upgrades have been planned till 2061 based on 2019 population growth projections. 25M
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 165 Fail FW3 (also insufficient hydrants to meet spacing requirements)
		Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than 100M.

7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

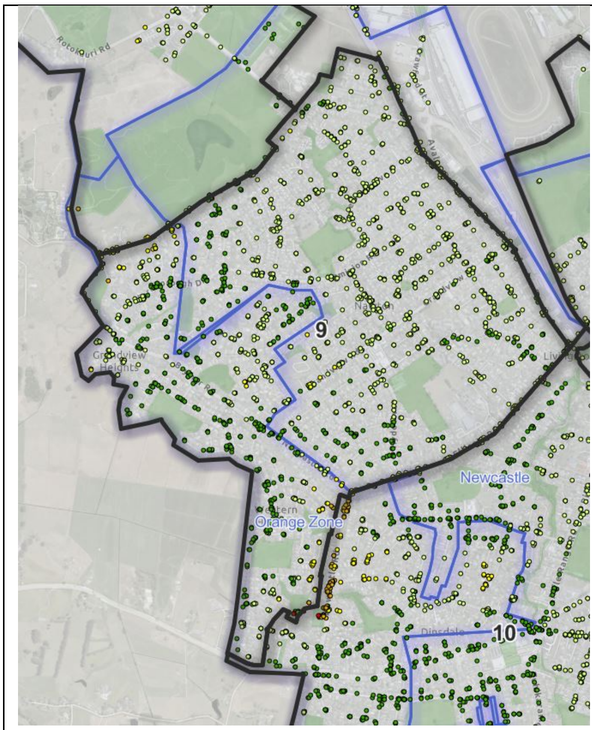


Figure 1. – 2031 Pressure Nodes

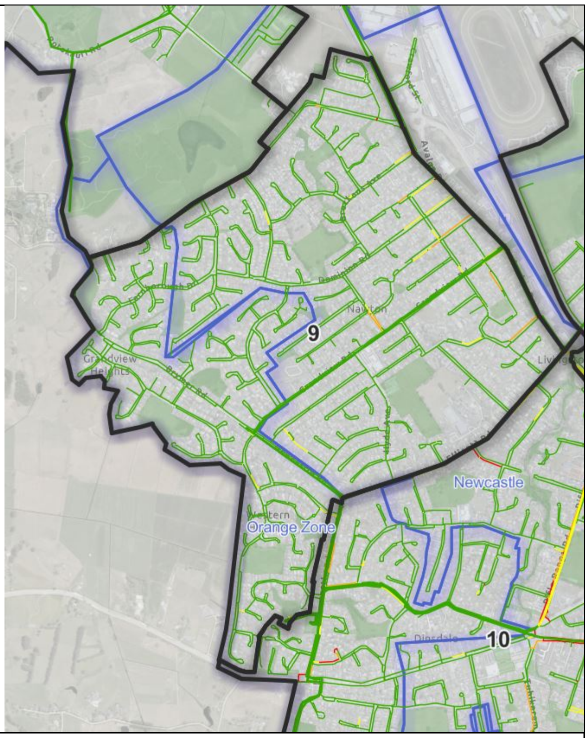
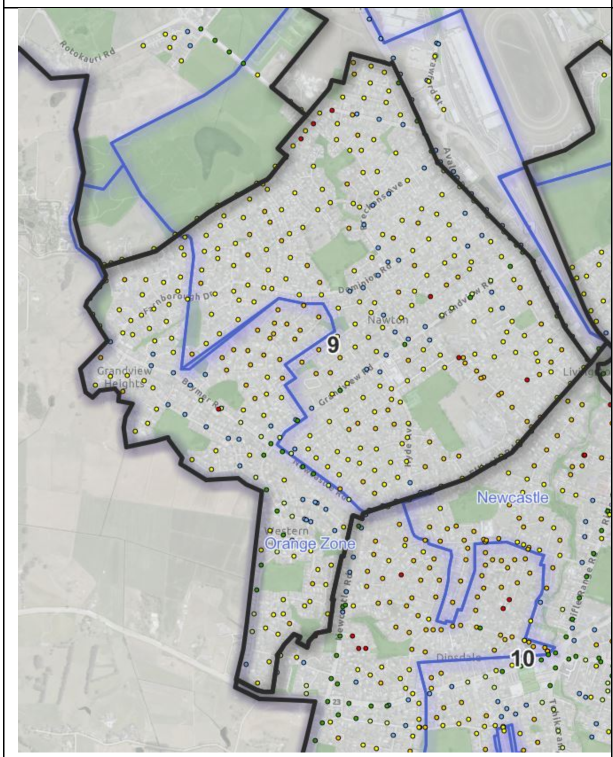


Figure 2. – 2031 Headloss 40mm and above diameter pipes



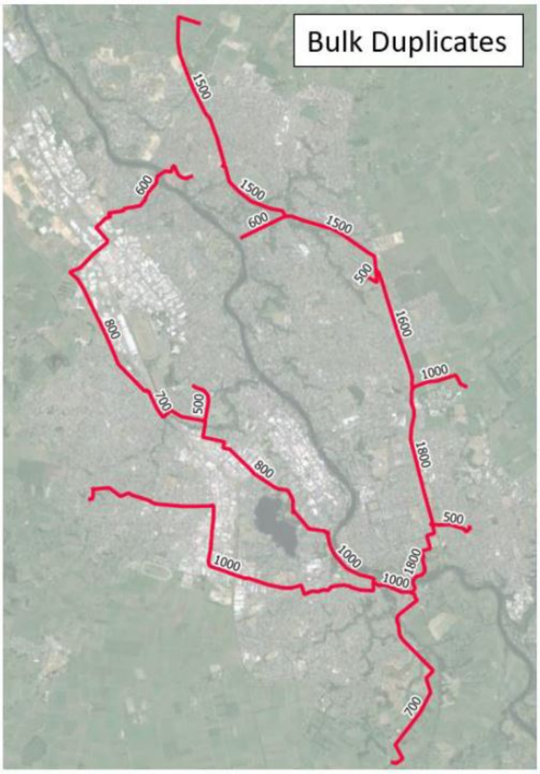


Figure 3. – 2031 Fire Fighting Cover	Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The current upgrades in terms of the new trunkmains and pump station pump sizes happening to create the Newcastle reservoir zone are now undersized.
- Both the Dinsdale and Newcastle reservoirs will be too small and sit on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Whilst we are just mentioning impacts around Dinsdale North, the cumulative effects of additional growth on the Western side of the city will trigger the need for significant bulk ring main upsizing.

Area 10 – Dinsdale North: Water Supply Assessment

1.1 Description

Study area size is 434.39ha and is mostly dominated by a ridgeline of elevated land up to 76m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.

The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.10	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.91	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.74	3

1.3 Key Area Features

Dinsdale North is located within an existing water demand management area (DMA) called the 'Orange' (Dinsdale reservoir) Zone and within a proposed DMA called 'Newcastle' which is in the process of being created around the existing Newcastle reservoir and due to be operational in approx. 2 years' time.

Both DMA's will ultimately have areas of separated boosted pressure and gravity pressure. Each of the existing reservoirs are filled from the Western Bulk Ring main.

Both zones have been recently approved with a design pressure minimum of just 15m, whereas this typically meant to be 20m. As such elevated areas within the study area have hydraulic results below the Regional Infrastructure Technical Specifications for minimum pressure. This has a flow on effect that makes the network less resilient to accommodating the proposed density changes requiring high demands and elevated firefighting cover.

1.4 Summary of key considerations against each criteria

	Criteria	**Level of significance /Impact**
1	*Predicted local and trunk (250mm only) network capacity at 2031*	3 pressure points less than 10m & 67 between 10-20m
		93% of all pipes have head loss of 5m/km or less

		7 Hydrants Fail FW2 classification (General Residential Zone)
2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 97% of all pipes have head loss of 3m/km or less
		600mm Dia and above - 93% of all pipes have head loss of 2m/km or less
3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Significant Capacity upgrades (Strategic and Trunk) have been funded which is appropriate for the proposed population growth projections and LOS at that time.
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans) (based on Master Plans)*	3 pressure points less than 10m & 47 between 10-20m
		Major capacity upgrades of approx. 25M have been planned till 2061 based on 2019 population growth projections.
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 249 Fail FW3 (also insufficient hydrants to meet spacing requirements)
		Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than 100M.

7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

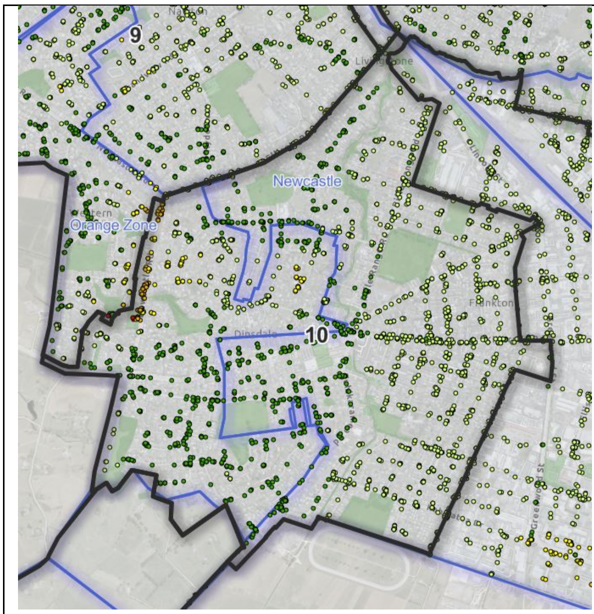


Figure 1. – 2031 Pressure Nodes

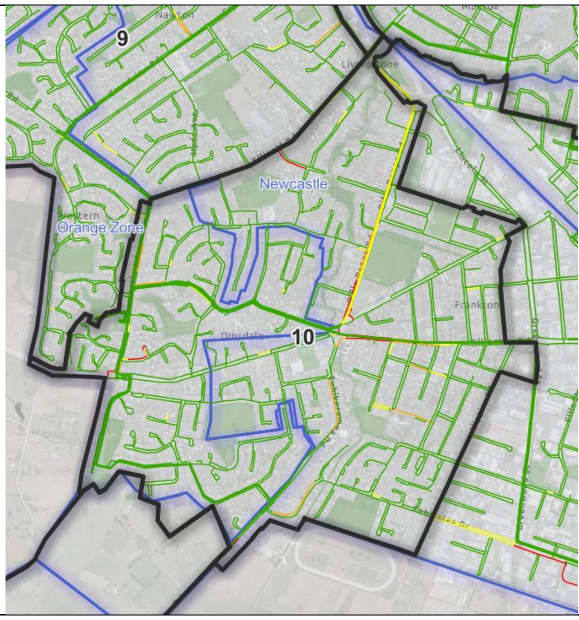


Figure 2. – 2031 Headloss 40mm and above diameter pipes

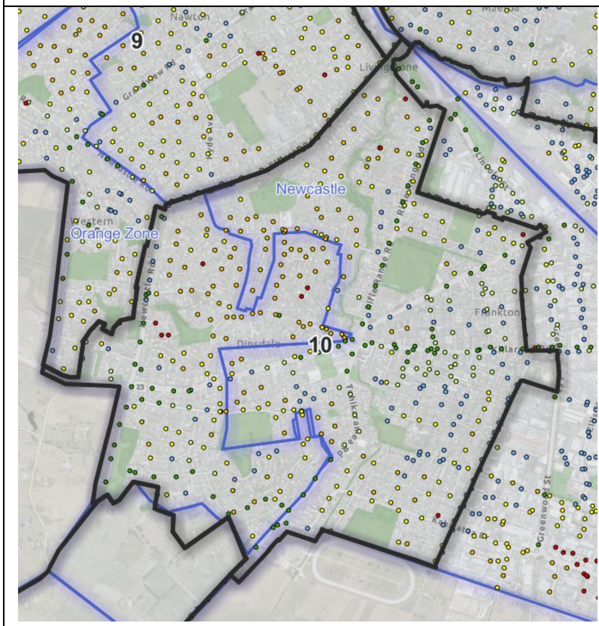


Figure 3. – 2031 Fire Fighting Cover

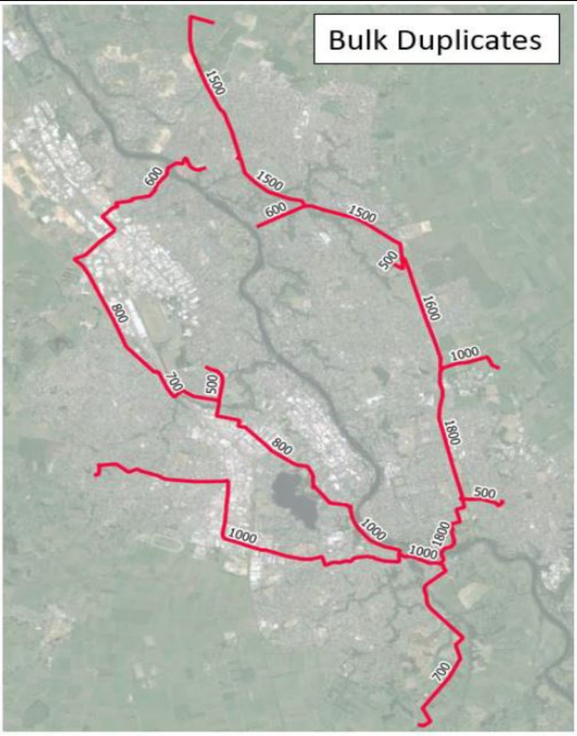


Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The current upgrades in terms of the new Trunkmains and pump station pump sizes happening to create the Newcastle reservoir zone are now undersized.
- Both the Dinsdale and Newcastle reservoirs will be too small and sit on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Whilst we are just mentioning impacts around Dinsdale North, the cumulative effects of additional growth on the Western side of the city will trigger the need for significant bulk ring main upsizing.

Area 11 – Hamilton Lake: Water Supply Assessment

1.1 Description

Study area size is 334.27ha and is rolling land mostly, includes the Hamilton Lake, Waikato Hospital and a ridgeline running along Lake Rd and parts of Ohaupo Rd. Elevation in land ranges from 38m, up to 67m RL. Significant areas are Commercial, Industrial and Mixed Use.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.

The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.30	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	3.27	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	3.22	3

1.3 Key Area Features

This area sits inside one existing DMA and one proposed DMA area.

We have the existing Ruakiwi DMA called the ‘Red’ Zone which supplies levels of service to the CBD via gravity from the Ruakiwi reservoir on Lake Road. The reservoir is filled from the Central bulkmain.

A new bigger reservoir and pump station have been proposed to replace the current reservoir.

Then there is a proposed DMA called the Hamilton South DMA that is due for creation sometime this year, utilising an existing reservoir which is filled from the Western Bulk Ring main. A second reservoir is planned for 2051 to go next to the current one to service 2019 population demands, however council doesn’t currently own any adjacent land for this to occur.

1.4 Summary of key considerations against each criteria

	Criteria	Level of significance /Impact
1	*Predicted local and trunk (250mm only) network capacity at 2031*	7 pressure points less than 10m & 3 between 10-20m
		95% of all pipes have head loss of 5m/km or less
		5 Hydrants Fail FW2 classification (General Residential Zone)

2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 27% of all pipes have head loss greater than 3m/km 600mm Dia and above - 100% of all pipes have head loss of 2m/km or less
3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Minor upgrades have been funded but not sufficient to serve for the proposed population growth projections and LOS at that time.
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans) (based on Master Plans)*	6 pressure points less than 10m & 3 between 10-20m No capacity upgrades were planned till 2061 based on 2019 population growth projections.
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 89 Fail FW3 (also insufficient hydrants to meet spacing requirements) Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

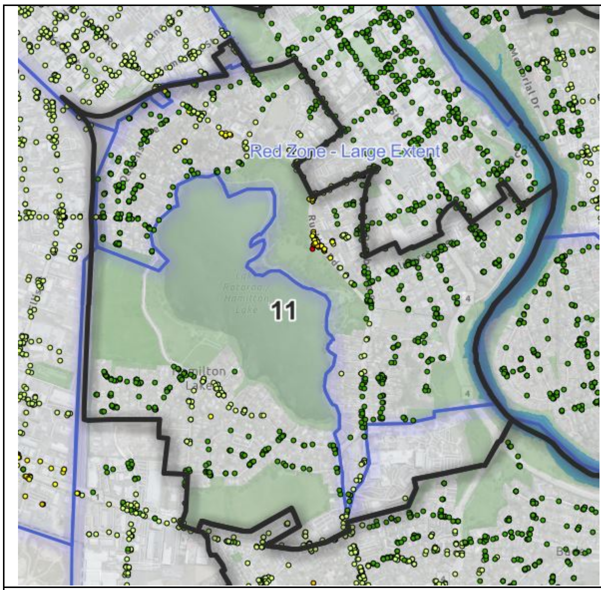


Figure 1. – 2031 Pressure Nodes

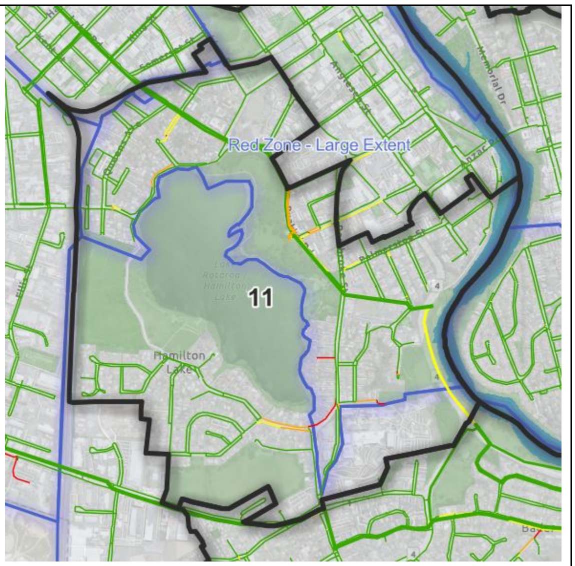


Figure 2. – 2031 Headloss 40mm and above diameter pipes

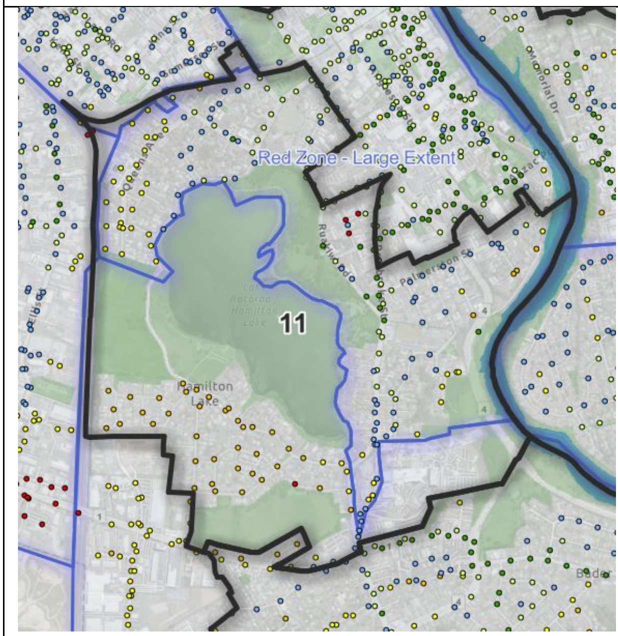


Figure 3. – 2031 Fire Fighting Cover

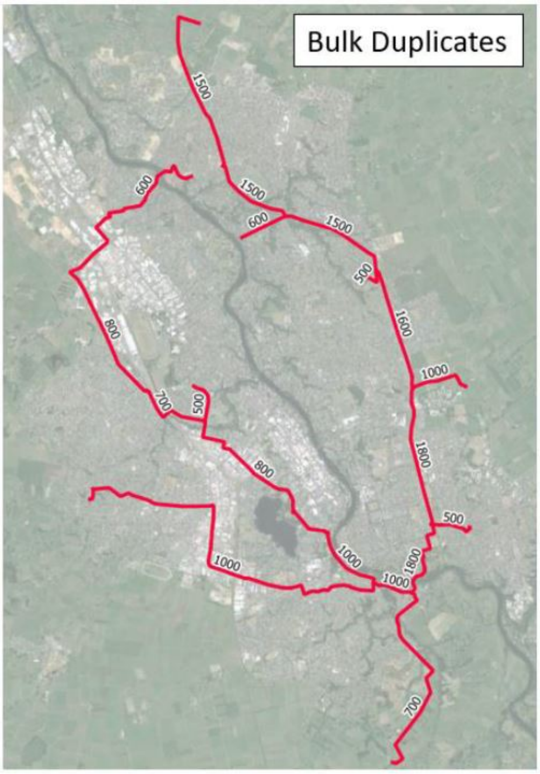


Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The proposed new Ruakiwi reservoir will require additional funding for much larger storage, along with an increase in bulk trunkmains needed with the Ruakiwi zone.
- The existing Hamilton South reservoir will be too small and sits on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Western side of the city will trigger the need for significant bulk ring main upsizing.

Area 12 – Bader: Water Supply Assessment

1.1 Description

Study area size is 695.08ha and is rolling land that goes from 19m, up to 59m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.
The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.17	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	3.03	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.90	3

1.3 Key Area Features

This area is located within a proposed DMA called the Hamilton South DMA that is due for creation sometime this year, utilising an existing reservoir which is filled from the Western Bulk Ring main. The Water Treatment Plant, responsible for supplying treated water to the entire city is located in this study area.

A second reservoir is planned for 2051 to go next to the current one to service 2019 population demands, however council doesn't currently own any adjacent land for this to occur.

1.4 Summary of key considerations against each criteria

	Criteria	**Level of significance /Impact**
1	*Predicted local and trunk (250mm only) network capacity at 2031*	1 pressure point less than 10m & 2 between 10-20m
		90% of all pipes have head loss of 5m/km or less
		7 Hydrants Fail FW2 classification (General Residential Zone)
2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 88% of all pipes have head loss of 3m/km or less
		600mm Dia and above - 92% of all pipes have head loss of 2m/km or less

3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Minor upgrades have been funded but not sufficient to serve for the proposed population growth projections and LOS at that time.
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans) (based on Master Plans)*	1 pressure point less than 10m & 2 between 10-20m
		Significant Capacity upgrade have been planned till 2061 based on 2019 population growth projections. Reservoir 32M
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 199 Fail FW3 (also insufficient hydrants to meet spacing requirements)
		Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

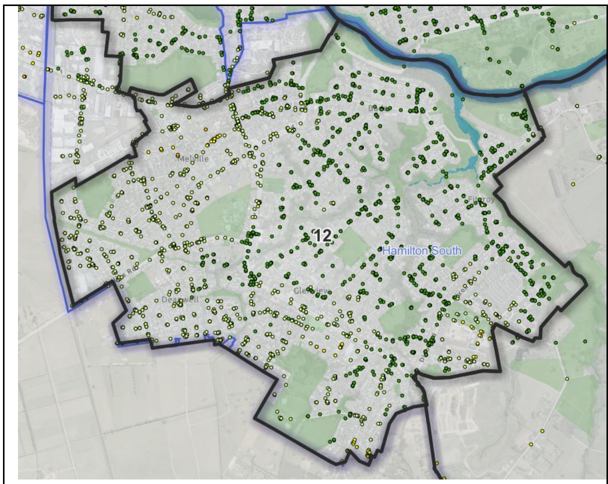


Figure 1. – 2031 Pressure Nodes

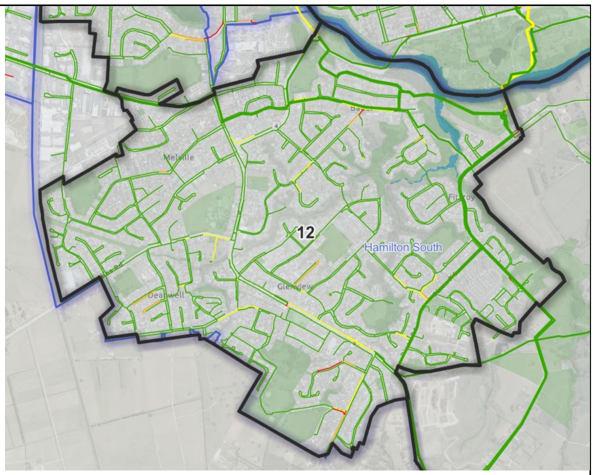


Figure 2. – 2031 Headloss 40mm and above diameter pipes

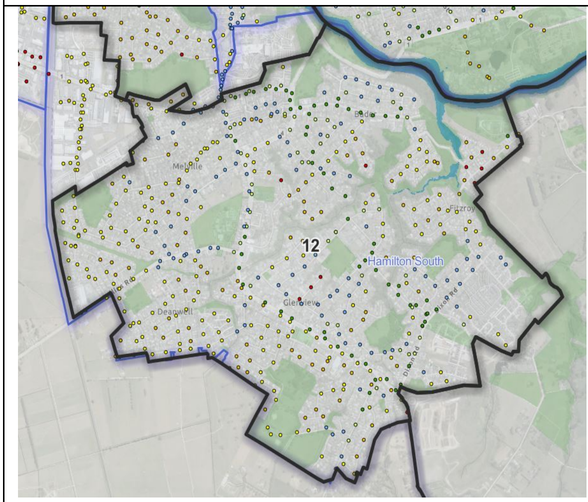


Figure 3. – 2031 Fire Fighting Cover

Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The existing Hamilton South reservoir and future reservoir will be too small and sits on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Western side of the city will trigger the need for significant bulk ring main upsizing.

Area 13 – Hillcrest East: Water Supply Assessment

1.1 Description

Study area size is 355.88ha and is mostly sloping land that goes from 20m, up to 50m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.
The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.93	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.78	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.64	3

1.3 Key Area Features

Located within the proposed water demand management area (DMA) called Hillcrest zone.

The Water Treatment Plant is currently providing levels of service to a temporary Hillcrest zone. In the future a reservoir and pump station will be installed for the Hillcrest zone.

The future reservoir will be filled via the Eastern Bulk Ring Main traversing along the Wairere Dr and Resolution Dr roading corridors.

Numerous locations/roads within the brownfield areas have existing local infrastructure built many decades ago and therefore isn't up to date with the current Regional Infrastructure Technical Specifications (RITS) standards.

1.4 Summary of key considerations against each criteria

	Criteria	**Level of significance /Impact**
1	*Predicted local and trunk (250mm only) network capacity at 2031*	3 pressure points less than 10m
		90% of all pipes have head loss of 5m/km or less
		5 Hydrants Fail FW2 classification (General Residential Zone)
2		251mm - 599mm Dia Pipe - 100% of all pipes have head loss of 3m/km or less

	Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031	600mm Dia and above - 100% of all pipes have head loss of 2m/km or less
3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Significant upgrades recommended in order to service proposed population growth projections and LOS at that time but not funded or deferred beyond 10-year plan.
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans)* *(based on Master Plans)*	3 pressure points less than 10m
		No capacity upgrades were planned till 2061 based on 2019 population growth projections.
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 121 Fail FW3 (also insufficient hydrants to meet spacing requirements)
		Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

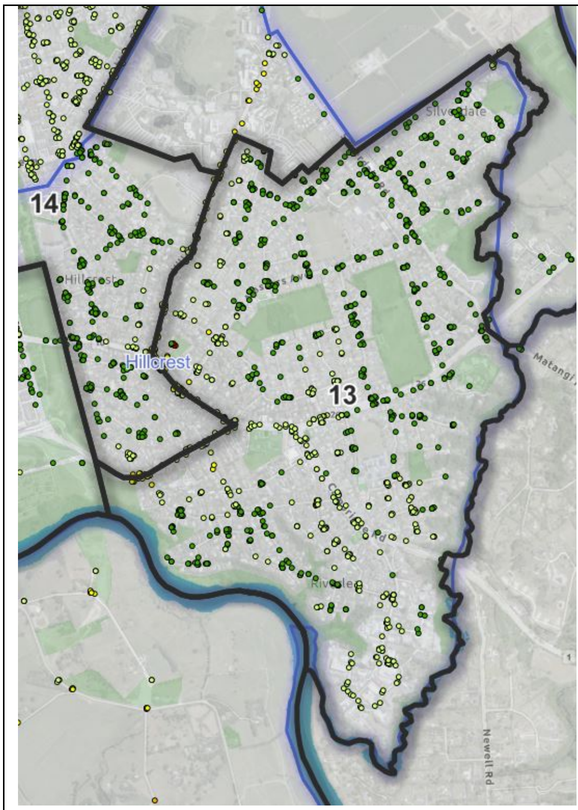


Figure 1. – 2031 Pressure Nodes

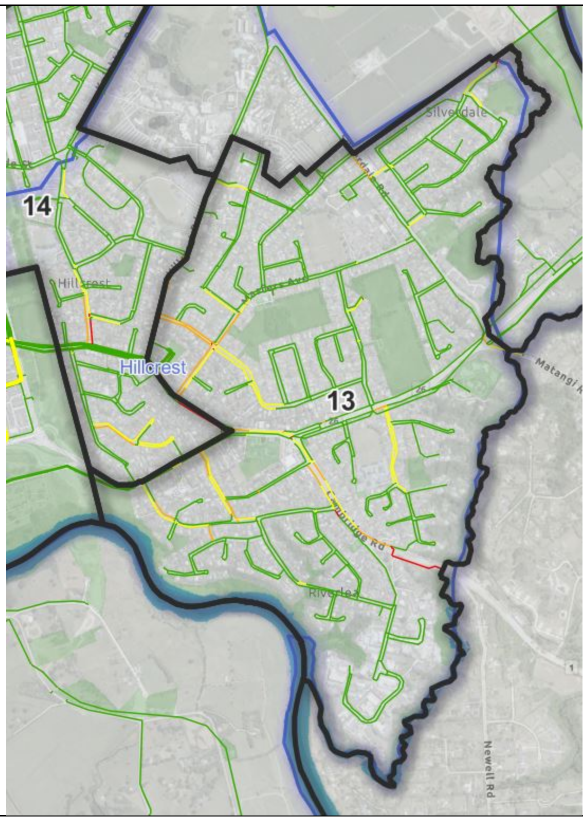


Figure 2. – 2031 Headloss 40mm and above diameter pipes

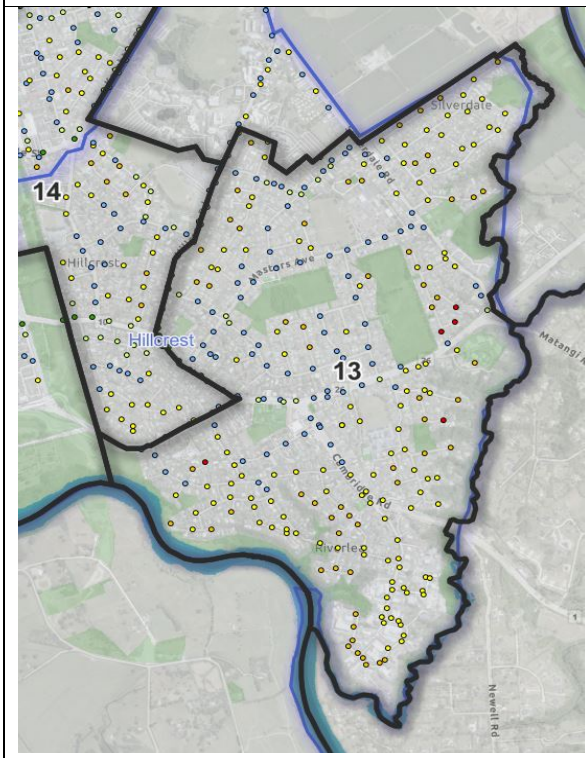


Figure 3. – 2031 Fire Fighting Cover

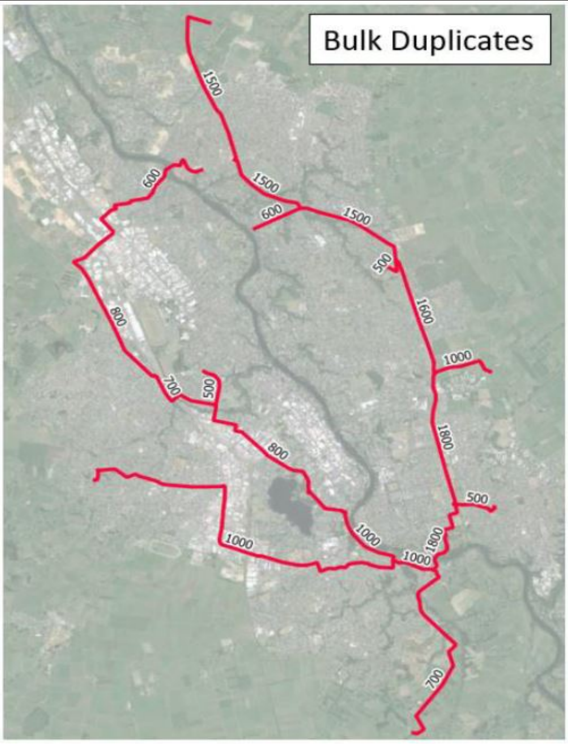


Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- Hillcrest zone has a planned reservoir, but it isn't not sized (or budgeted) for the population increases and would not fit on the current proposed reservoir (Hillcrest bowling green) site without acquiring neighbouring land.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Eastern side of the city will trigger the need for significant bulk ring main upsizing.

Area 14 – Greensboro: Water Supply Assessment

1.1 Description

Study area size is 207.05ha has a land formation that goes from 37m, up to 59m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.
The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.57	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.30	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.06	2

1.3 Key Area Features

Located within the recently created water demand management area (DMA) called Ruakura zone and the proposed Hillcrest zone.

The Ruakura zone has its own reservoir and pump station that supplies flow and pressure to meet the DMA demands, whereas the Water Treatment Plant is currently providing levels of service to a temporary Hillcrest zone. In the future a reservoir and pump station will be installed for the Hillcrest zone.

The existing and future reservoirs will be filled via the Eastern Bulk Ring Main traversing along the Wairere Dr and Resolution Dr roading corridors.

Numerous locations/roads within the brownfield areas have existing local infrastructure built many decades ago and therefore isn't up to date with the current Regional Infrastructure Technical Specifications (RITS) standards.

1.4 Summary of key considerations against each criteria

	Criteria	**Level of significance /Impact**
1	*Predicted local and trunk (250mm only) network capacity at 2031*	No Design Pressure Issues, 20m or less
		97% of all pipes have head loss of 5m/km or less
		No general residential zoned hydrant less than FW2 Classification

2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 100% of all pipes have head loss of 3m/km or less 600mm Dia and above - 32% of all pipes have head loss greater than 2m/km
3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Only partial funding provided for 2nd reservoir. Also, timing was pushed back, not matching intended operational date $13.5M
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans)* *(based on Master Plans)*	No Design Pressure Issues, 20m or less 13.5M
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 30 Fail FW3 (also insufficient hydrants to meet spacing requirements) Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

Figure 1. – 2031 Pressure Nodes

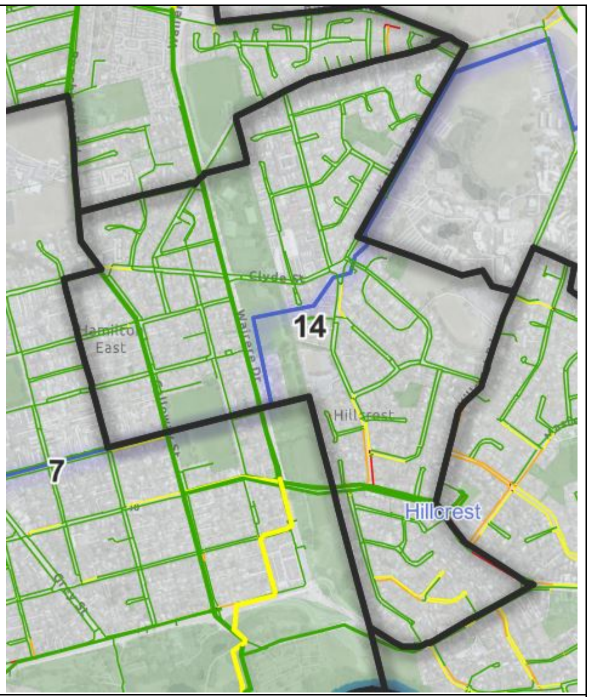


Figure 2. – 2031 Headloss 40mm and above diameter pipes

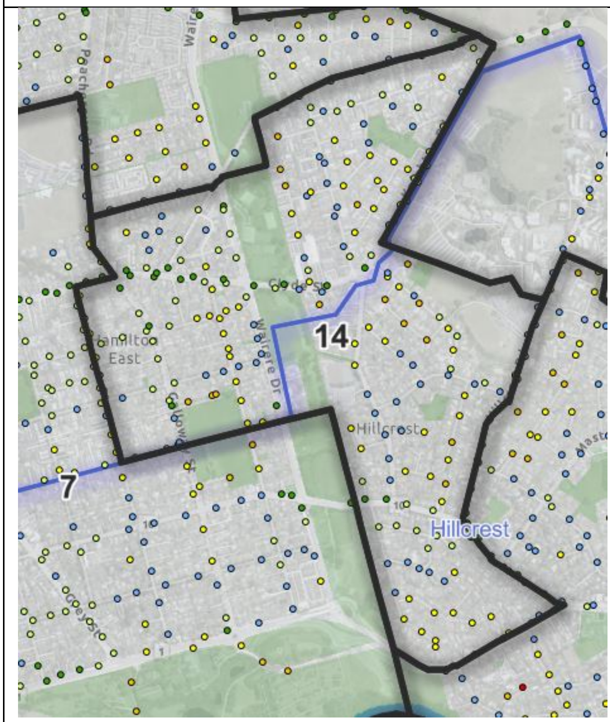


Figure 3. – 2031 Fire Fighting Cover

Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The existing Ruakura reservoir and pumping station will be too small and sit on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Ruakura has another planned reservoir but is not sized (or budgeted) for the population increases and a 3rd reservoir would not fit on the current designated reservoir(s) site.
- Hillcrest has a planned reservoir, but it also isn't not sized (or budgeted) for the population increases and would not fit on the current proposed reservoir (Hillcrest bowling green) site without acquiring neighbouring land.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Eastern side of the city will trigger the need for significant bulk ring main upsizing.

Area 15 – Rotokauri-Waiwhakareke: Water Supply Assessment

1.1 Description

Study area size is 710.15ha and is mostly flat land with a ridgeline of elevated land on the Western side that goes from 30m, up to 50m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.
The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.63	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.43	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.26	2

1.3 Key Area Features

Rotokauri is mostly located within a future water demand management area (DMA) called the Pukete Zone utilising the existing Pukete reservoir and an upgraded pump station. However, the pump station was not funded in the 2021 LTP so there is a delay on zone creation.

In 2041 the area is proposed to be serviced by a new zone called the Rotokauri Zone that necessitates constructing a reservoir and pump station. Timing is based upon 2019 growth rates.

A small portion of this study area sits with the existing Dinsdale and Newcastle Zones

All of the existing and proposed reservoirs get filled via the Western Bulk Ring Main traversing along the Avalon Dr/SH1 roading corridor.

1.4 Summary of key considerations against each criteria

	Criteria	**Level of significance /Impact**
1	*Predicted local and trunk (250mm only) network capacity at 2031*	3 pressure points between 10-20m
		100% of all pipes have head loss of 5m/km or less
		1 Hydrants Fail FW2 classification (General Residential Zone) Must be noted area is only partially developed in this timeline.

2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 100% of all pipes have head loss of 3m/km or less No pipes in this Dia Category
3	*Scale (cost) of funded upgrades that will improve network performance- Reference LTP*	Proposed Pukete pump station upgrade to create reservoir Zone, along with other strategic pipelines were unfunded in the LTP.
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans)* *(based on Master Plans)*	No Design Pressure Issues, 20m or less Significant Capacity upgrade have been planned till 2061 based on 2019 population growth projections above $50M (plus roading projects)
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 1 Failing FW3 performance (also insufficient hydrants to meet spacing requirements) Widespread network LOS issues across the area of interest and/ impacts across other areas. Widespread locations below design LOS in local and trunkmains including bulk supply mains. Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential" in brownfield areas. Insufficient reservoir storage and/or pumping capacity at the Pukete reservoir for the unplanned growth. Pukete reservoir site is also not well located hydraulically & has no space for more storage. Demand exceeds bulk ring main capacity.
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades*	Significant local and strategic infrastructure upgrades and renewals are required in existing brownfield areas. A new reservoir, Pump Station, Bulkmains and Trunkmains are required to create a new Rotokauri zone. Additional cost for upgrade would be (renewals not considered) greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

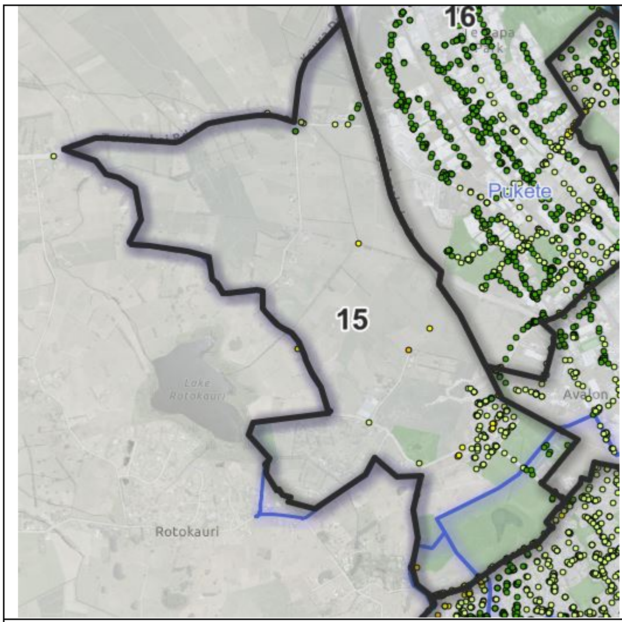


Figure 1. – 2031 Pressure Nodes

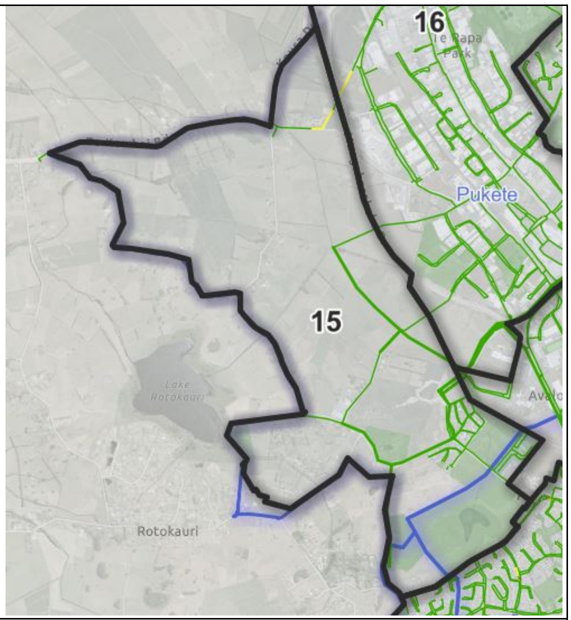


Figure 2. – 2031 Headloss 40mm and above diameter pipes

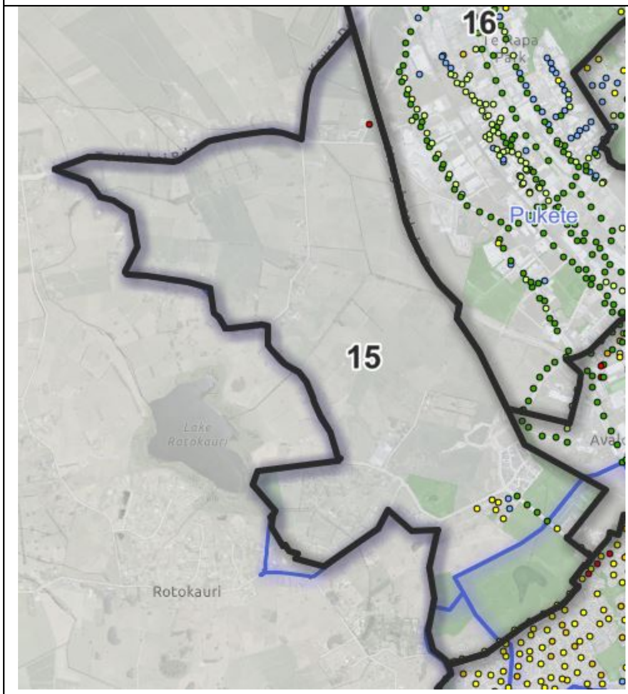


Figure 3. – 2031 Fire Fighting Cover

Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The proposed Rotokauri zone has a planned reservoir, but it isn't not sized (or budgeted) for the population increases. Same can be said in terms of the proposed new Trunkmains and pump station pump sizes.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Western side of the city will trigger the need for significant bulk ring main upsizing.

Area 16 – Te Rapa North: Water Supply Assessment

1.1 Description

Study area size is 923.16ha and is mostly flat land that goes from 18m, up to 38m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.
The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.13	2
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	1.87	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.64	2

1.3 Key Area Features

Te Rapa North is located within a future water demand management area (DMA) called the Pukete Zone utilising the existing Pukete reservoir and an upgraded pump station. However, the pump station was not funded in the 2021 LTP so there is a delay on zone creation.

The Pukete reservoir get filled via the Western Bulk Ring Main traversing along the Avalon Dr/SH1 roading corridor.

1.4 Summary of key considerations against each criteria

	Criteria	**Level of significance /Impact**
1	*Predicted local and trunk (250mm only) network capacity at 2031*	No Design Pressure Issues, 20m or less
		99% of all pipes have head loss of 5m/km or less
		No general residential zoned hydrant less than FW2 Classification Must be noted some areas are only partially developed in this timeline.
2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 100% of all pipes have head loss of 3m/km or less
		No pipes in this Dia Category

3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Proposed Pukete pump station upgrade to create reservoir Zone, along with other strategic pipelines were unfunded.
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans)* *(based on Master Plans)*	No Design Pressure Issues, 20m or less No capacity upgrades were planned till 2061 based on 2019 population growth projections.
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 4 Fail FW3 (also insufficient hydrants to meet spacing requirements) Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

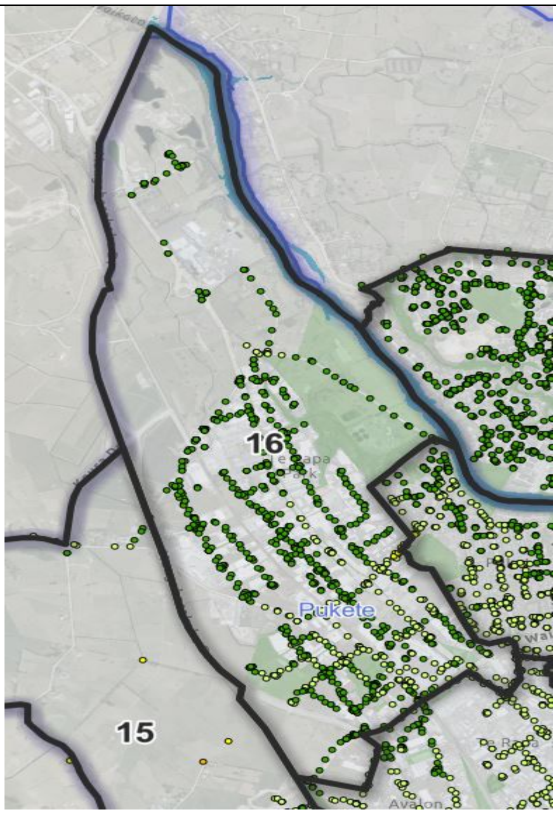


Figure 1. – 2031 Pressure Nodes

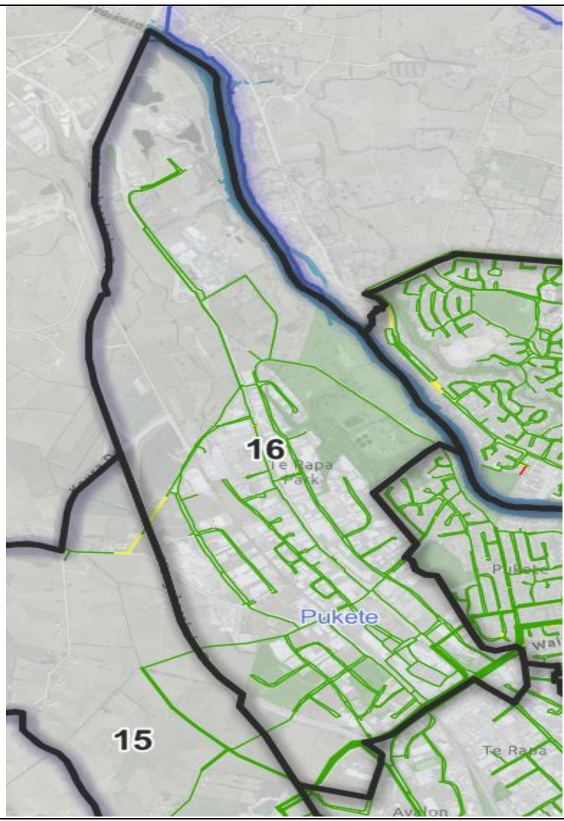


Figure 2. – 2031 Headloss 40mm and above diameter pipes

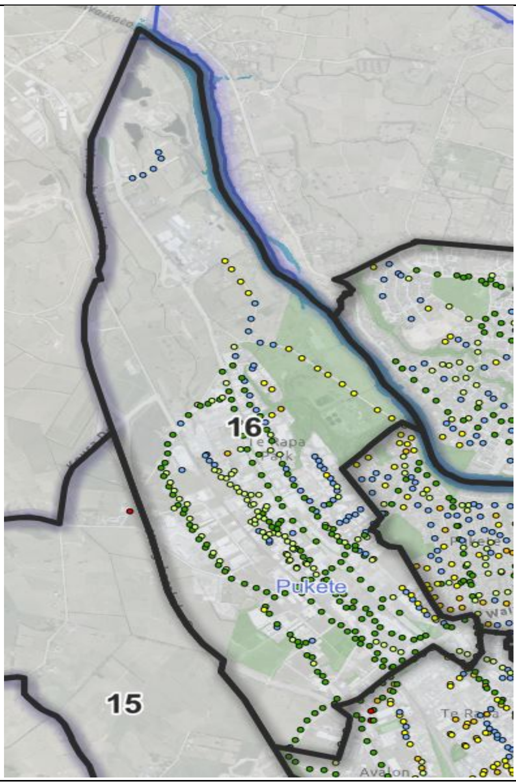


Figure 3. – 2031 Fire Fighting Cover

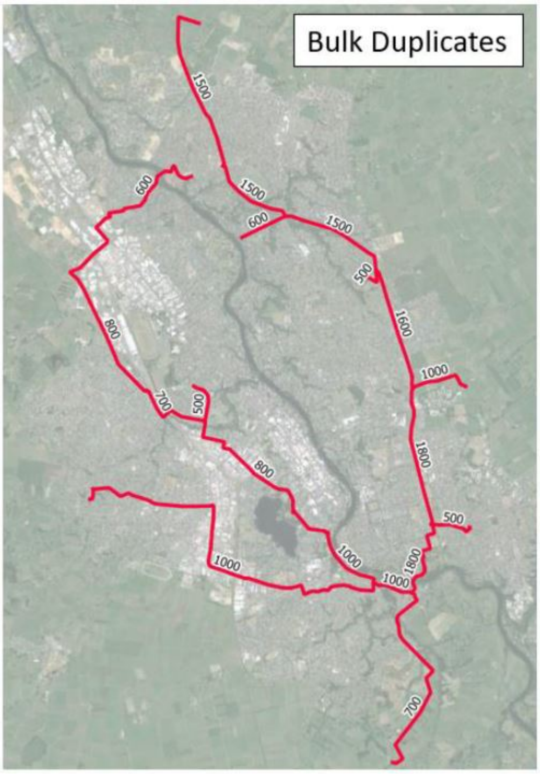


Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The Pukete reservoir will be too small and its sits on designated land that cannot accommodate additional reservoirs. Additionally, the current site is also not placed on suitably elevated land to attempt neighbouring land purchase. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Western side of the city will trigger the need for significant bulk ring main upsizing.

Area 17 – Fairview Downs: Water Supply Assessment

1.1 Description

Study area size is 1014.77ha and is mostly flat land apart from the AG Research and University sites, land formation goes from 33m, up to 60m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.
The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.07	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.67	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.36	2

1.3 Key Area Features

Located mostly within the recently created water demand management area (DMA) called Ruakura Zone, except for the university that will ultimately be served by the proposed Hillcrest zone.

The Ruakura zone has its own reservoir and pump station that supplies flow and pressure to meet the DMA demands, whereas the Water Treatment Plant is currently providing levels of service to the University. In the future a reservoir and pump station will be installed for the Hillcrest zone.

The existing and future reservoirs will be filled via the Eastern Bulk Ring Main traversing along the Wairere Dr and Resolution Dr roading corridors.

Numerous locations/roads within the brownfield area (Fairview Downs) of the Ruakura zone have existing local infrastructure built many decades ago and therefore isn't up to date with the current Regional Infrastructure Technical Specifications (RITS) standards.

1.4 Summary of key considerations against each criteria

	Criteria	**Level of significance /Impact**
1	*Predicted local and trunk (250mm only) network capacity at 2031*	6 pressure points less than 10m & 2 between 10-20m
		97% of all pipes have head loss of 5m/km or less

		No general residential zoned hydrant less than FW2 Classification
2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 100% of all pipes have head loss of 3m/km or less
		600mm Dia and above - 94% of all pipes have head loss of 2m/km or less
3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Only partial funding provided for 2nd reservoir. Also, timing was pushed back, not matching intended operational date $13.5M Strategic pipes along the spine road keep getting pushed back $25M
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans)* *(based on Master Plans)*	6 pressure points less than 10m & 2 between 10-20m
		13.5M
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has24 Fail FW3 (also insufficient hydrants to meet spacing requirements)
		Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than 100M.

7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

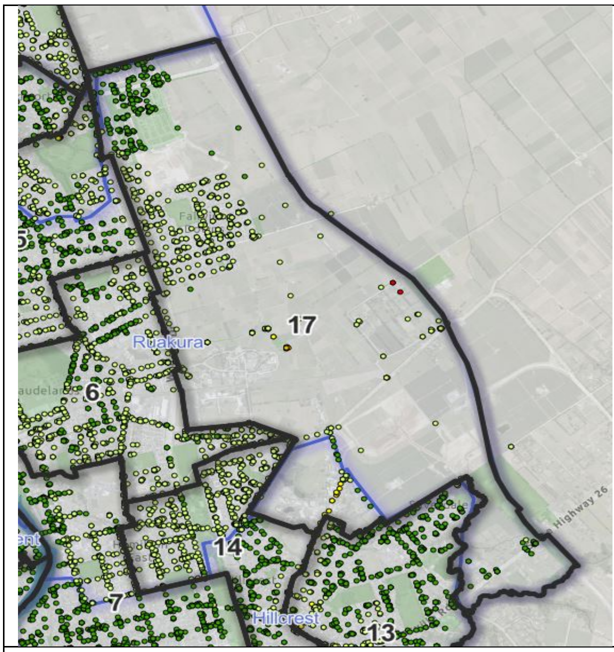


Figure 1. – 2031 Pressure Nodes

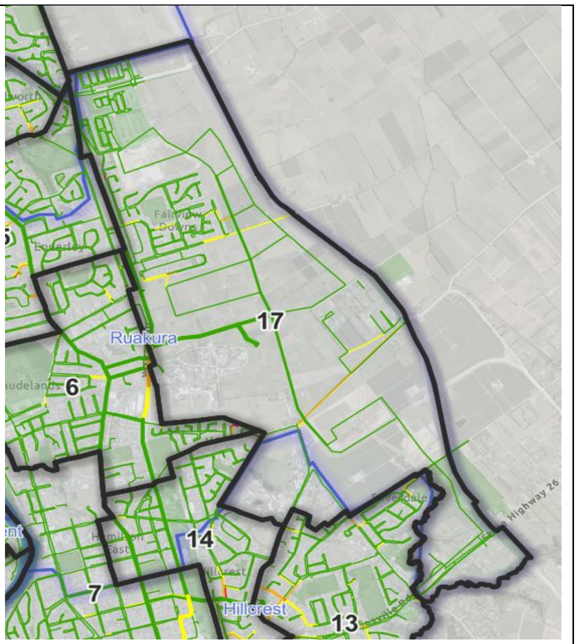


Figure 2. – 2031 Headloss 40mm and above diameter pipes

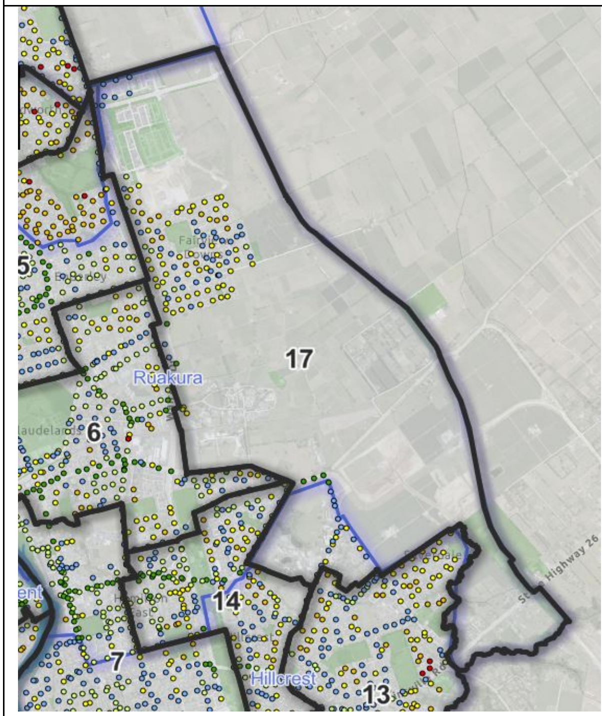


Figure 3. – 2031 Fire Fighting Cover

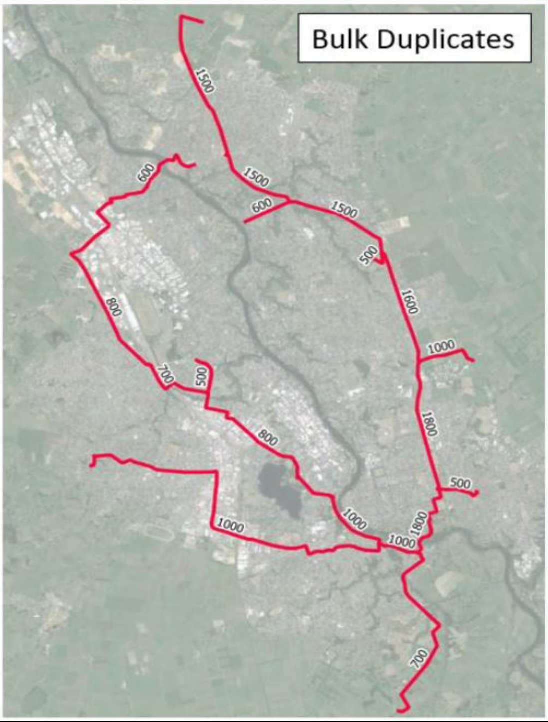


Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The existing Ruakura reservoir and pumping station will be too small and sit on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Ruakura has another planned reservoir but is not sized (or budgeted) for the population increases and a 3rd reservoir would not fit on the current designated reservoir(s) site.
- Hillcrest has a planned reservoir, but it also isn't not sized (or budgeted) for the population increases and would not fit on the current proposed reservoir (Hillcrest bowling green) site without acquiring neighbouring land.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Eastern side of the city will trigger the need for significant bulk ring main upsizing.

Area 18 – Peacocke: Water Supply Assessment

1.1 Description

Study area size is 693.3ha has a mixture of flat, rolling, and sloping land that peaks along Ohaupo Rd. Elevations goes from 25m, up to 79m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.
The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.67	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.13	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.72	2

1.3 Key Area Features

This area is located within a proposed DMA called the Hamilton South DMA that is due for creation sometime this year, utilising an existing reservoir which is filled from the Western Bulk Ring main.

A second reservoir is planned for 2051 to go next to the current one to service 2019 population demands, however council doesn't currently own any adjacent land for this to occur.

1.4 Summary of key considerations against each criteria

	Criteria	**Level of significance /Impact**
1	*Predicted local and trunk (250mm only) network capacity at 2031*	1 pressure points less than 10m & 3 between 10-20m
		100% of all pipes have head loss of 5m/km or less
		No general residential zoned hydrant less than FW2 Classification Must be noted area is only partially developed in this timeline.
2		251mm - 599mm Dia Pipe - 100% of all pipes have head loss of 3m/km or less

	Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031	600mm Dia and above - 100% of all pipes have head loss of 2m/km or less
3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Significant Capacity upgrades (Strategic and Trunk) have been funded which is appropriate for the proposed population growth projections and LOS at that time.
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans)* *(based on Master Plans)*	1 pressure point less than 10m & 2 between 10-20m
		Significant Capacity upgrade have been planned till 2061 based on 2019 population growth projections. Strategic Pipes 24M Reservoir 32M
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 2 Fail FW3 (also insufficient hydrants to meet spacing requirements)
		Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

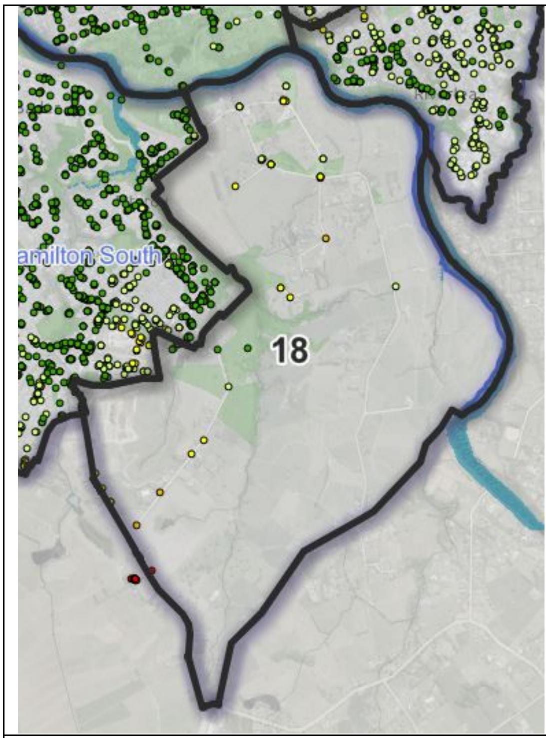


Figure 1. – 2031 Pressure Nodes

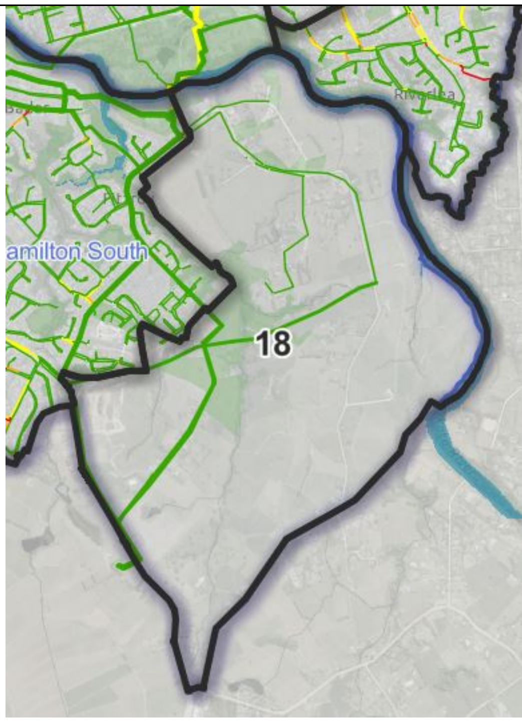


Figure 2. – 2031 Headloss 40mm and above diameter pipes

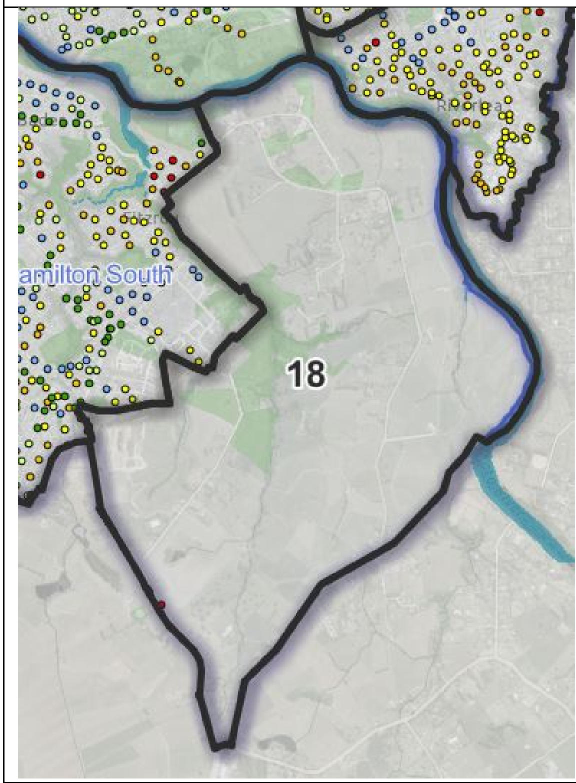


Figure 3. – 2031 Fire Fighting Cover

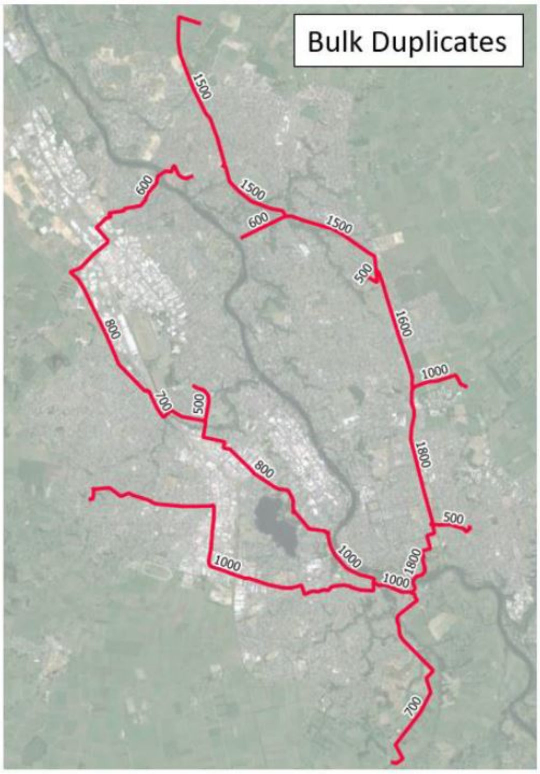


Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The existing Hamilton South reservoir and future reservoir will be too small and sits on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Western side of the city will trigger the need for significant bulk ring main upsizing.

Area 19 – Temple View: Water Supply Assessment

1.1 Description

Study area size is 437.23ha and is mostly dominated by rolling land and couple of ridgelines of elevated land that goes from 30m, up to 79m RL.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.
The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.57	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	1.95	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.46	2

1.3 Key Area Features

Temple View is located within a proposed DMA called 'Newcastle' which is in the process of being created around the existing Newcastle reservoir and due to be operational in approx. 2 years' time.

This DMA will ultimately have areas of separated boosted pressure and gravity pressure and the existing reservoir is filled from the Western Bulk Ring main.

However, in the future (approx. 2051) a dedicated Temple View DMA with its own reservoir is proposed that will supply most of this study area and only a smaller portion near Dinsdale will continue to be serviced by the Newcastle DMA.

The timing of the Temple View DMA is based upon 2019 population data and associated demands.

1.4 Summary of key considerations against each criteria

	Criteria	Level of significance /Impact
1	*Predicted local and trunk (250mm only) network capacity at 2031*	No Design Pressure Issues, 20m or less
		100% of all pipes have head loss of 5m/km or less
		No general residential zoned hydrant less than FW2 Classification

2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	251mm - 599mm Dia Pipe - 100% of all pipes have head loss of 3m/km or less No pipes in this Dia Category
3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Significant Capacity upgrades (Strategic and Trunk) have been funded which is appropriate for the proposed population growth projections and LOS at that time.
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans)* *(based on Master Plans)*	3 pressure points less than 10m Major capacity upgrades have been planned till 2061 based on 2019 population growth projections. 24M
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 has 8 Fail FW3 (also insufficient hydrants to meet spacing requirements) Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity Demand exceeds existing treatment capacity and/or bulk ring main capacity including reservoir filling mains. Demand exceeds water allocation (maxed at 2051)
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	The existing local and strategic infrastructure capacity has "significant deficit" and the infrastructure condition is "poor". Significant local and strategic infrastructure upgrades and renewals are required (complete replacement of local infrastructure is likely). Additional cost for upgrade would be (renewals not considered) greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

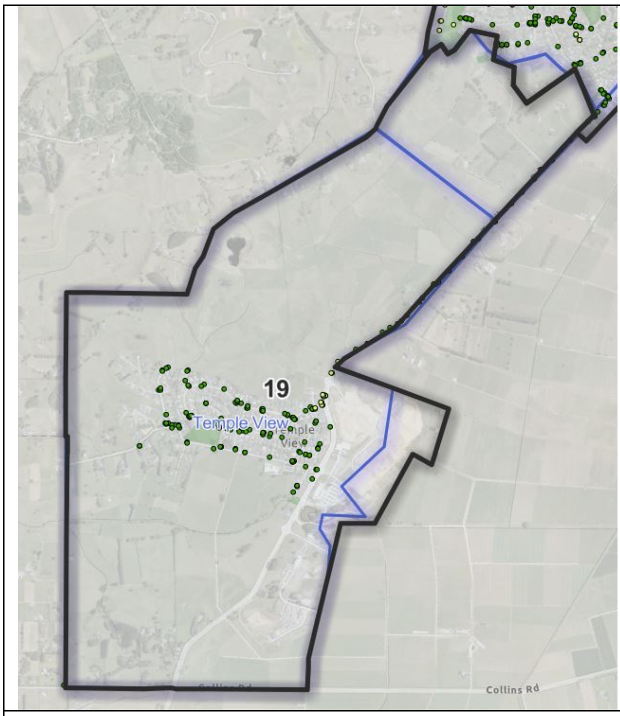


Figure 1. – 2031 Pressure Nodes

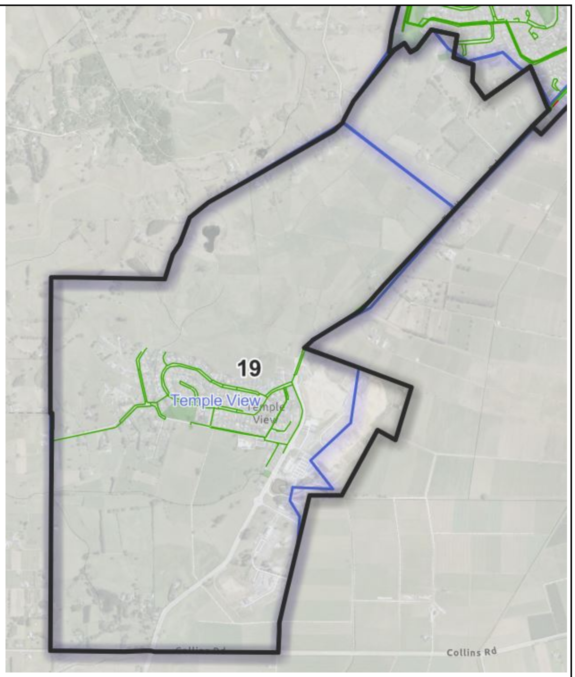


Figure 2. – 2031 Headloss 40mm and above diameter pipes

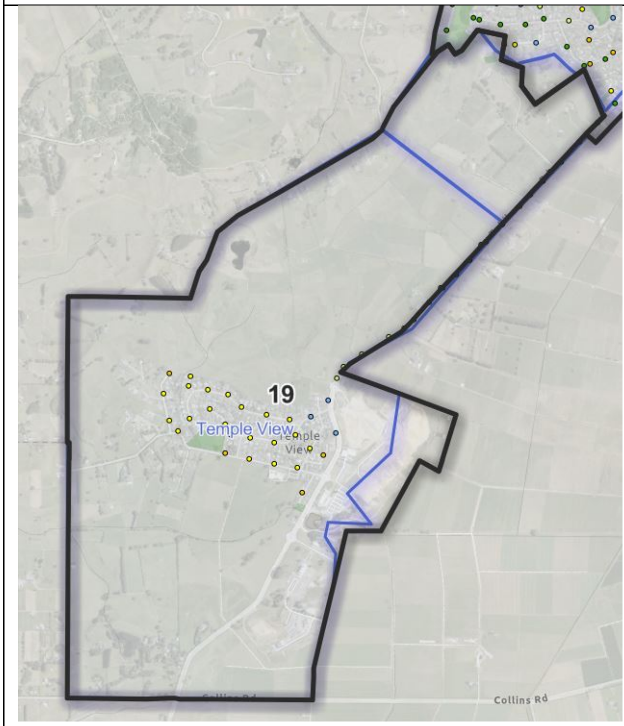


Figure 3. – 2031 Fire Fighting Cover

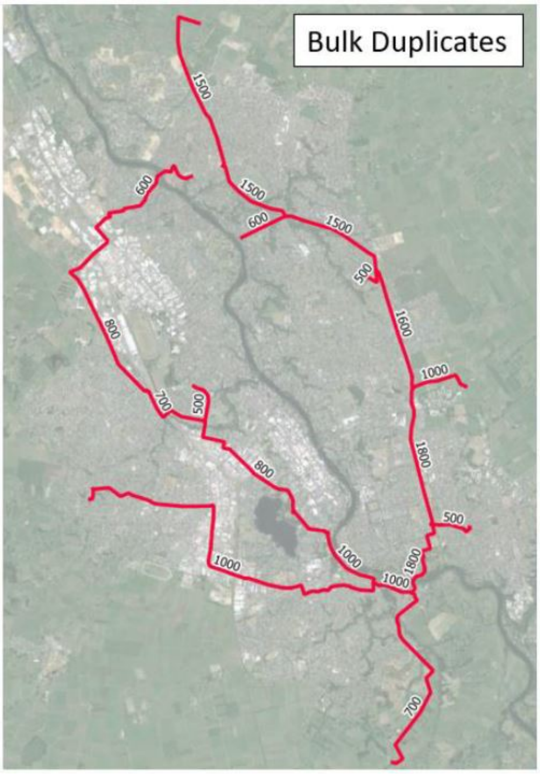


Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

Strategic infrastructure is also impacted by the density increases such as:

- The current upgrades in terms of the new Trunkmains and pump station pump sizes happening to create the Newcastle reservoir zone are now undersized.
- Both the existing Newcastle and Temple View reservoirs will be too small and (for Newcastle sit on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- The Temple View DMA and associated funding will need to be moved forward with timing confirmed once modelling has been run with the revised population demands.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Western side of the city will trigger the need for significant bulk ring main upsizing.

Area 20 – City CBD: Water Supply Assessment

1.1 Description

Study area is mostly flat apart from the ridgeline running along Lake Rd. Elevation in land ranges from 35m, up to 60m RL. Significant areas are Commercial, Industrial and Mixed Use.

High level assessment on the hydraulic and capacity constraints in the water infrastructure utilized the 2020 Water Master Plan, system performance results. These results are based upon, proposed (funded or unfunded) infrastructure upgrades such as the creation of reservoir zones.

The reason for not using the baseline 2019 Hydraulic water model for this analysis largely relates to the baseline not capturing recent upgrades completed or in progress that has improved the hydraulic performance since 2019.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.67	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.31	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.04	2

1.3 Key Area Features

This area sits inside one existing DMA and two proposed DMA areas.

We have the existing Ruakiwi DMA called the 'Red' Zone which supplies levels of service to the CBD via gravity from the Ruakiwi reservoir on Lake Road. The reservoir is filled from the Central bulkmain.

A new bigger reservoir and pump station have been proposed to replace the current reservoir.

Secondly there is a proposed DMA called 'Newcastle' which is in the process of being created around the existing Newcastle reservoir and due to be operational in approx. 2 years' time. This will service the biggest portion of this study area which is the Frankton commercial and industrial land on both sides of the main railway line.

Lastly, we have a small portion of area in the South-Eastern corner (Melville area) which sits in the proposed Hamilton South DMA that is due for creation sometime this year.

The Hamilton South and Newcastle DMA's (or Zones) have existing reservoirs being filled from the Western Bulk Ring main.

1.4 Summary of key considerations against each criteria

	Criteria	Level of significance /Impact
1	*Predicted local and trunk (250mm only) network capacity at 2031*	2 pressure points between 10-20m Pipe Head Loss of 5 metres or less. More than 95% Compliance of all pipes in Diam category No general residential zoned hydrant less than FW2 Classification Must be noted area has 31 commercial hydrants below FW3
2	*Predicted strategic network (trunkmains above 250mm & bulkmains) capacity at 2031*	Pipe Head Loss of 3 metres or less. More than 95% Compliance of all pipes in Dia category Pipe Head Loss of 2 metres or less. More than 95% Compliance of all pipes in Dia category
3	*Scale (cost) of funded upgrades that will improve network performance - 2021-2031 LTP & 2020 Master Plans*	Significant upgrades fully funded for Newcastle zone. However, no funding was provided for the Ruakiwi zone to install new pumping station, change operating philosophy of current reservoir and install new reservoir.
4	*Scale (cost) of already planned upgrades 2061 - (reference master plans) (based on Master Plans)*	2 pressure points between 10-20m Significant Capacity upgrade have been planned till 2061 based on 2019 population growth projections. Strategic Pipes 50M Reservoir 32M
5	***STEP CHANGE GROWTH:*** *FUTURE POSSIBLE PERFORMENCE WITH "EXTRA" UNPLANNED GROWTH (E.G. NPS UD)*	Assessment of 2031 fire cover, changing from FW2 to FW3 mostly complies in mixed use areas. (also insufficient hydrants to meet spacing requirements) Must be noted area has 31 commercial hydrants below FW3

		Widespread network LOS issues across the area of interest and/ impacts across other areas Widespread locations below design LOS in local and trunkmains including bulk supply mains Local infrastructure layout only meeting general Residential housing specifications. Significant local upgrades and additional pipes required to support density level demands above "Residential". Insufficient reservoir storage and/or pumping capacity for the unplanned growth. Demand exceeds bulk ring main capacity including reservoir filling mains
6	***STEP CHANGE GROWTH:*** *Potential (un-modelled) additional cost of upgrades – unplanned and unfunded system upgrade costs. Include the localised and system wide costs,*	Significant local and strategic infrastructure upgrades and renewals are required. Complete replacement of local infrastructure is likely in some areas. Additional reservoir storage required with bigger pumps. Additional cost for upgrade would be (renewals not considered) greater than 100M.
7	*IF OUT OF BOUNDARY – Contribution to treatment plant upgrades, construction of conveyance system*	N/A

1.5 Evidence Used to Support Assessment

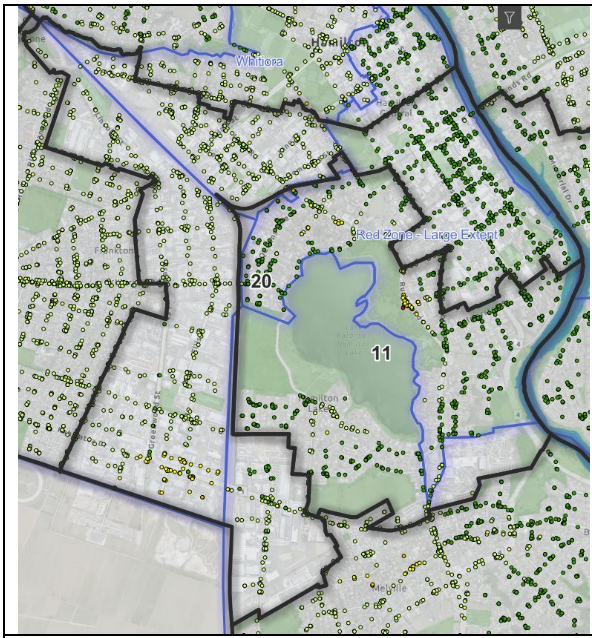


Figure 1. – 2031 Pressure Nodes

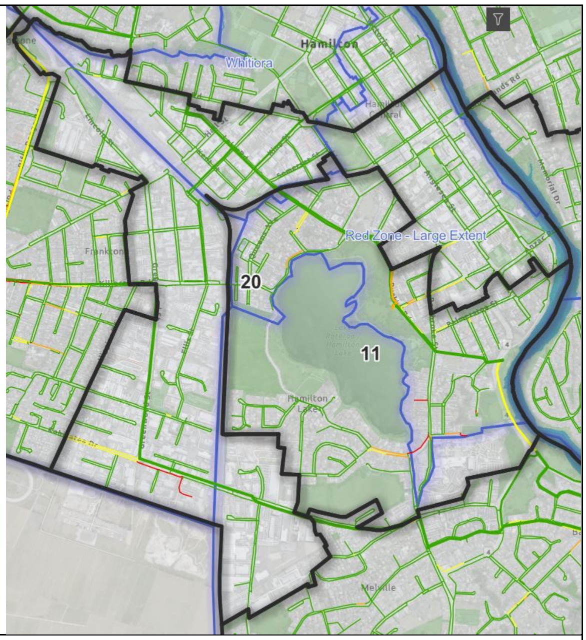


Figure 2. – 2031 Headloss 40mm and above diameter pipes

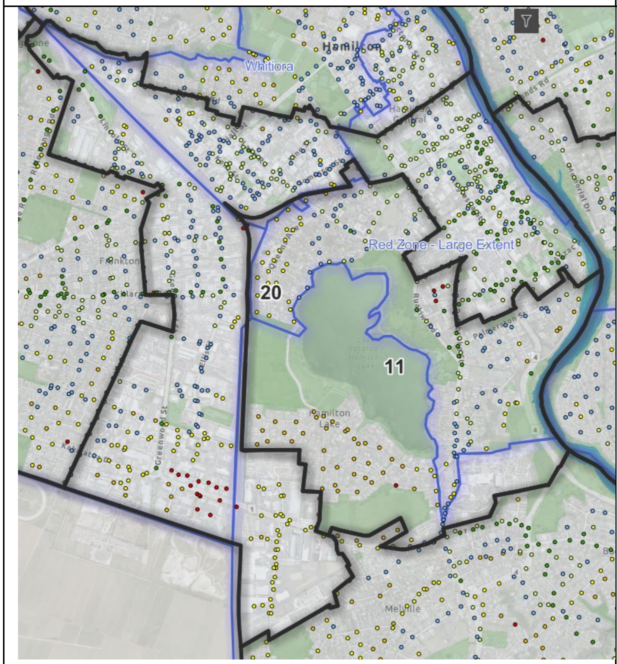


Figure 3. – 2031 Fire Fighting Cover

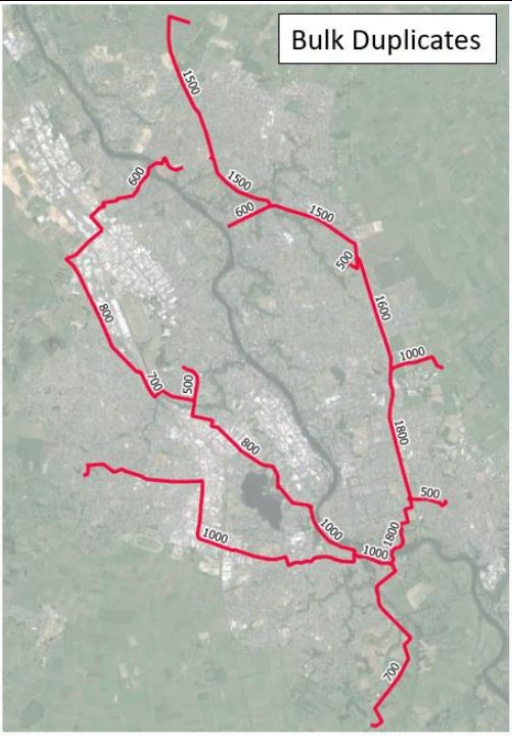


Figure 4. – Bulk Ring Main, duplicate pipelines needed to service proposed (Citywide) NPS Densities

1.6 Other Comments:

Existing residential Population densities used in the 2020 strategic master planning ranged up to a max of 45 persons/hectare or 16.7 houses/hectare. Whereas the proposed NPS_UD related densities to be applied to existing residential zones can be potentially up to 50 houses/hectare and possibly even higher densities in the CBD areas.

Generally speaking, the proposed density increases signal a minimum uplift of 3 times the previously utilised demands in Master Planning for Strategic Infrastructure.

Therefore, it shouldn't be surprising that when a density increase is approved in an existing built-up environment that it triggers a number of design requirements which require upsizing at the local infrastructure level.

As a default, changing an Area or Zone from say general Residential to High Density triggers the requirement of Principal main (150mm Diameter) on both sides of the road. Literally, all existing 50mm Ridermains are undersized and need upsizing to a 150mm Principal main which would have to occur virtually on one side off every local road within a zoning change.

This also requires greater fire hydrant coverage with the current council standard of FW3 for general residential areas being increased to FW3 for high density/apartment style housing. This requirement is more difficult to achieve in the higher elevated areas.

It should be noted that this study area includes a lot of commercial/industrial area, to which some of the 'residential' analysis doesn't apply. However, some commercial and industrial areas already have local infrastructure that better suits higher housing densities, but this would require Council setting aside more land to accommodate the displaced, non-residential activities.

Strategic infrastructure is also impacted by the density increases such as:

- The current upgrades in terms of the new Trunkmains and pump station pump sizes happening to create the Newcastle reservoir zone will be undersized to meet the unplanned growth.
- The proposed new Ruakiwi reservoir will require additional funding for much larger storage, along with an increase in bulk trunkmains needed with the Ruakiwi zone.
- The existing Hamilton South & Newcastle reservoirs will be too small and sits on designated land that cannot accommodate additional reservoirs. Costs to buy land for new reservoir sites and new potential DMA infrastructure haven't been included above.
- Whilst we are just mentioning impacts around this study area, the cumulative effects of additional growth on the Western side of the city will trigger the need for significant bulk ring main upsizing.

APPENDIX D – WASTEWATER ASSESSMENT SUMMARY REPORTS

Area 1 – Flagstaff: Wastewater Assessment

1.1 Description

The area is serviced by the 1050 mm dia Far Eastern Interceptor. The area is located at toward the downstream end of the interceptor. A series of trunk mains connect the local reticulation to the interceptor. The eastern extent of the area connects to the interceptor via trunk infrastructure through Area 2.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.2	2
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	1.48	1
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.12	1

1.3 Key Network Features

The Flagstaff East area is a relatively new development area.

Wastewater infrastructure in the southern extent around Endeavour Drive/ Alandale was developed between late 1980's to mid-1990s. Further development of the area occurred generally in a northward direction from the mid - 2000's and is still continuing. The northern eastern areas in the vicinity of the Waikato Expressway are yet to be developed.

A total of 9 Sewer Pump Stations are located within the area. Three are small riverside pumpstations (Durham Estate (SPS 129), Paratai (SPS140), Alandale (SPS92)). St Petersberg (SPS 135) is a local PS on the banks of the Te Awa o Katapaki stream/gully.

Woodridge (SPS 130), Cumberland (SPS 132), Endeavor (SPS091), Rototuna West (SPS 139), and North City (SPS146) are larger local/trunk pumpstations.

The Borman Rd Pump station (SPS 131) is located on the boundary with Area 2 and is a trunk SPS servicing both areas.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local and trunk network < 50% pipe full under dry weather conditions.
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to	5 low frequency/low volume overflow locations predicted across the area. Total modelled average annual overflow volume <50m3.

	matrix of overflow frequency / volume used to guide the assessment)	
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Far Eastern Interceptor flowing through and servicing the area is < 50% pipe full under dry weather conditions
4	Scale of funded interventions in the current LTP	No interventions identified in Master Plan
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local and trunk network < 50% pipe full under dry weather conditions.
6	2061 Modelled Local and Trunk Wet weather overflows	Note that the modelled network in this area may not be accurate and needs to be updated to reflect the as-built system. These results should be considered with caution. 9 low frequency/low volume overflow locations predicted across the area. Additional low frequency/med volume overflows upstream of North City PS. Total modelled average annual overflow volume near North City SPS 1,000m3.
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Additional flow from overall catchment results in ~400m length of interceptor flowing between 50 - 75% full. However, no overflows in the vicinity of the area created.
8	Scale of investments identified in current Master Plans to service historic 2061 growth	No interventions identified in Master Plan
9	Scale of investment to service "step change" in demand in long term. Excludes treatment plants	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely

1.5 Example supporting Evidence used to inform assessment

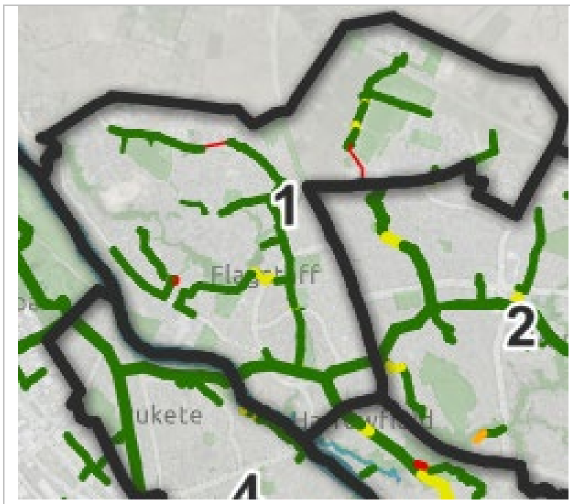


Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

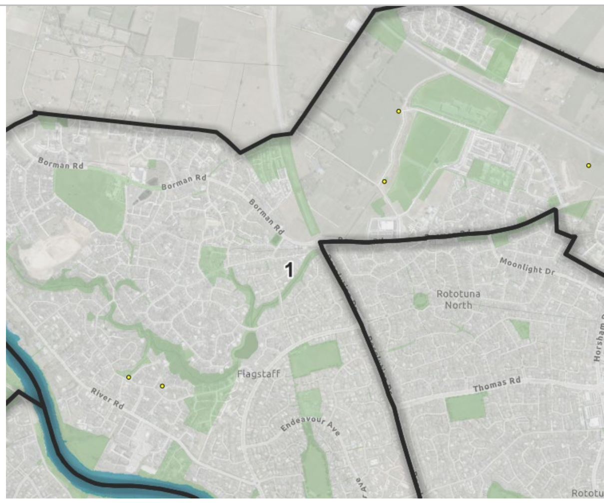


Fig 1.2 - 2031 Wet Weather Overflows

Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

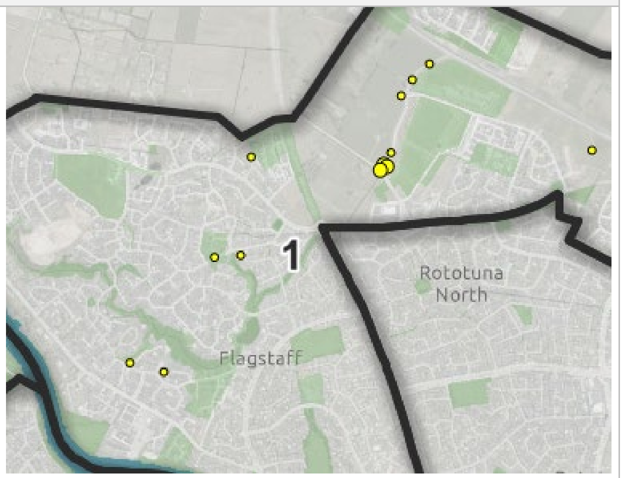


Fig 1.4 - 2061 Performance – Wet Weather overflows

1.6 Other Comments

It is likely that local smaller infrastructure will need to be upgraded to cope with the increased densities. Local public network infrastructure in private properties may also need to be relocated to Road reserve to allow full buildout of sections.

Area 2 – Huntington: Wastewater Assessment

1.1 Description

The area is serviced by the 1050mm dia Far Eastern Interceptor. A series of trunk mains connect the local reticulation to the interceptor. The eastern parts of Area 1 flow through Area 2 and discharge into the interceptor.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.37	2
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	1.72	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.4	1

1.3 Key Network Features

The Huntington area was developed from the mid - 1990s to c2010 generally in a northward direction.

Wastewater infrastructure in the southern extent around Endeavour Drive/ Alandale was developed between late 1980's to mid-1990s. Further development of the area occurred generally in a northward direction from the mid - 2000's and is still continuing. The northern eastern areas in the vicinity of the Waikato Expressway are yet to be developed.

A total of 16 Sewer Pump Stations are located within the area. Three are small riverside pumpstations (Durham Estate (SPS 129), Paratai (SPS140), Alandale (SPS92)). St Petersberg (SPS 135) is a local PS on the banks of the Te Awa o Katapaki stream/gully.

Woodridge (SPS 130), Cumberland (SPS 132), Endeavor (SPS091), Rototuna West (SPS 139), and North City (SPS146) are larger local/trunk pumpstations.

The Borman Rd Pump station (SPS 131) is located on the boundary with Area 2 and is a trunk SPS servicing both areas.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local and trunk network < 50% pipe full under dry weather conditions. ~600m of 300mm dia trunk pipeline along Barrington/ St James Drive between 50-75% full. ~200m section of 600mm dia pipeline through Cranmar Cl between 50-75% full. This 600mm dia section of the trunk main is located between two 675mm dia pipelines.

2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	No predicted wastewater overflows
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Far Eastern Interceptor flowing through and servicing the area is < 50% pipe full under dry weather conditions
4	Scale of funded interventions in the current LTP	No interventions identified in Master Plan
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local and trunk network < 50% pipe full under dry weather conditions, however ~600m of 300mm dia trunk pipeline along Barrington/ St James Drive between 50-75% full. ~200m section of 600 mm dia pipeline through Cranmar Cl also between 50-75% full. This section of the trunk main is constricted as it is located between two 675mm dia pipelines
6	2061 Modelled Local and Trunk Wet weather overflows	No predicted wastewater overflows
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Additional flow from overall upstream catchment results in ~600m length of 1050mm dia far eastern interceptor located downstream of Chapel Hill flowing between 50 - 75% full. However, no overflows the area created.
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Current master plan recommends a new staged bulk wastewater storage facility to manage additional flows into FEI. ~$16m for Stage 1.
9	Scale of investment to service “step change” in demand in long term. Excludes treatment plants	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely

1.5 Evidence Used to Support Assessment

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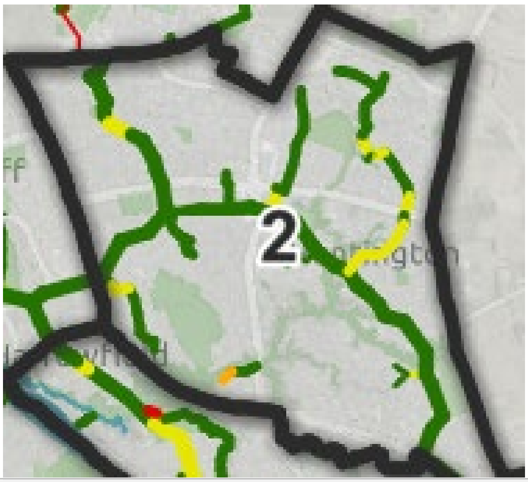
<td>
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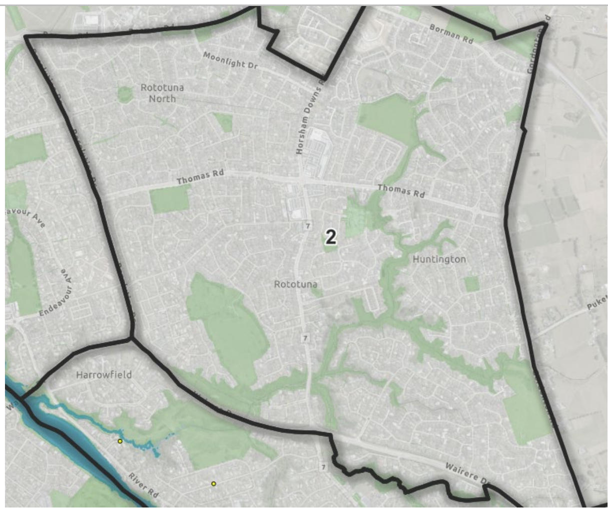
<td>
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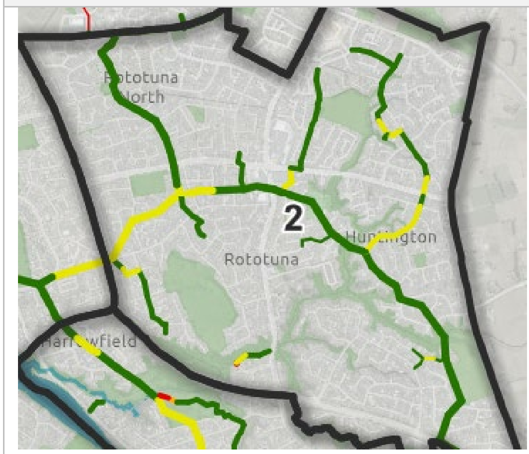
<td>
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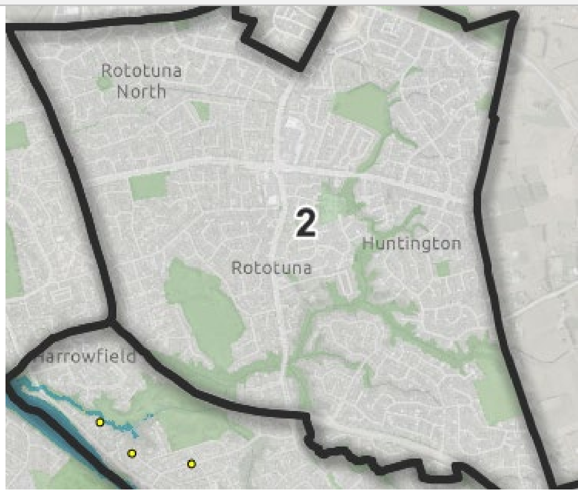
<td>
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1.6 Other Comments

It is likely that local smaller infrastructure will need to be upgraded to cope with the increased densities. Local public network infrastructure in private properties may also need to be relocated to Road reserve to allow full buildout of sections.

Area 3 – Chartwell: Wastewater Assessment

1.1 Description

The area is largely serviced by the 1050mm dia Eastern Interceptor. A small pocket in the north eastern corner of the area (Chedworth) is serviced through the Far Eastern Interceptor.

Description of the area including:

Area (ha), age of development, hydrologic sub-catchment it's located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features.

Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.13	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.77	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.58	3

1.3 Key Network Features

The majority of the Chartwell area was developed between early-1970s and early 1980s.

A total of 10 sewer pump stations are located within the area. The majority of the pump stations service small catchments. However, there are several larger local/trunk pump stations in the area (Chedworth (SPS012), Comries (SPS017), Fairfield (SPS024), McInnes (SPS052), McLaren (SPS053), Ranfurly (SPS064), and Wymer (SPS087).

Fairfield, Cussen, Wymer, Queenwood, Knights, and River North pump stations are located immediately adjacent to the main stem of the Waikato River. Tauhara, and McInnes pump stations are located on the edge of Kukutaaruhe Gully / Donny Park. Crosby and Chedworth are located adjacent to southern Kirikirioa Stream Gully.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local and trunk network < 50% pipe full under dry weather conditions. ~1,000m of 160mm dia service main (installed in 1985) located in Ranfurly Gully 50-75% pipe full under dry weather conditions. This pipeline is on the boundary with Area 5 but flows into Ranfurly SPS so is accounted for in Area 3 assessment.
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to	5 low frequency/low volume overflow locations predicted across the

	matrix of overflow frequency / volume used to guide the assessment)	area. Predicted overflow volume where Ranfurly SPS discharges to the local network >1000m3/annum. Overflow from Fairfield SPS ~400m3/annum. There are 3 further overflows on the boundary with Area 5. The overflows are from manholes and spill between 1 - 5 times per year with a total combined overflow volume of >4000m3/annum. Service line through Ranfurly Gully predicted to overflow infrequently with combined volume of <500m3/annum.
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Majority of interceptor servicing the area is between 50 - 75% full in dry weather conditions
4	Scale of funded interventions in the current LTP	Current master plan recommends two new staged bulk wastewater storage facilities to alleviate pressure on the Eastern Interceptor. One storage facility is in Area 3, the other is located upstream of Area 3. Investigation, planning and construction of these bulk storage facilities are funded in the current LTP. The gravity trunk mains immediately downstream of the Ranfurly pump station rising main are predicted to be under-capacity and causing manhole overflows. The preferred capacity upgrade is to upsize approximately 100 m of the downstream trunk main from DN225 to DN300 to reduce overflows. The upgrade is funded in the LTP. These investments will have an improvement on the overall network performance.
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local and trunk network < 50% pipe full under dry weather conditions. Small isolated pockets of pipelines between 50 - 75% to >100% pipe full under dry weather conditions ~1,000m long service main located in Ranfurly Gully 50-75% pipe full under dry weather conditions. This pipeline is on the boundary with Area 5 but flows into Ranfurly SPS so is accounted for in Area 3 assessment.
6	2061 Modelled Local and Trunk Wet weather overflows	6 predicted wet weather overflow locations in the area. All within proximity to receiving waterways and main stem of the river. Increased frequency and overflow volumes predicted downstream of Ranfurly SPS without infrastructure investment. Increased overflow volume predicted from Fairfield SPS.
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Majority of central interceptor servicing the area is between 50 - 75% full in dry weather conditions

8	Scale of investments identified in current Master Plans to service historic 2061 growth	Second stage of bulk storage facility identified in current master plan. ~$8m for Stage 2.
9	Scale of investment to service “step change” in demand in long term. Excludes treatment plants	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely

1.5 Example supporting Evidence used to inform assessment

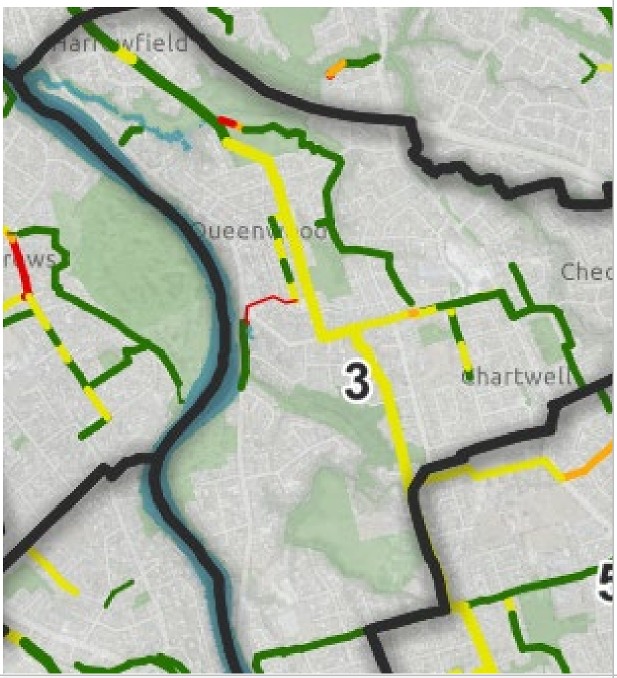


Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

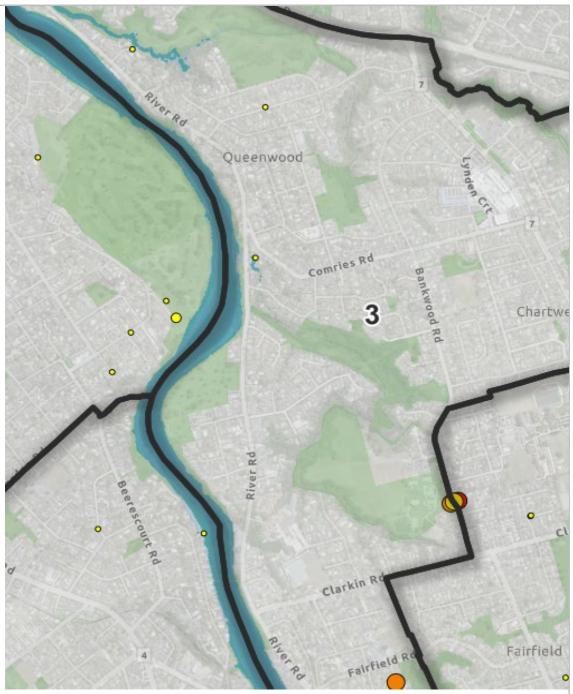


Fig 1.2 - 2031 Wet Weather Overflows

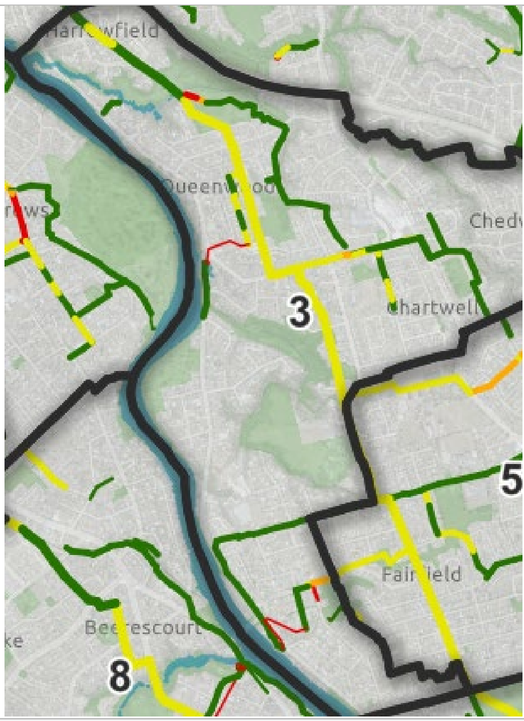
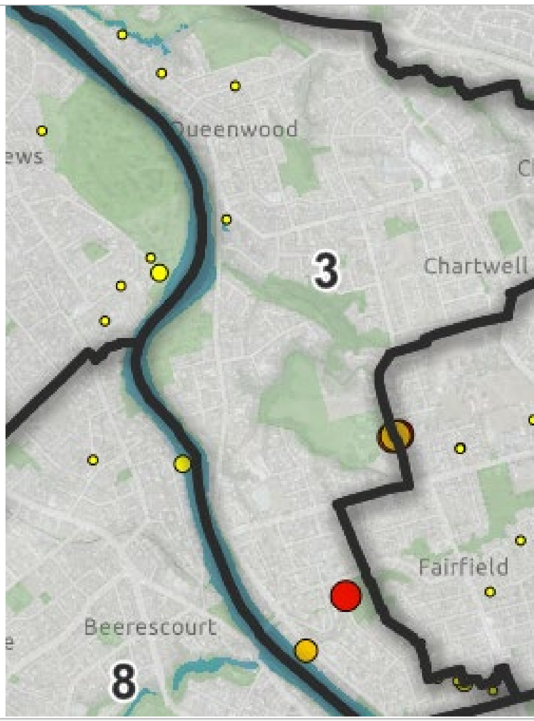
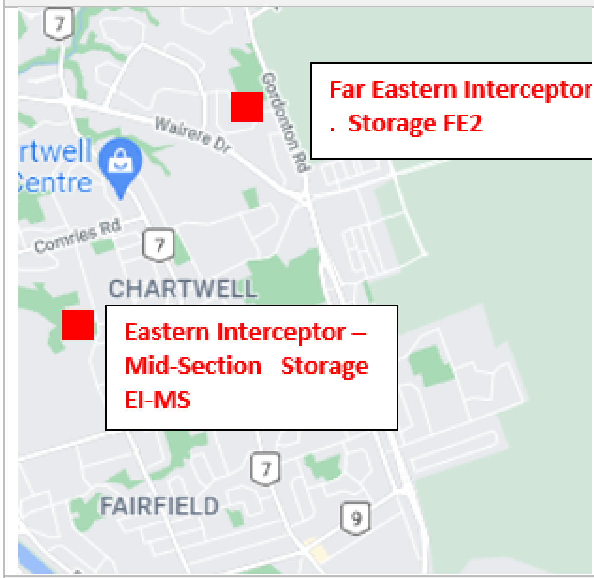


Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.



2061 Performance – Wet Weather overflows



LTP Funded projects

Eastern Interceptor Storage Stage 1	$14m
Eastern Interceptor Storage Stage 2	$8m
Ranfurly PS Pipe upgrades	$0.34m

Master Planned Investment

1.6 Other Comments

It is likely that local smaller infrastructure will need to be upgraded to cope with the increased densities. Local public network infrastructure in private properties may also need to be relocated to Road reserve to allow full buildout of sections.

Area 4 – Pukete East: Wastewater Assessment

1.1 Description

Area (ha), age of development, hydrologic sub-catchment it's located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.6	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.11	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.9	2

1.3 Key Network Features

The areas around the St Andrews Golf Course and either side of Wairere Dr were developed between the mid-1970s and the mid-1980s. Areas adjacent to the Te Rapa commercial area, on the banks oof the Waikato River and at the northern end of the area (Moreland Ave) were developed from the early-mid-1990s.

The confluence of the central interceptor (1800mm dia) and the eastern interceptor (1200mm dia) occurs in the northern extent of the area.

A total of 9 sewer pump stations are located within the area. 6 of the pumpstations are very small. The sandwich and Sycamore SPS are larger/trunk pump stations.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network < 50% pipe full under dry weather conditions. ~1500m of dia 300 - 375mm dia trunk main 50 - 75% full, and ~300m of 300mm dia >100% full
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	6 low frequency/ low volume overflow locations predicted across the area. One high frequency overflow at Sycamore SPS (located on bank of main river stem). Average annual overflow volume ~300m3. One low frequency moderate volume overflow at St.Andrews SPS (<200m3)

3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Interceptors that service the area both <50% full.
4	Scale of funded interventions in the current LTP	No interventions identified in Master Plan
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network < 50% pipe full under dry weather conditions. ~1500m of dia 300 - 375mm dia trunk main 50 - 75% full, and ~300m of 300mm dia >100% full
6	2061 Modelled Local and Trunk Wet weather overflows	7 low frequency/ low volume overflow locations predicted across the area. One high frequency overflow at Sycamore SPS (located on bank of main river stem). Average annual overflow volume ~300m3. One low frequency moderate volume overflow at st Andrews SPS (<200m3)
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Interceptors that service the area both <50% full.
8	Scale of investments identified in current Master Plans to service historic 2061 growth	No interventions identified in Master Plan
9	Scale of investment to service “step change” in demand in long term. Excludes treatment plants	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely

1.5 Example supporting Evidence used to inform assessment

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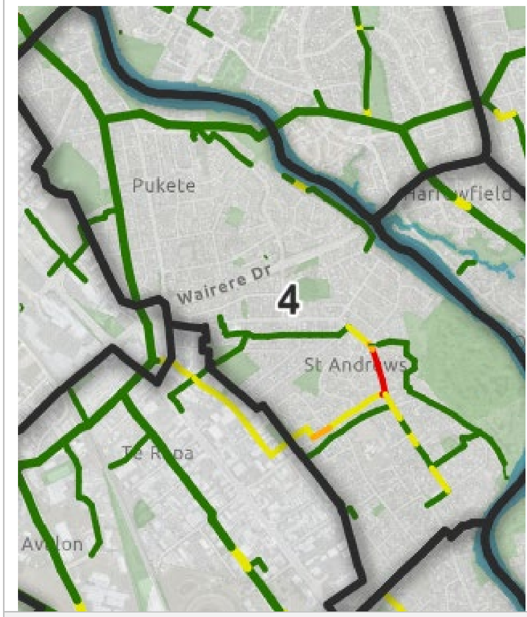
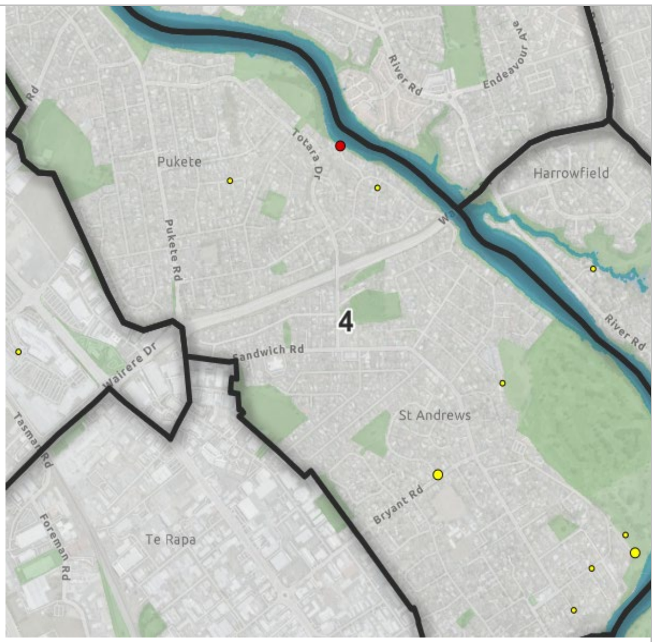
<td>
Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.</td>
<td>
Fig 1.2 - 2031 Wet Weather Overflows</td>
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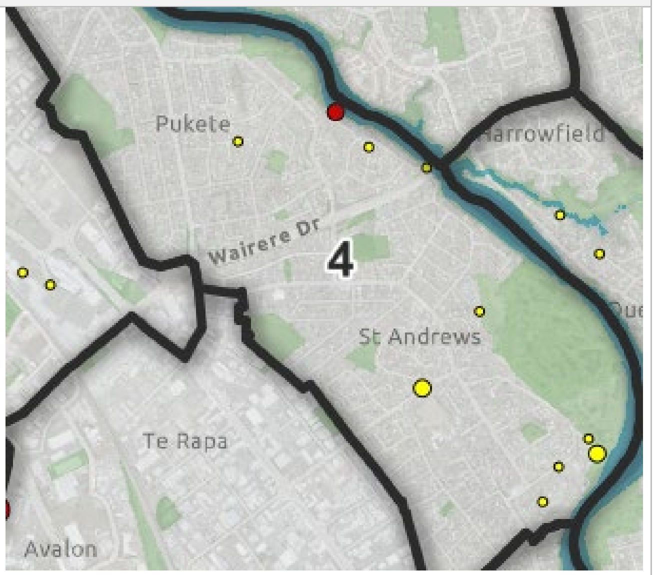
<td>
2061 Performance – Wet Weather overflows</td>
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<td>Sandwich Rd trunk main $6.7m</td>
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<td>**LTP Funded projects**</td>
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1.6 Other Comments

It is likely that local smaller infrastructure will need to be upgraded to cope with the increased densities. Local public network infrastructure in private properties may also need to be relocated to Road reserve to allow full buildout of sections.

Area 5 – Enderley North: Wastewater Assessment

1.1 Description

The Enderley North area was developed from the mid-1970s. Area (ha), age of development, hydrologic sub-catchment it's located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.27	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.98	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.84	3

1.3 Key Network Features

The area is currently serviced by the 1050mm dia Eastern Interceptor. The area is located in the mid-section of the interceptor. A series of trunk mains connect the local reticulation to the interceptor. A 450mm dia trunk main and two pump stations on Snells Dr currently convey flows from the eastern side of the area through St Pauls Collegiate to the interceptor.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network < 50% pipe full under dry weather conditions. ~1500 of dia 450mm dia trunk main 50 - 75% full, and ~400m 75% - 100% full. ~100m 100% full.
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	AREA CONSIDERED LOW IMPACT (DESPITE OVERFLOW PERFORMANCE) FOR THE PURPOSE OF THIS ASSESSMENT BECAUSE ALL OF THE RECOMMENDED UPGRADES IN THE CURRENT MASTER PLAN ARE FUNDED. 9 low frequency/ low volume overflow locations predicted across the area. 1 high frequency high volume overflow at receiving manhole downstream of Snells SPS discharge (~6,000m3). 1 mod frequency/ mod volume overflow further downstream on same trunk line (~500m3) Works currently underway will alleviate the high frequency, high volume overflow.

		Refer to comments on Area 3 for discussion on overflows along the eastern area boundary.
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Majority of interceptor servicing the area is between 50 - 75% full in dry weather conditions
4	Scale of funded interventions in the current LTP	Snells SPS funded and under construction. Upstream and downstream bulk storage facilities in design investigation phase. Construction of both storage facilities are funded in current LTP. These investments will have an improvement on the overall network performance. Enderley/Fifth Ave Pipeline Diversion funded. These investments will have an improvement on the overall network performance.
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network < 50% pipe full under dry weather conditions. ~1500 of dia 450mm dia trunk main 50 - 75% full, and ~400m 75% - 100% full. ~100m 100% full.
6	2061 Modelled Local and Trunk Wet weather overflows	AREA CONSIDERED LOW IMPACT (DESPITE OVERFLOW PERFORMANCE) FOR THE PURPOSE OF THIS ASSESSMENT BECAUSE ALL OF THE RECOMMENDED UPGRADES IN THE CURRENT MASTER PLAN ARE FUNDED. 11 low frequency/ low volume overflow locations predicted across the area. 1 high frequency high volume location.5 overflows/year. ~8000m/year at receiving manhole downstream of Snells SPS discharge. 1 mod frequency/ mod volume overflow further downstream on same trunk line (~600m3) Works currently underway will alleviate the high frequency, high volume overflow. Refer to comments on Area 3 for discussion on overflows along the eastern area boundary.
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Majority of interceptor servicing the area is between 50 - 75% full in dry weather conditions
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Second stage of bulk storage facility identified in current master plan. ~$8m for Stage 2.
9	Scale of investment to service "step change" in demand in long term. Excludes treatment plants	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely

1.5 Example supporting Evidence used to inform assessment

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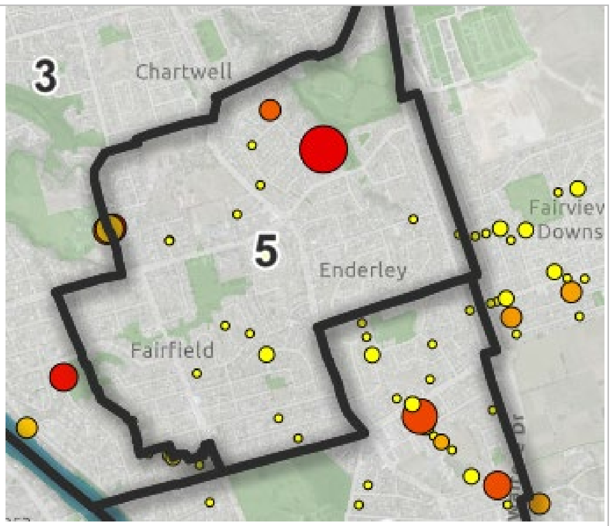
Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.</td>
<td>

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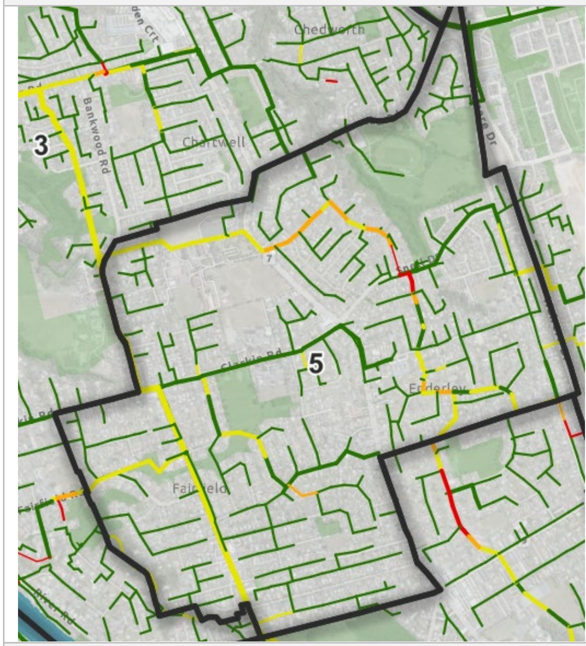
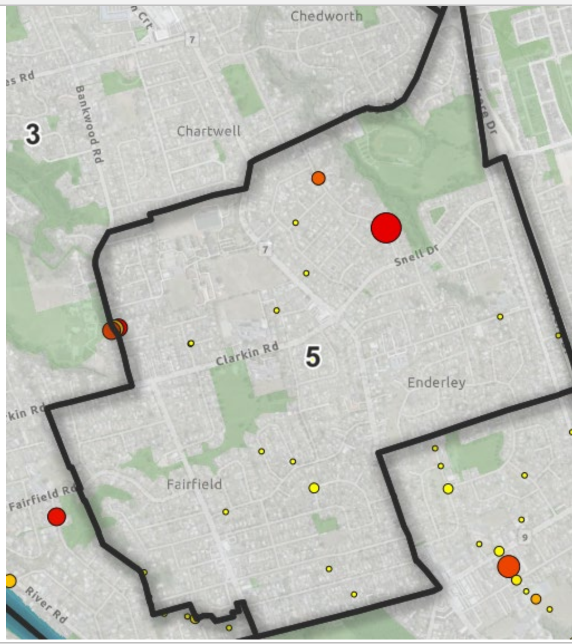
<td>

Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.</td>
<td>

2061 Performance – Wet Weather overflows</td>
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<td>Snells PS Upgrade and diversion $4.4m
Enderley Diversion $3.5m</td>
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<td>LTP Funded projects</td>
<td>Master Planned Investment</td>
</tr>
</table>

1.6 Other Comments

It is likely that local smaller infrastructure will need to be upgraded to cope with the increased densities. Local public network infrastructure in private properties may also need to be relocated to Road reserve to allow full buildout of sections.

While this area has a number of projects either underway or funded the local network is not considered in any of them. They are large scale investments in strategic infrastructure.

Area 6 – Claudelands: Wastewater Assessment

1.1 Description

Area (ha), age of development, hydrologic sub-catchment it's located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.27	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.98	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.84	3

1.3 Key Network Features

The Claudelands area was developed in the 1930s-40s with the Eastern Interceptor running through it installed in the 1970s.

The area is served by the 900mm Eastern Interceptor via a gravity network with one pumpstation SPS077 Strangs lifting flows from the Riverside properties to the gravity network. SPS077 also takes flows from SPS060 Opoia which is located in are 7 Hamilton East

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network < 50% pipe full under dry weather conditions. ~1300m long 225mm dia trunk main along Tennyson Rd, through private property to East Street varies. ~400m 100% full, ~800m between 50% - 100% full
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	AREA CONSIDERED LOW IMPACT (DESPITE OVERFLOW PERFORMANCE) FOR THE PURPOSE OF THIS ASSESSMENT BECAUSE ALL OF THE RECOMMENDED UPGRADES IN THE CURRENT MASTER PLAN ARE FUNDED. Large number (28) of overflow locations throughout the area. Majority are infrequent and low volume overflows from local reticulation as a result of capacity constraints downstream. 13 overflows associated with Tennyson Trunk main with total volume > ~4,000m3/annum ~500m3/annum overflows in the vicinity of Wairere Dr local reticulation.

3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Majority of interceptor servicing the area is between 50 - 75% full in dry weather conditions
4	Scale of funded interventions in the current LTP	Snells SPS funded and under construction. Upstream and downstream bulk storage facilities in design investigation phase. Construction of both storage facilities are funded in current LTP. These investments will have an improvement on the overall network performance. Enderley/Fifth Ave Pipeline Diversion funded. These investments will have an improvement on the overall network performance.
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Local network < 50% pipe full under dry weather conditions. ~1300m long 225mm dia trunk main along Tennyson Rd, through private property to East Street varies. ~400m 100% full, ~800m between 50% - 100% full
6	2061 Modelled Local and Trunk Wet weather overflows	AREA CONSIDERED LOW IMPACT (DESPITE OVERFLOW PERFORMANCE) FOR THE PURPOSE OF THIS ASSESSMENT BECAUSE ALL OF THE RECOMMENDED UPGRADES IN THE CURRENT MASTER PLAN ARE FUNDED. Large number (30) of overflow locations throughout the area. Significant increase in overflow volumes from local reticulation and Tennyson Trunk Main as a result of capacity constraints downstream. 15 overflows associated with Tennyson Trunk main with total volume > ~5500m3/annum ~900m3/annum overflows in the vicinity of Wairere Dr local reticulation.
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Majority of interceptor servicing the area is between 50 - 75% full in dry weather conditions
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Second stage of bulk storage facility identified in current master plan. ~$8m for Stage 2.
9	Scale of investment to service “step change” in demand in long term. Excludes treatment plants	Local and trunk infrastructure replacements required. Increase in bulk storage volume required, duplication of interceptors likely

1.5 Example supporting Evidence used to inform assessment

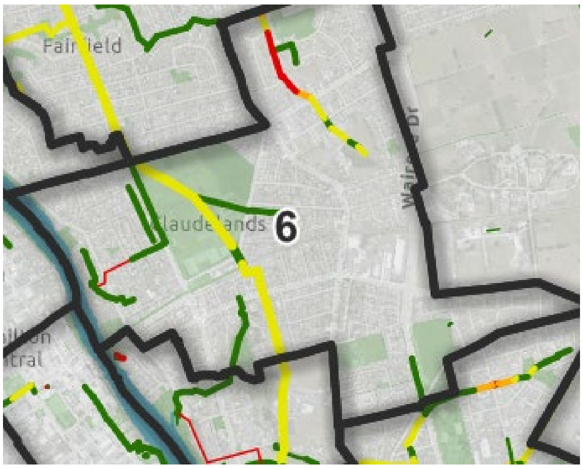


Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

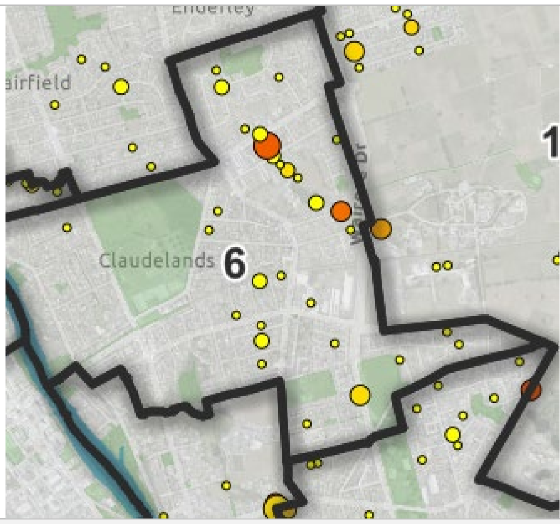


Fig 1.2 - 2031 Wet Weather Overflows

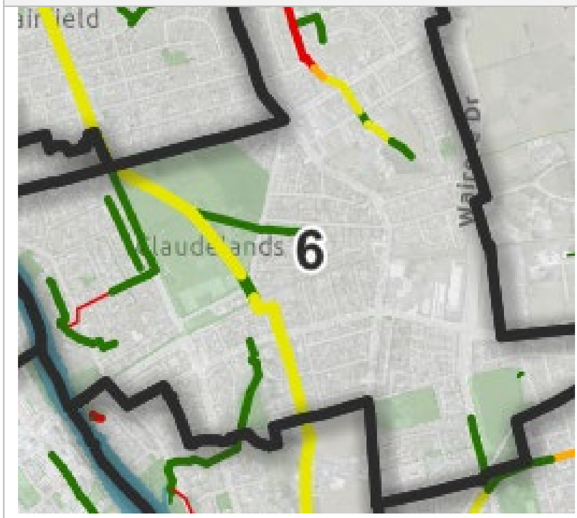


Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

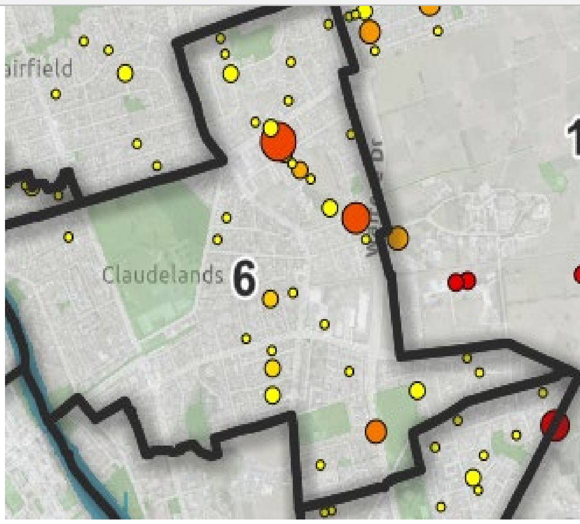


Fig 1.4 - 2061 Performance – Wet Weather overflows

1.6 Other Comments

It is likely that local smaller infrastructure will need to be upgraded to cope with the increased densities. Local public network infrastructure in private properties may also need to be relocated to Road reserve to allow full buildout of sections.

Area 7 – Hillcrest East: Wastewater Assessment

1.1 Description

Area (ha), age of development, hydrologic sub-catchment it's located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.23	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.95	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.82	3

1.3 Key Network Features

The Hamilton East area was developed in the 1920s-40s with the trunk WW infrastructure at the head of the Eastern Interceptor installed in the 1970s.

The area is served by the Eastern Interceptor with properties West of Grey Street (Hayes Paddock) discharging through a gravity network to SPS015 Clyde and then discharging to a trunk main in Clyde St leading to the Eastern Interceptor. The area to the East of Grey Street discharges predominately by gravity network to the Eastern Interceptor with small pumpstations SPS112 Foxlane and SPS118 Hungerford lift flows form the lower areas to the gravity. Hamilton Gardens is serviced by SPS068 Rose Garden which also lifts flows into the gravity network

Flows from area 14 Greensboro enter the gravity network in this area from the East.

A bulk storage facility is currently proposed in this area to assist with pressure on the Eastern Interceptor.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local and trunk network < 50% pipe full under dry weather conditions. ~450mm of 300mm dia trunk main along Riverside walk is between 50% - 100% full, however not surcharging. ~200m of local pipeline to Opoia SPS >100% full.
2	2031 Modelled Local and Trunk Wet weather	Frequent (>5) and high volume ~1,700m3/annum overflows from manholes on Clyde St and Kelvin Place. Overflows are on the

	overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	600mm dia Interceptor. Several low volume/low frequency overflows shown in vicinity of Firth/Albert Street. Bridge St SPS shown as an overflow location, but SPS has been decommissioned and Hillsborough SPS recently upgraded so disregard this location.
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Majority of upper Eastern Interceptor flowing through the area is between 50 - 75% full.
4	Scale of funded interventions in the current LTP	Bulk storage facility to be located in this area to alleviate Eastern Interceptor capacity constraints in design investigation phase. Construction of is funded in current LTP. These investments will have an improvement on the overall network performance.
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local and trunk network < 50% pipe full under dry weather conditions. ~450mm of 300mm dia trunk main along Riverside walk is between 50% - 100% full, however not surcharging. ~200m of local pipeline to Opoia SPS >100% full.
6	2061 Modelled Local and Trunk Wet weather overflows	Frequent (>5) and high volume ~2900m3/annum overflows from manholes on Clyde St and Kelvin Place. Overflows are on the 600mm dia Interceptor. Several low volume/low frequency overflows shown in vicinity of Firth/Albert Street. Bridge St SPS shown as an overflow location, but SPS has been decommissioned and Hillsborough SPS recently upgraded so disregard this location.
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Additional flow from overall catchment increases the length of interceptor flowing between 5. - 75% full. However, not overflows in the vicinity of the area created.
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Upgrade to ~700m to 300/375mm trunk main in vicinity of Firth Street identified in the Master Plan. ~$1.7m
9	Scale of investment to service “step change” in demand in long term. Excludes treatment plants	

1.5 Example supporting Evidence used to inform assessment

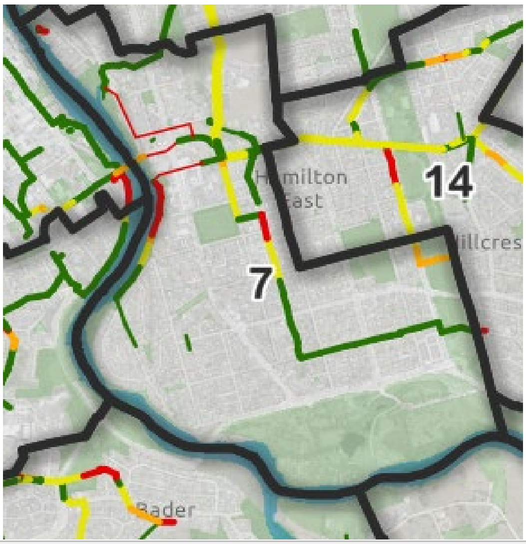


Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

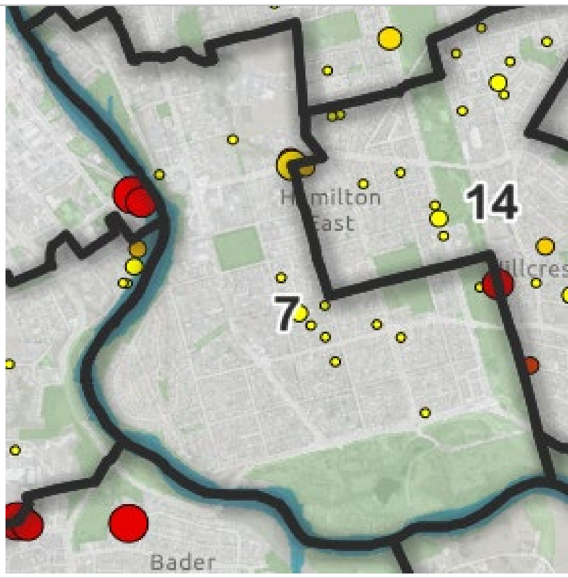


Fig 1.2 - 2031 Wet Weather Overflows

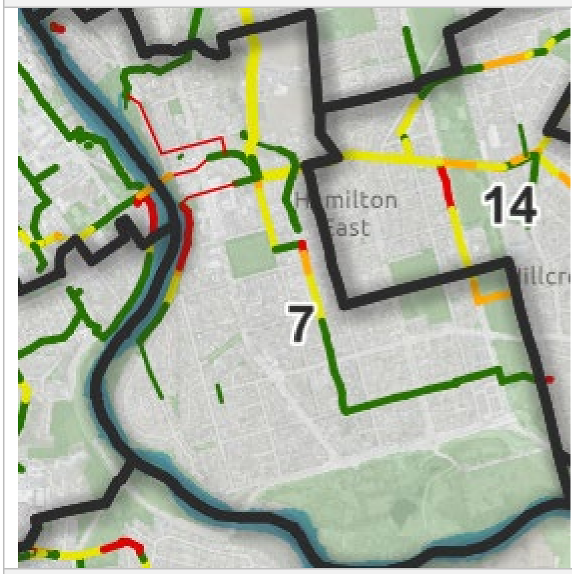


Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

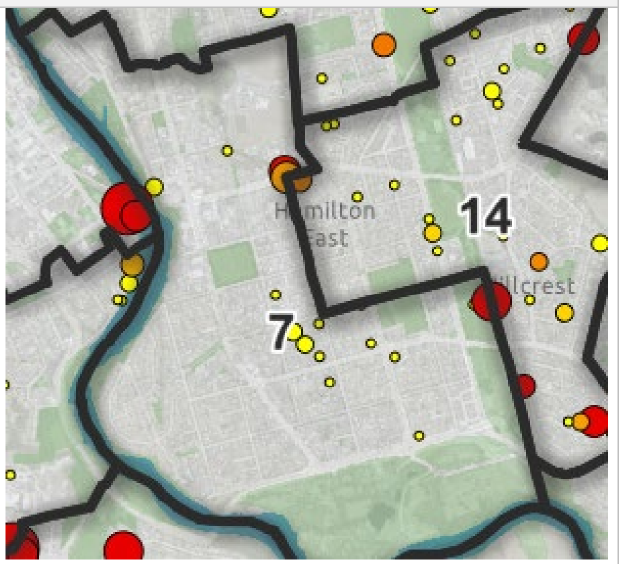


Fig 1.4 - 2061 Performance – Wet Weather overflows

LTP Funded projects	Eastern Interceptor Upper Storage $20m Firth Street Pipe Upgrade $1.7m Master Planned Investment

1.6 Other Comments

It is likely that local smaller infrastructure will need to be upgraded to cope with the increased densities. Local public network infrastructure in private properties may also need to be relocated to Road reserve to allow full buildout of sections.

Area 8 – Beerescourt: Wastewater Assessment

1.1 Description

Area (ha), age of development, hydrologic sub-catchment its located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.23	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.95	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.82	3

1.3 Key Network Features

The Beerescourt was developed from the 1920s-50s and covers a large area to the North Northwest of the central city.

The area is served by both the Central and Western Duplication Interceptors. There are several pumpstations that lift the flows to gravity networks discharging to each of interceptors.

SPS030 Gwynne, SPS023 Edgecombe, SPS072 Seddon are all substantial stations and discharge to the 600mm Central Interceptor. SPS040 Kingsway also discharges to the gravity network leading to the Central but has a very small catchment. SPS002 Ann located on the banks of the Waikato River also ultimately discharges to the Central.

SPS065 Rimu Rata, SPS066 Rimu, SPS123 Minogue all discharge into the gravity network leading to the Western Duplication Interceptor.

Area between Tainui Street, Queens Ave to the railway drains into Gwynne SPS catchment. Frankton commercial area to Tahi Street drains into the Seddon SPS.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network < 50% pipe full under dry weather conditions. ~500m of 300mm-375mm dia trunk main upstream of Gwynne SPS >100% full. ~600m of 300mm dia trunk main upstream of Seddon SPS >100% full.

		~300m of 225mm dia trunk main on Cunningham 50 - 75% full. ~150m of 150mm local main along Maeroa Rd from Victoria Street to central interceptor >100% ~500m of 150mm local main from Storey Ave, Garnett Ave, Dalgliesh Ave to Central interceptor between 50% to >100% full
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	11 predicted low frequency/low volume overflows throughout the area. All less than 0.2 OF/yr. >5 overflows/annum from Seddon SPS and trunk main with total annual overflow volume of ~2,500m3. 4 overflows/annum from manhole on Forestlake Rd upstream of western interceptor. With total annual overflow volume ~1500m3. This predicted overflow needs to be verified with connection to recently installed mid- western duplication.
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	~50% (1000m) of 525mm dia central interceptor flowing through and servicing the majority of the area between 50 - 75% full.
4	Scale of funded interventions in the current LTP	No interventions identified in Master Plan
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network < 50% pipe full under dry weather conditions. ~500m of 300mm-375mm dia trunk main upstream of Gwynne SPS >100% full. ~600m of 300mm dia trunk main upstream of Seddon SPS >100% full. ~300m of 225mm dia trunk main on Cunningham 50 - 75% full. ~350m of 150mm local main along Maeroa Rd from Victoria Street to central interceptor >100% ~500m of 150mm local main from Storey Ave, Garnett Ave, Dalgliesh Ave to Central interceptor between 50% to >100% full
6	2061 Modelled Local and Trunk Wet weather overflows	11 predicted low frequency/low volume overflows throughout the area. All less than 0.2 OF/yr. >5 overflows/annum from Seddon SPS and trunk main with total annual overflow volume of ~2800m3. >5 overflows/annum from manhole on Forestlake Rd upstream of western interceptor. With total annual overflow volume ~2700m3. This predicted overflow needs to be verified with connection to recently installed mid- western duplication.

7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	~50% (1000m) of 525mm dia central interceptor between 50 - 75% full.
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Seddon SPS Upgrade recommended to accommodate growth $3m
9	Scale of investment to service “step change” in demand in long term. Excludes treatment plants	

1.5 Example supporting Evidence used to inform assessment

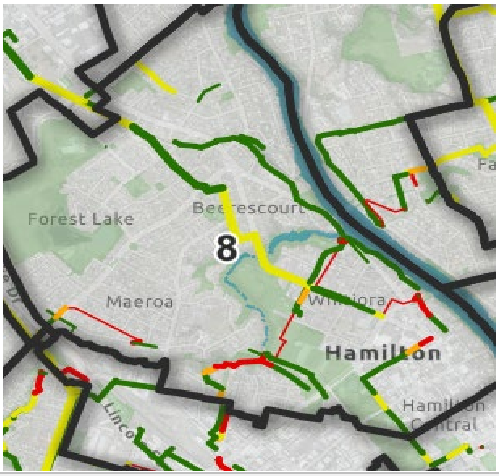


Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

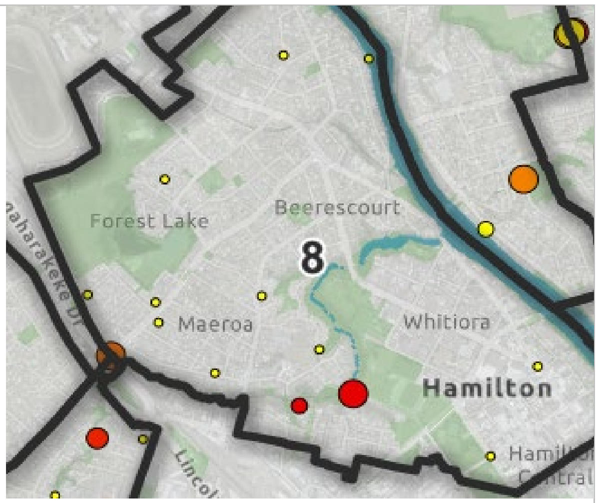


Fig 1.2 - 2031 Wet Weather Overflows

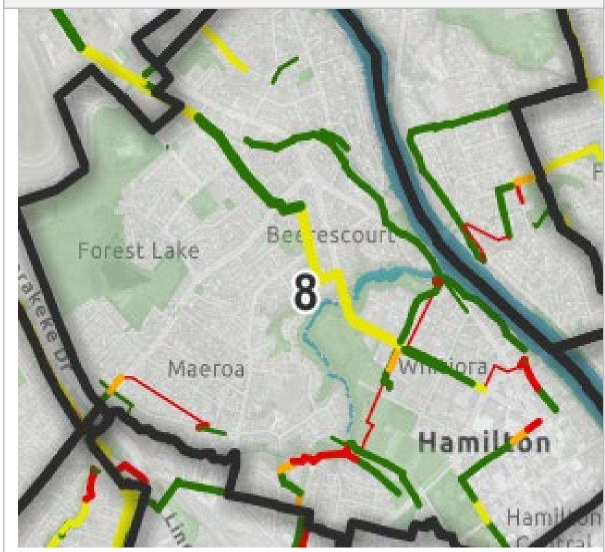


Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

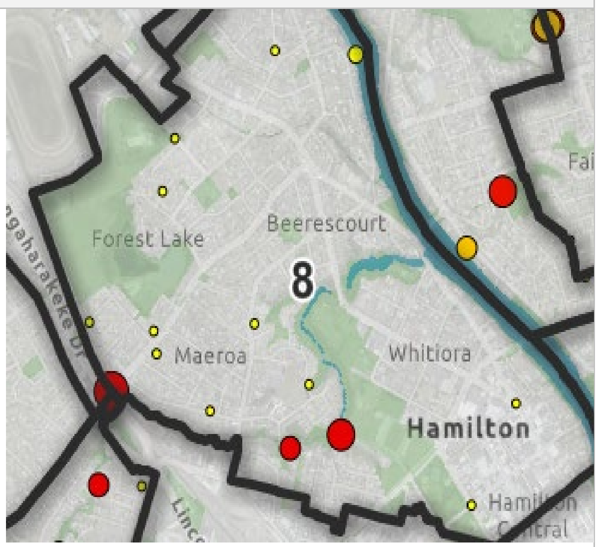


Fig 1.4 - 2061 Performance – Wet Weather overflows

	Seddon Ps Upgrade	$2.6m
LTP Funded projects	Master Planned Investment	

1.6 Other Comments

It is likely that local smaller infrastructure will need to be upgraded to cope with the increased densities. Local public network infrastructure in private properties may also need to be relocated to Road reserve to allow full buildout of sections.

Area 9 – Crawshaw: Wastewater Assessment

1.1 Description

Area (ha), age of development, hydrologic sub-catchment it's located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.20	2
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	1.57	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.3	1

1.3 Key Network Features

The Crawshaw area has been developed from the 1960s through to the early 2000s and is on the Western boundary of the city

The area is predominately served by the 900mm Western Interceptor with a small part of the area discharging into area 10 Dinsdale North. There are 6 pumpstations in the area. SPS107 Palm discharges into area 10. SPS055 Park View, SPS098 Grandview, SPS022 David, SPS105 Highgrove, SPS090 Crawshaw all ultimately discharge into the Western Interceptor.

There is a 300mm trunk main running from the Western Interceptor up Grandview Road.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network < 50% pipe full under dry weather conditions. ~1,100m long 300/375mm dia trunk main down Grandview Rd is between 50% - >100% full ~500m of 300/375mm dia trunk main along Breckons Ave between 50- 75% full.
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	7 predicted low frequency/low volume overflows through the area as a result of trunk main constraints.

3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Area is serviced by the mid-section of the Western Interceptor which has recently been duplicated. The modelling results do not include this new pipeline which was installed to alleviate capacity constraints in the area.
4	Scale of funded interventions in the current LTP	Mid-section western interceptor duplicated in 2020.
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network < 50% pipe full under dry weather conditions. ~1,100m long 300/375mm dia trunk main down Grandview Rd is between 50% - >100% full ~500m of 300/375mm dia trunk main along Breckons Ave between 50- 75% full.
6	2061 Modelled Local and Trunk Wet weather overflows	7 predicted low frequency/low volume overflows through the area as a result of trunk main constraints.
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Area is serviced by the mid-section of the Western Interceptor which has recently been duplicated. The modelling results do not include this new pipeline which was installed to alleviate capacity constraints in the area.
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Significant investment is required in the upper section of the western interceptor to minimise overflows and accommodate growth upstream of Dinsdale.
9	Scale of investment to service “step change” in demand in long term. Excludes treatment plants	

1.5 Example supporting Evidence used to inform assessment

Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

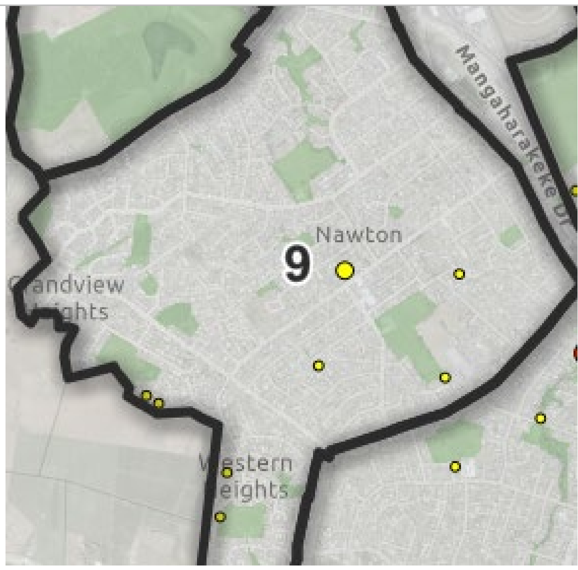


Fig 1.2 - 2031 Wet Weather Overflows

Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

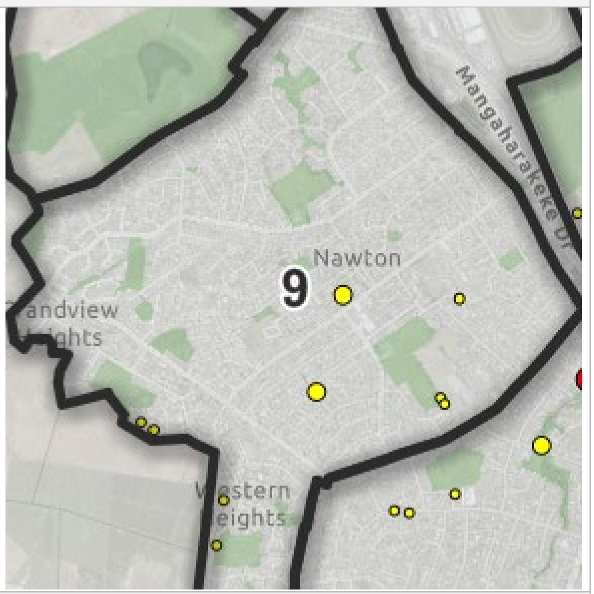


Fig 1.4 - 2061 Performance – Wet Weather overflows

1.6 Other Comments

It is likely that local smaller infrastructure will need to be upgraded to cope with the increased densities. Local public network infrastructure in private properties may also need to be relocated to Road reserve to allow full buildout of sections.

Area 10 – Dinsdale North: Wastewater Assessment

1.1 Description

Area (ha), age of development, hydrologic sub-catchment its located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.03	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.77	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.7	3

1.3 Key Network Features

The Dinsdale North area has had many stages of development through the years ranging from the 1930s through to the more recent infill development along Massey and Killarney in the 2000s.

The area is served by the Western Interceptor and has 3 pumpstations in the catchment.

SPS 021 Dinsdale is the largest station by volume in Hamilton and is online of the Western Interceptor lifting flows. SPS119 Karen takes the flows from Temple View along with gravity flows from the surrounding area and discharges downstream of SPS021 into one of the twin interceptors on Rifle Range Road. SPS027 Frederick takes flows from 300mm trunk main running along the Waitawhiriwhiri Stream and discharges into the Western Interceptor.

The Waitawhiriwhirir Gully and Stream run through the middle of this area and has a result of being the lower parts of the catchment contains significant WW infrastructure.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network <50% pipe full under dry weather conditions. Majority of trunk network between 50 - 75% pipe full. These pipelines include 1,000m of 300mm dia trunk main along Bremworth and 1,100m long 225/300mmpipeline from Aberdeen Dr to Aberfoyle and along the Waitawhiriwhiri Stream. 900m long 225/300mm dia trunk main connecting to Western Interceptor at Karen Cres 50-75% pipe full.

2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	Several overflows in the vicinity of Bremworth Ave trunk main. ~1,600m3/annum. Frequent overflow upstream of Frederick SPS. ~600m3/annum directly adjacent to Waitawhiriwhiri Stream. Cluster of low frequency overflows in vicinity of Karen Cres
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	The majority of the 600/675mm diameter Western Interceptor is >100% pipe full under dry weather conditions. Dinsdale SPS upgrade has been put on hold, but previously identified as being necessary. The (dual) western interceptor downstream of Dinsdale is shown as between 50-75% full, however the modelling results need to include the recently completed mid -section duplication.
4	Scale of funded interventions in the current LTP	Bulk storage facility to be located in this area to alleviate pressure on Western Interceptor and reduce overflows. The facility is funded in the current LTP.
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network <50% pipe full under dry weather conditions. Majority of trunk network between 50 - 75% pipe full. These pipelines include 1,000m of 300mm dia trunk main along Bremworth and 1,100m long 225/300mmpipeline from Aberdeen Dr to Aberfoyle and along the Waitawhiriwhiri Stream. 900m long 225/300mm dia trunk main connecting to Western Interceptor at Karen Cres 50-75% pipe full.
6	2061 Modelled Local and Trunk Wet weather overflows	Significant incrase in the frequency and volumes of overflows in the area. In particular along the Bremworth trunk mainl, Karen SPS and the trunk network near Karen Cres.
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	The majority of the 600/675mm diameter Western Interceptor is >100% pipe full under dry weather conditions. Dinsdale SPS upgrade has been put on hold, but previously identified as being necessary. The (dual) western interceptor downstream of Dinsdale is shown as between 50-75% full, however the modelling results need to include the recently completed mid -section duplication.
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Upgrade to Frederick SPS is identified in current master plan $2.3m Upgrade of Karen SPS identified in current master plan $2.3m
9	Scale of investment to service “step change” in demand in long term. Excludes treatment plants	

1.5 Example supporting Evidence used to inform assessment

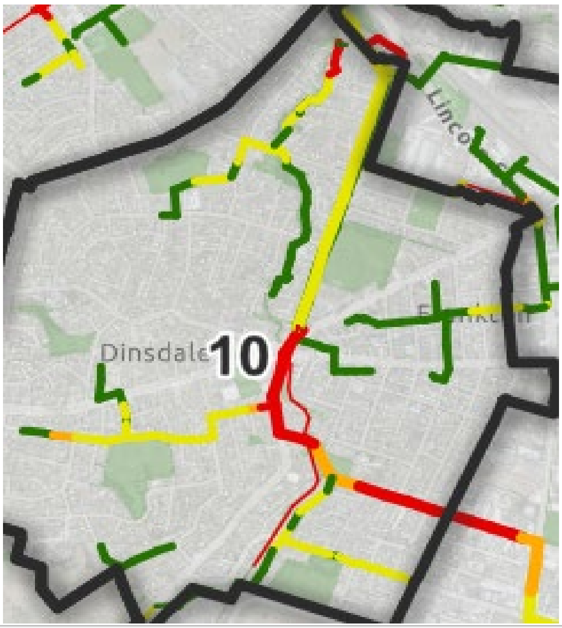


Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

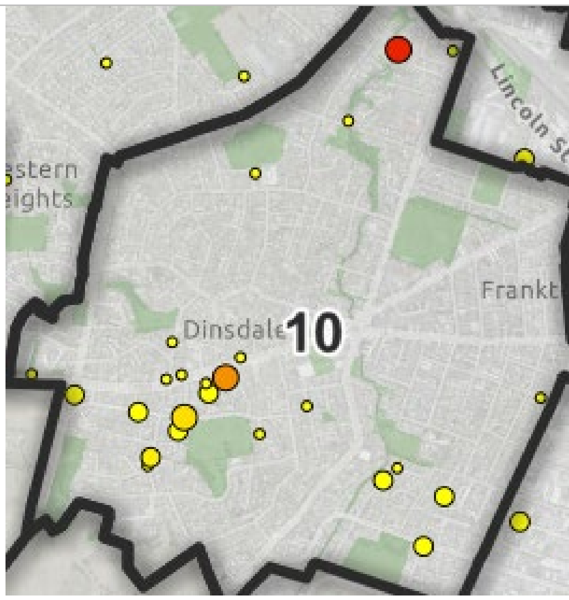


Fig 1.2 - 2031 Wet Weather Overflows

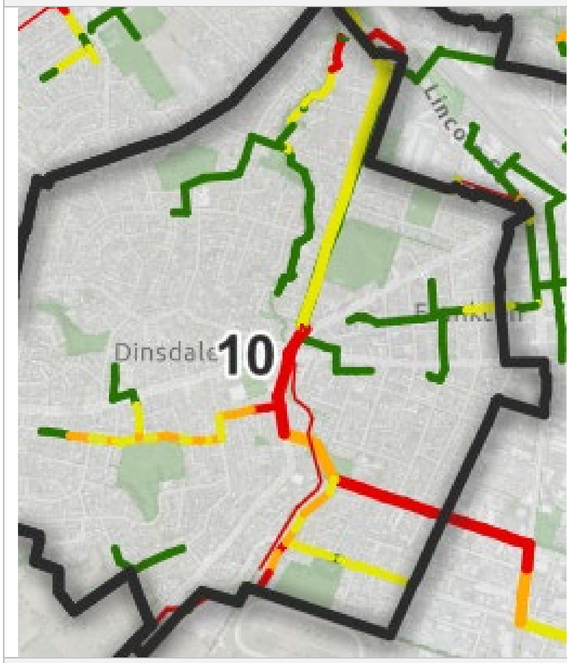


Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

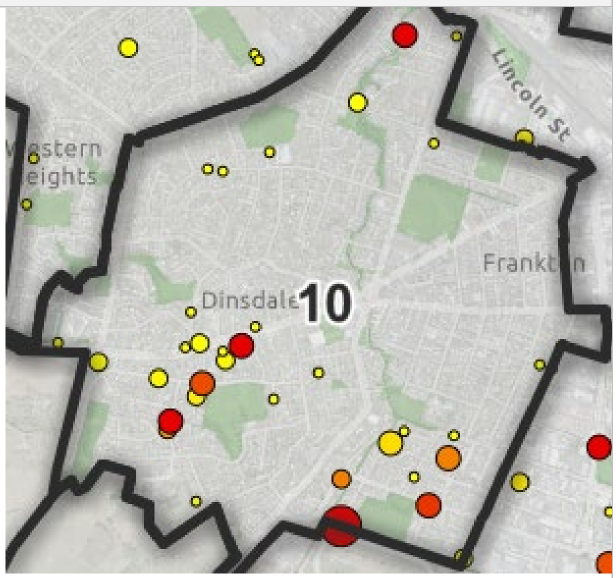
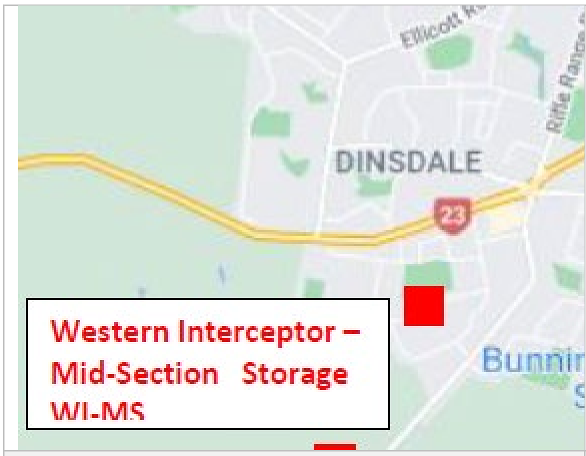


Fig 1.4 - 2061 Performance – Wet Weather overflows

	Western Mid-Section Storage Stage 1 $10m Western Mid-Section Storage Stage 2 $7m Dinsdale SPS Western (upper) duplication $52m Frederick SPS Upgrade $2.3 Karen SPS Upgrade $2.3
LTP Funded projects	Master Planned Investment

1.6 Other Comments

It is likely that local smaller infrastructure will need to be upgraded to cope with the increased densities. Local public network infrastructure in private properties may also need to be relocated to Road reserve to allow full buildout of sections.

Area 11 – Hamilton Lakes: Wastewater Assessment

1.1 Description

Area (ha), age of development, hydrologic sub-catchment it's located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.20	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.92	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.80	3

1.3 Key Network Features

The Hamilton Lake area has been developed from the 1920s through the 1950s with pockets of newer development occurring in the 2000s.

The Eastern portion of the area discharges ultimately to the Eastern Interceptor across the river via SPS150 Grantham. The Western and Southern portion of the area discharges to the Western Interceptor.

There are 11 pumpstations in the area. SPS042 Lake1, SPS043 Lake2, and SPS088 Yacht are located around the lake and predominately serve amenities such as toilet blocks and the cafe facilities.

SPS037 Hospital1 and SPS038 Hospital2 are located within the Waikato Hospital grounds and service a large portion of that facility and discharge into the network leading to the Eastern Interceptor.

SPS036 Horne and SPS013 Clarence both discharge into the gravity network leading to SPS150 Grantham which discharges across the river into the head of the Eastern interceptor.

SPS032 Hibiscus, SPS029 Gilbass1, and SPS029 Gilbass2 discharge to the gravity network leading to the Western Interceptor.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local and trunk network < 50% pipe full under dry weather conditions. ~300m of 225mm dia is 50-75% pipe full under dry weather conditions

2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	12 low frequency/low volume overflows in vicinity of Lake Rotorua and Hillsborough. 2 low frequency overflows ~100m3/annum in vicinity of Lake Rotorua. Low frequency overflows ~500m3/annum on pipeline upstream of Hillsborough SPS. Hillsborough SPS has recently been upgraded which will alleviate overflows and capacity challenges shown in modelling results.
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Area is serviced by upper western interceptor which is known to have significant capacity constraints. ~50,000m3/annum overflow from the upper western interceptor immediately upstream of Area 11 .
4	Scale of funded interventions in the current LTP	Upper Western Interceptor duplication identified in the most recent Wastewater Master plan but not funded in the current LTP ($50m+)
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local and trunk network < 50% pipe full under dry weather conditions. ~300m of 225mm dia is 50-75% pipe full under dry weather conditions
6	2061 Modelled Local and Trunk Wet weather overflows	12 low frequency/low volume overflows in vicinity of Lake Rotorua and Hillsborough. 2 low frequency overflows ~100m3/annum in vicinity of Lake Rotorua. Low frequency overflows ~500m3/annum on pipeline upstream of Hillsborough SPS.
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Area is serviced by upper western interceptor which is known to have significant capacity constraints. ~7500m3/annum overflow from the upper western interceptor immediately upstream of Area 11.
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Upper Western Interceptor duplication identified in the most recent Wastewater Master plan but not funded in the current LTP. ($50m+) Upgrades to local network near lake identified in current master plan $4.1m
9	Scale of investment to service “step change” in demand in long term. Excludes treatment plants	

1.5 Example supporting Evidence used to inform assessment

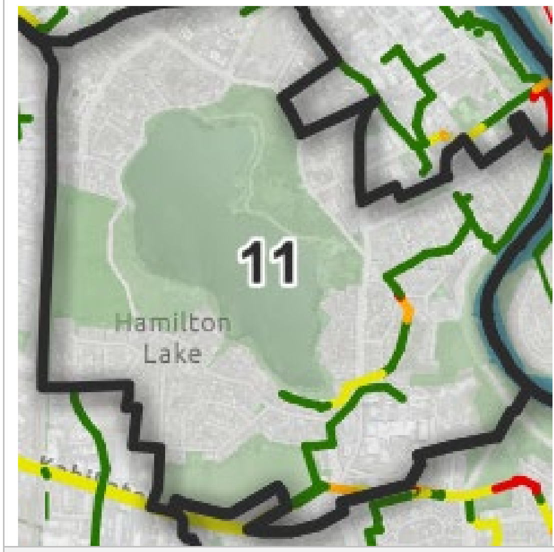
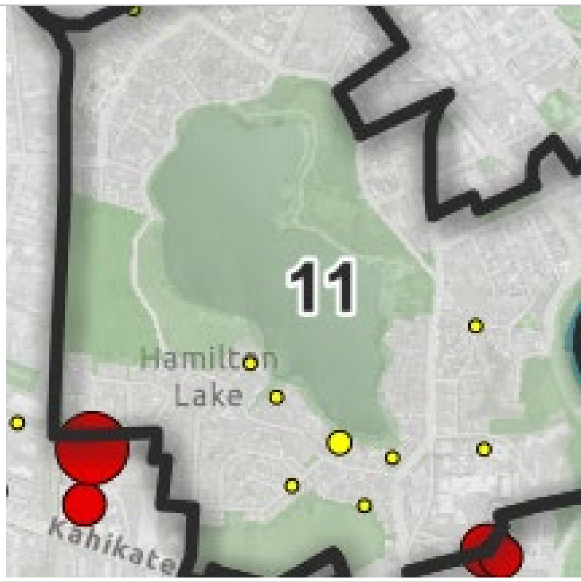
	

Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.	*Fig 1.2 - 2031 Wet Weather Overflows*

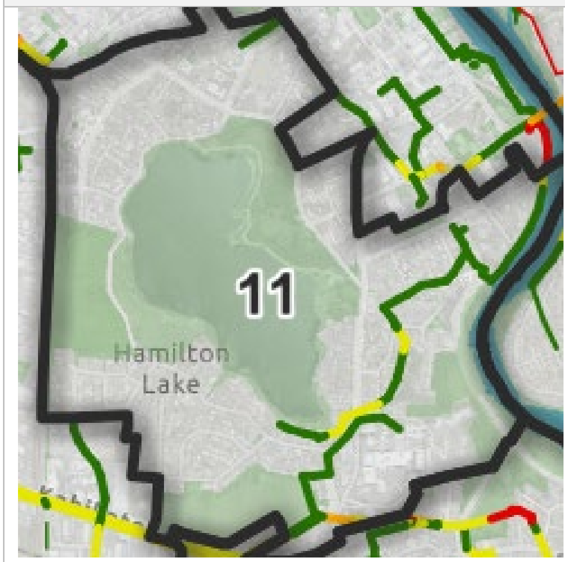
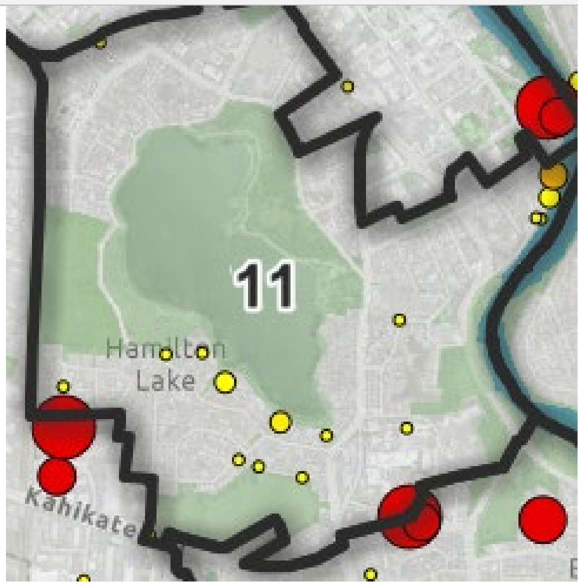

	

Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.	*Fig 1.4 - 2061 Performance – Wet Weather overflows*
	Lakes Pipe Upgrades $4.1m Western (upper) duplication $52m
LTP Funded projects	Master Planned Investment

1.6 Other Comments

It is likely that local smaller infrastructure will need to be upgraded to cope with the increased densities. Local public network infrastructure in private properties may also need to be relocated to Road reserve to allow full buildout of sections.

Area 12 – Mangakootukutuku/Bader: Wastewater Assessment

1.1 Description

Area (ha), age of development, hydrologic sub-catchment it's located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.8	4
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	3.73	4
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	3.7	4

1.3 Key Network Features

The Mangakootukutuku area was developed in the 1960s-70s. The area is almost solely residential with a large gully network passing through it.

The area is served by the Western Interceptor via a network of gravity mains and 19 pumpstations. The area has a high number of pumpstations due to the topography and gully network not allowing large trunk mains to be constructed.

SPS044 Lorne St is a large pumpstation that takes a large proportion of the flows from this catchment and lifts it to the head of the Western Interceptor. SPS016 Collins is another large station in the area and discharges flows into trunk networks that lead to the Western Interceptor.

The reaming pumpstations are SPS108 Catalina, SPS059 Ohaupo, SPS082 Tomin, SPS083 Ulrich, SPS062 Pine Ave, SPS111 Normandy34, SPS056 Normandy, SPS014 Cleveland. SPS009 Bruce, SPS075 Splitt, SPS080 Te Anau, SPS058 McMurdo. SPS094 Sunny Hills, SPS147 Dixon, SPS047 Manor, SPS025 Fitzroy, and SPS061 Peacocke.

A portion of this network is to be diverted to area 18 Peacocke.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network <50% pipe full but with several pockets where local network is 50 - >100% pipe full. Around half of the trunk network in the area is 50 - >100% pipe full.
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to	Extensive low frequency/low volume overflows throughout the area.

	matrix of overflow frequency / volume used to guide the assessment)	4 high volume/high frequency overflows locations on trunk main along Collins Rd/Prisk St/Yvonne St ~4,500m³/annum overflow volume. High frequency/high volume (~7, 000 m3/annum) at Fitzroy SPS. High frequency/high volume (~2500 m3/annum) at Normandy SPS. High frequency/high volume (~6500 m3/annum) at Lorne SPS. High frequency/high volume (~2000 m3/annum) at Te Anau SPS.
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Area is serviced by upper western interceptor which is known to have significant capacity constraints. ~50,000m3/annum overflow from the upper western interceptor immediately upstream of Area 11.
4	Scale of funded interventions in the current LTP	Fitzroy SPS upgrade and diversion funded in current LTP ($9m) Colins Rd bulk storage facility funded in current LTP ($13m) Upper western capacity upgrades not funded in the current LTP ($50m +) Other SPS and trunk main upgrades identified in current master plan but not funded ($10m)
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network <50% pipe full but with several pockets where local network is 50 - >100% pipe full. Around half of the trunk network in the area is 50 - >100% pipe full.
6	2061 Modelled Local and Trunk Wet weather overflows	Extensive low frequency/low volume overflows throughout the area. 4 high volume/high frequency overflows locations on trunk main along Collins Rd/Prisk St/Yvonne St ~6200 m3/annum overflow volume. High frequency/high volume (~8300 m3/annum) at Fitzroy SPS. High frequency/high volume (~3300 m3/annum) at Normandy SPS. High frequency/high volume (~7500 m3/annum) at Lorne SPS. High frequency/high volume (~4000 m3/annum) at Te Anau SPS.
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Area is serviced by upper western interceptor which is known to have significant capacity constraints. ~5000m3/annum overflow from the upper western interceptor immediately upstream of Area 11.
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Upper Western Interceptor duplication identified in the most recent Wastewater Master plan but not funded in the current LTP.

9	Scale of investment to service “step change” in demand in long term. Excludes treatment plants	

1.5 Example supporting Evidence used to inform assessment

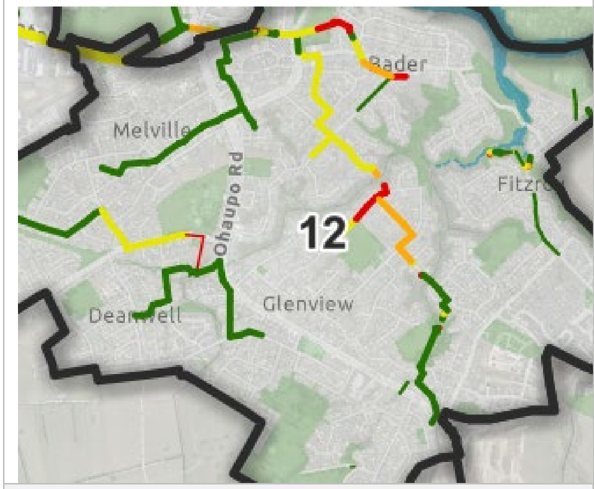


Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

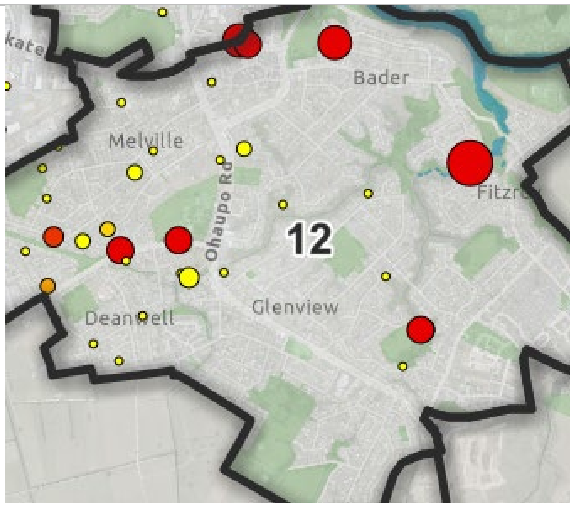


Fig 1.2 - 2031 Wet Weather Overflows

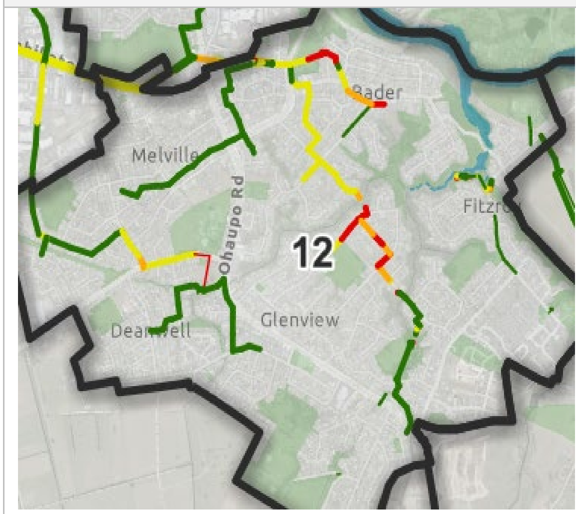


Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

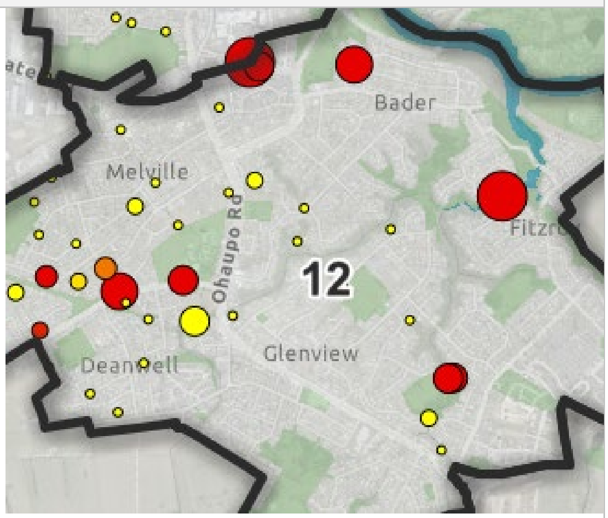
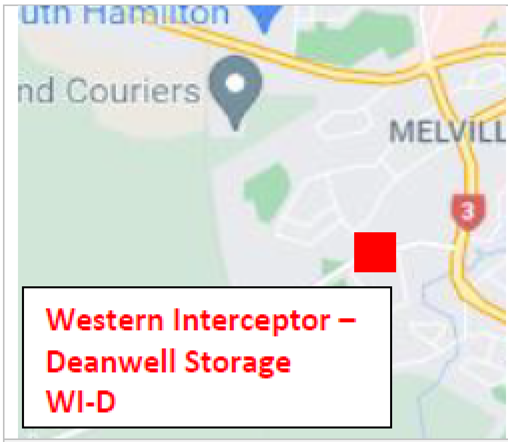


Fig 1.4 - 2061 Performance – Wet Weather overflows

	Western (upper) duplication $52m Normandy SPS Upgrade $2.4m Collins Rd SPS & Pipe $5.1m Collins Rd Storage Stage 1 $8m Collins Rd Storage Stage 2 $3m Splitt SPS Upgrade and diversion $1m Te Anau SPS Upgrade and diversion $2.4m Fitzroy SPS Upgrade and diversion $9m Dixon Rd Trunk Upgrade $3.5m
LTP Funded projects	Master Planned Investment

1.6 Other Comments

It is likely that local smaller infrastructure will need to be upgraded to cope with the increased densities. Local public network infrastructure in private properties may also need to be relocated to Road reserve to allow full buildout of sections.

Area 13 – Hillcrest East: Wastewater Assessment

1.1 Description

Area (ha), age of development, hydrologic sub-catchment it's located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.97	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.56	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.36	2

1.3 Key Network Features

The Hillcrest East area was developed in the 1960s and is at the south eastern boundary of the city.

The area is served by the Eastern Interceptor through a network of gravity mains and pumpstations through area 14 Greensboro.

There are pumpstations in the area. SPS003 Barrie, SPS051 Morrinsville, SPS018 Cranwell, SPS067 Riverlea, SPS134 Mexted, SPS005 Berkley ,

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network <50% pipe full but with several pockets where local network is 50 - >100% pipe full. Around half of the trunk network in the area is 50 - >100% pipe full.
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	16 low frequency/low volume overflows throughout the area. 3 med frequency/volume overflows at Barry Cres, Morris Cres and Howell Ave. Total of ~1700 m3/annum
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Area discharges into the upper section of Eastern Interceptor. Majority of upper Eastern Interceptor flowing through the area is between 50 - 75% full.

4	Scale of funded interventions in the current LTP	Stage 1 of Morris and Howell SPS recommended in master plan.
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network <50% pipe full but with several pockets where local network is 50 - >100% pipe full. Around half of the trunk network in the area is 50 - >100% pipe full.
6	2061 Modelled Local and Trunk Wet weather overflows	16 low frequency/low volume overflows throughout the area. 3 med frequency/volume overflows at Barry Cres, Morris Cres and Howell Ave. Total of ~3500 m3/annum
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Area discharges into the upper section of Eastern Interceptor. Majority of upper Eastern Interceptor flowing through the area is between 50 - 75% full.
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Stage 2 of Morris and Howell SPS recommended in master plan.
9	Scale of investment to service "step change" in demand in long term. Excludes treatment plants	

1.5 Example supporting Evidence used to inform assessment

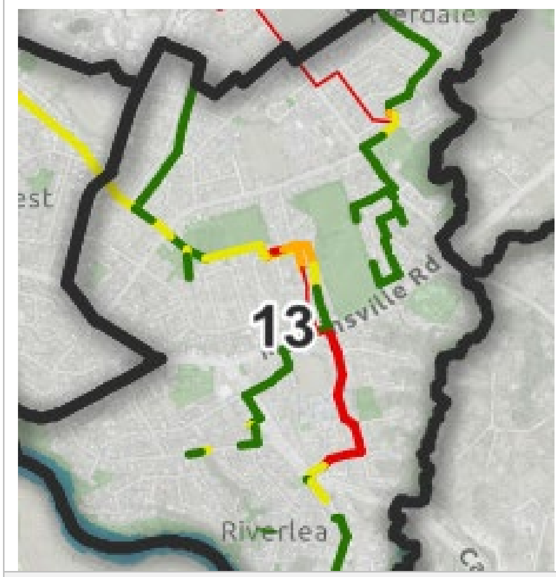


Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

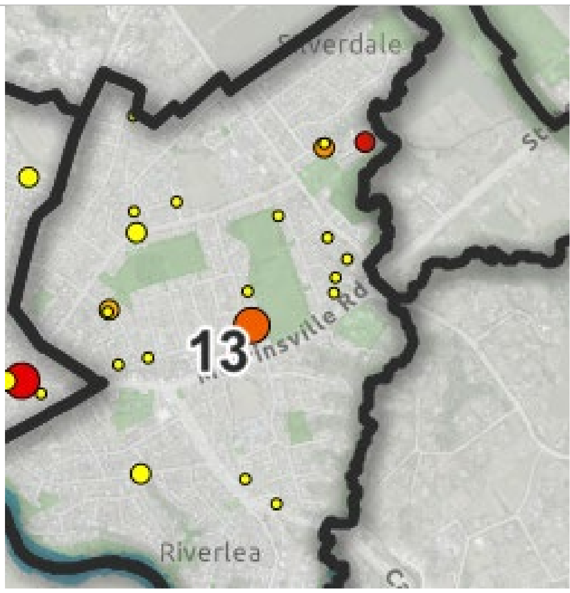


Fig 1.2 - 2031 Wet Weather Overflows

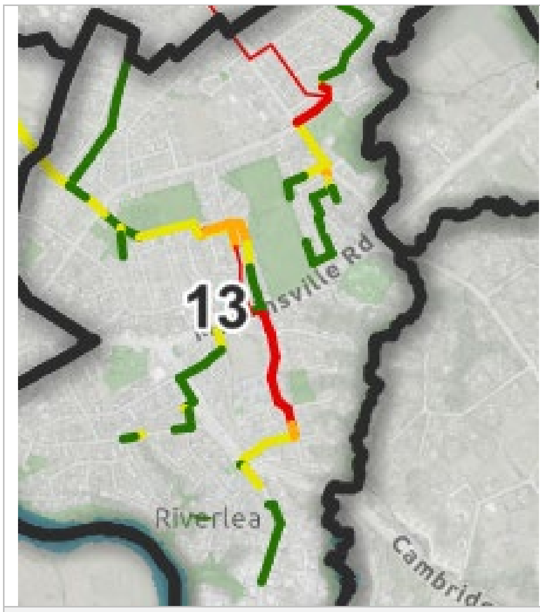
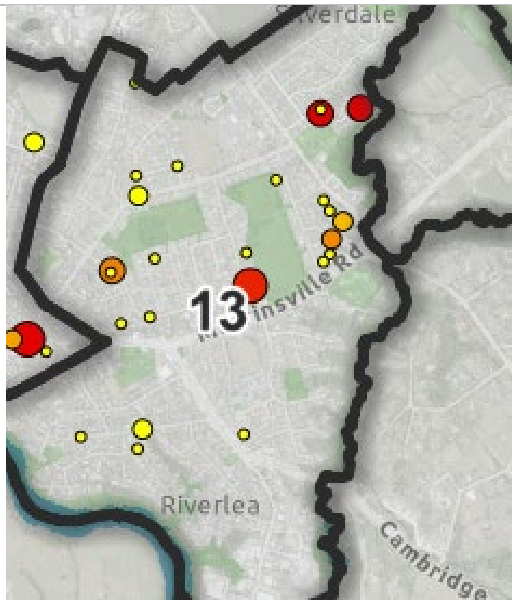
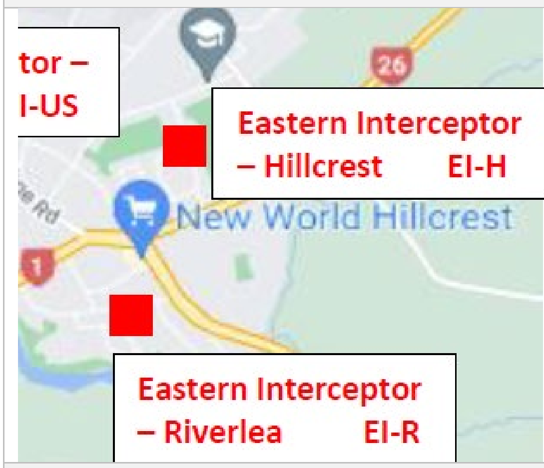
 	

Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.	*Fig 1.4 - 2061 Performance – Wet Weather overflows*
 	Flynn SPS Upgrade & diversion $1.7m Morris Storage $4.5m Howell Storage $2.2m
LTP Funded projects	Master Planned Investment

1.6 Other Comments

It is likely that local smaller infrastructure will need to be upgraded to cope with the increased densities. Local public network infrastructure in private properties may also need to be relocated to Road reserve to allow full buildout of sections.

Area 14 – Greensboro: Wastewater Assessment

1.1 Description

Area (ha), age of development, hydrologic sub-catchment it's located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.07	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.74	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.60	3

1.3 Key Network Features

The Greensboro area was developed from the 1920s on the Eastern side of the Town Belt and the 1960s on the Western side.

The area is served by the eastern Interceptor through trunk mains in Clyde St. There are no pumpstations in this area.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network <50% pipe full but with several pockets where local network is 50 - >100% pipe full. Around half of the trunk network in the area is 50 - >100% pipe full.
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	20 low frequency/low volume overflows throughout the area. High frequency/high volume overflow near Flynn SPS (~1800 m3/annum) and Somme Cres (2300m3/annum). Low freq/med volume overflows at Edinburgh Rd, Clyde St, Wairere Dr, Beaumont St.
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Area discharges into the upper section of Eastern Interceptor. Majority of upper Eastern Interceptor flowing through the area is between 50 - 75% full.
4	Scale of funded interventions in the current LTP	Two bulk storage facilities recommended in master plan ($13m)

5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local network <50% pipe full but with several pockets where local network is 50 - >100% pipe full. Around half of the trunk network in the area is 50 - >100% pipe full.
6	2061 Modelled Local and Trunk Wet weather overflows	20 low frequency/low volume overflows throughout the area. High frequency/high volume overflow near Flynn SPS (~2800 m3/annum) and Somme Cres (2800m3/annum). Low freq/med volume overflows at Edinburgh Rd, Clyde St, Wairere Dr, Beaumont St.
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Area discharges into the upper section of Eastern Interceptor. Majority of upper Eastern Interceptor flowing through the area is between 50 - 75% full.
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Flynn SPS upgrade recommended in master plan $2m
9	Scale of investment to service “step change” in demand in long term. Excludes treatment plants	

1.5 Example supporting Evidence used to inform assessment

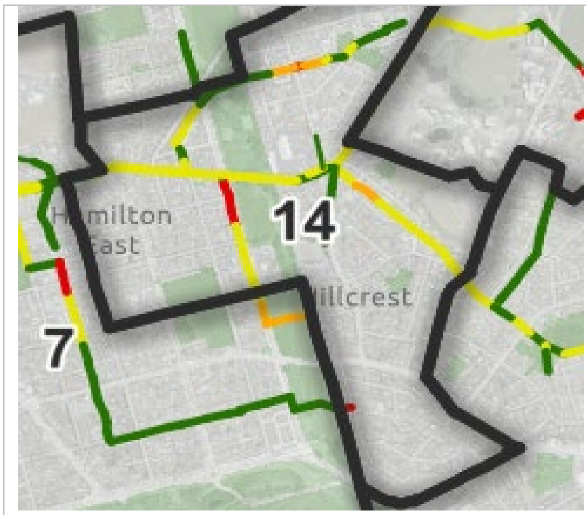


Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

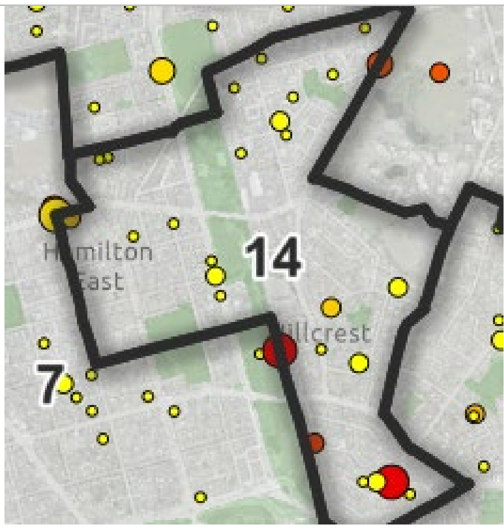


Fig 1.2 - 2031 Wet Weather Overflows

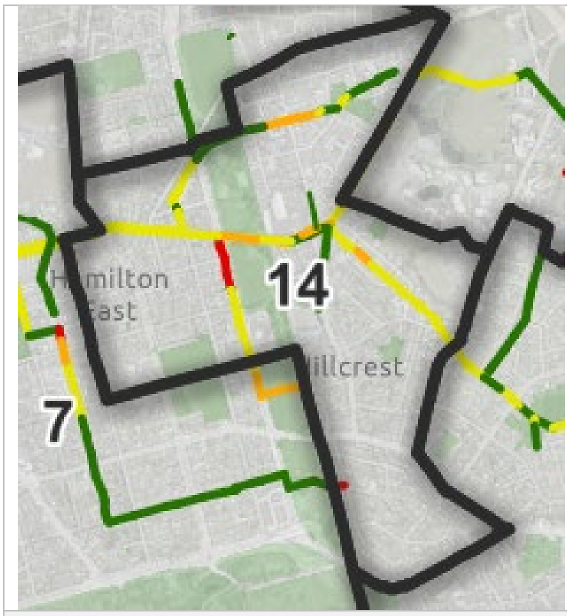


Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

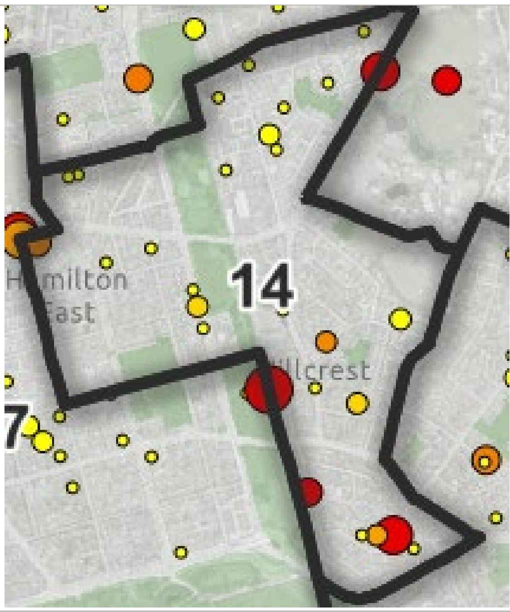


Fig 1.4 - 2061 Performance – Wet Weather overflows

1.6 Other Comments

It is likely that local smaller infrastructure will need to be upgraded to cope with the increased densities. Local public network infrastructure in private properties may also need to be relocated to Road reserve to allow full buildout of sections.

Area 15 – Rotokauri: Wastewater Assessment

1.1 Description

Area (ha), age of development, hydrologic sub-catchment it's located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.00	2
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	1.30	1
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.00	1

1.3 Key Network Features

The Rotokauri area is largely undeveloped with a small residential area being developed in 2015 and larger scale development occurring now which started in 2018. There also small areas of Rural Residential properties served by private on-site septic systems.

The 1050mm Far Western Interceptor passes through the area and was installed in 2018 to provide a wastewater solution to enable development.

The area has 2 pumpstations SPS144 Rotokauri and SPS149 Te Wetini with SPS149 discharging the catchment to the Far Western Interceptor.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry	Area is serviced by Far Western Interceptor <50% pipe full.

	weather flow conditions (winter)	
4	Scale of funded interventions in the current LTP	No strategic interventions identified in Master Plan
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.
6	2061 Modelled Local and Trunk Wet weather overflows	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Area is serviced by Far Western Interceptor <50% pipe full.
8	Scale of investments identified in current Master Plans to service historic 2061 growth	No strategic interventions identified in Master Plan
9	Scale of investment to service "step change" in demand in long term. Excludes treatment plants	

1.5 Example supporting Evidence used to inform assessment

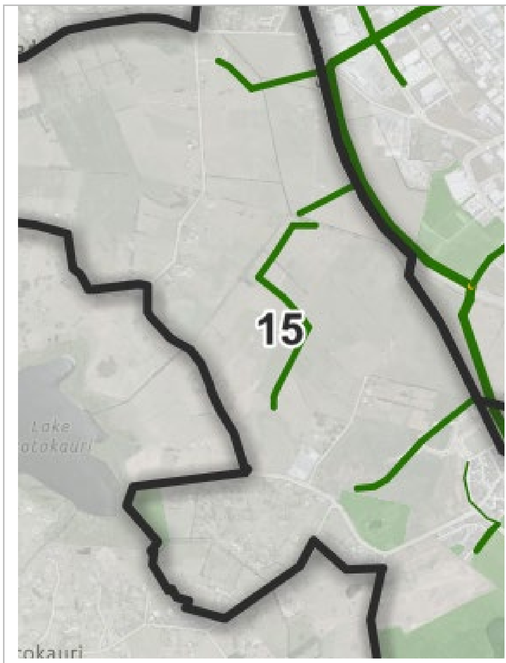


Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

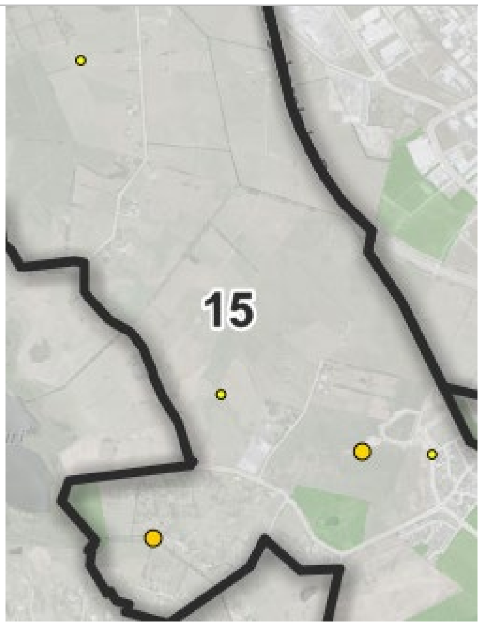


Fig 1.2 - 2031 Wet Weather Overflows

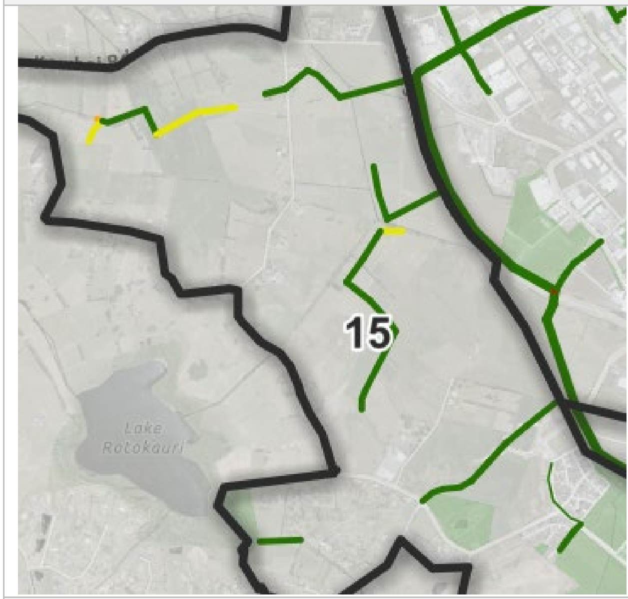
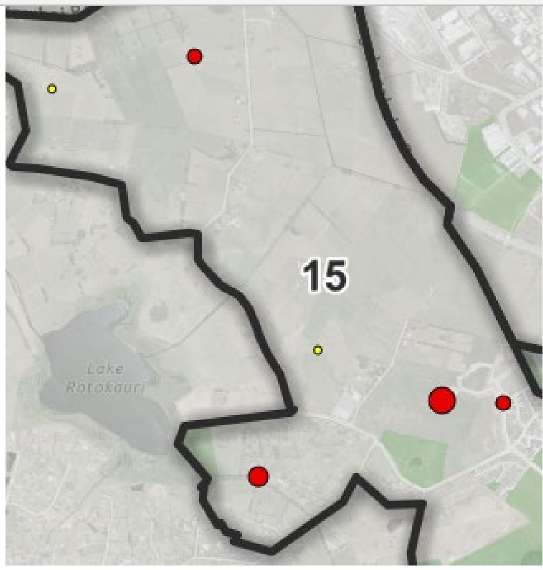
	

Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.	*Fig 1.4 - 2061 Performance – Wet Weather overflows*

1.6 Other Comments

With the catchment being largely undeveloped local infrastructure can be designed and built to meet the needs of new densities. Existing bulk network infrastructure that has been designed and built using lower densities will need to be assessed and upgraded according to the additional flows the higher densities produce.

Area 16 – Te Rapa: Wastewater Assessment

1.1 Description

Area (ha), age of development, hydrologic sub-catchment it's located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.20	2
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	1.57	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.30	1

1.3 Key Network Features

The Te Rapa area is largely Industrial and Commercial with development running from the 1960s to current day.

The area is predominately served by gravity a gravity network discharging to both the Western and Far Western Interceptors. There are 2 pumpstations SPS110 Maui and SPS148 Ruffell.

There is a small remote pocket of industrial development to the North of the area which is served by private pumps

The Pukete Wastewater Treatment Plant is also located in this area.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.

3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Area is serviced by Far Western Interceptor <50% pipe full. Also, relatively close to the Pukete WWTP
4	Scale of funded interventions in the current LTP	No strategic interventions identified in Master Plan. However strategic and trunk infrastructure needed to service the area. Currently unfunded.
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.
6	2061 Modelled Local and Trunk Wet weather overflows	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Area is serviced by Far Western Interceptor <50% pipe full. Also, relatively close to the Pukete WWTP
8	Scale of investments identified in current Master Plans to service historic 2061 growth	No strategic interventions identified in Master Plan. However strategic and trunk infrastructure needed to service the area. Currently unfunded.
9	Scale of investment to service "step change" in demand in long term. Excludes treatment plants	

1.5 Example supporting Evidence used to inform assessment

Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.	*Fig 1.2 - 2031 Wet Weather Overflows*

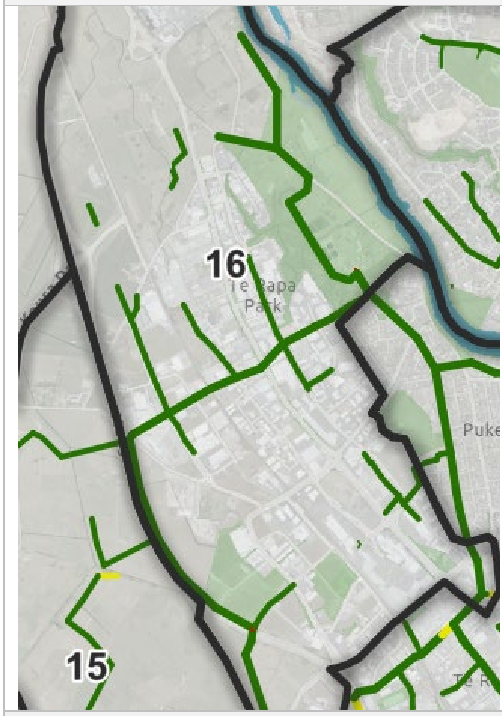
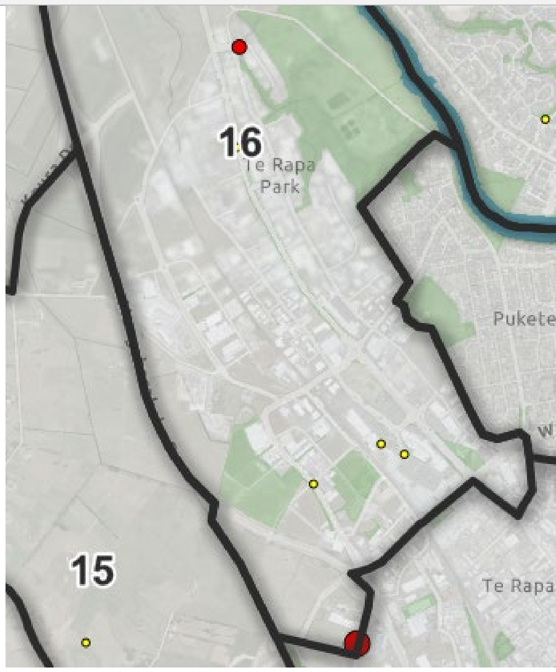

	

Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.	*Fig 1.4 - 2061 Performance – Wet Weather overflows*

1.6 Other Comments

Area 17 – Ruakura: Wastewater Assessment

1.1 Description

Area (ha), age of development, hydrologic sub-catchment it's located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.27	2
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	1.63	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.34	1

1.3 Key Network Features

The Ruakura area has development in the 1970s for the Fairview Downs area and from 2016 in the Greenhill area. The remaining area is predominately rural land. The Ruakura Inland Port that is currently under construction is also located in this area and will convert a large portion of the rural land to Industrial and Commercial.

The area is served by the Far Eastern Interceptor which is accessed through area 5 and the parallel duplication of it that is partly constructed.

There are 3 pumpstations in the catchment. SPS093 Raleigh, SPS057 Northolt, and SPS074 Silverdale

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure. Powells Rd area flows to Eastern Interceptor through Area 5. Extensive low frequency/low volume overflows in the Powells Rd area.
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry	Far Eastern Interceptor and infrastructure designed for density proposed in 2018. Pipeline is under construction and is potentially too small for densities being contemplated now.

	weather flow conditions (winter)	Far Eastern Interceptor has flows <50% pipe full in dry weather conditions. Peacock Rising Mains and Snells SPS will discharge into the Far Eastern Interceptor and trigger the need for Dajon Storage.
4	Scale of funded interventions in the current LTP	No strategic interventions identified in Master Plan. HCC contribution to Far Eastern Interceptor extension funded in LTP
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.
6	2061 Modelled Local and Trunk Wet weather overflows	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure. Powells Rd area flows to Eastern Interceptor through Area 5. Extensive low frequency/low volume overflows in the Powells Rd area.
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Far Eastern Interceptor and infrastructure designed for density proposed in 2018. Pipeline is under construction and is potentially too small for densities being contemplated now. Far Eastern Interceptor has flows <50% pipe full in dry weather conditions. Peacock Rising Mains and Snells SPS will discharge into the Far Eastern Interceptor and trigger the need for Dajon Storage.
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Current master plan recommends a new staged bulk wastewater storage facility to manage additional flows into FEI. ~$16m for Stage 1.
9	Scale of investment to service “step change” in demand in long term. Excludes treatment plants	

1.5 Example supporting Evidence used to inform assessment

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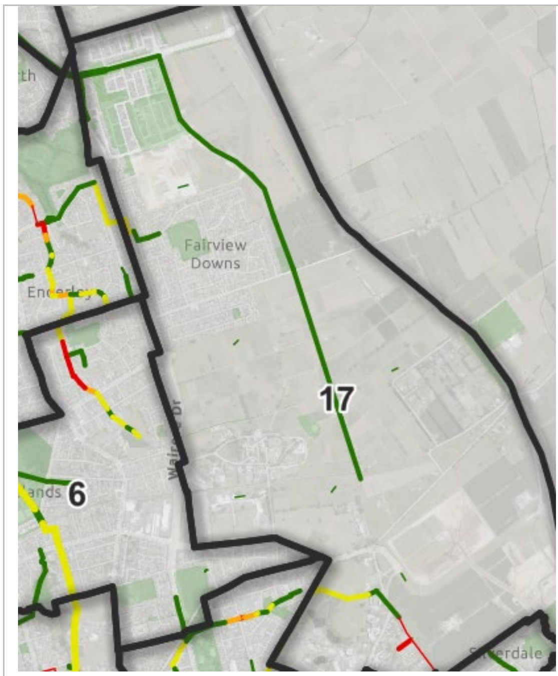
<td>
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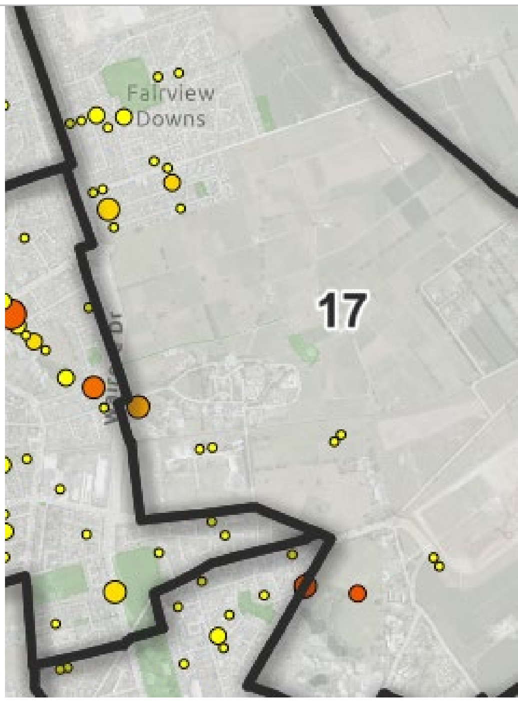
<td>
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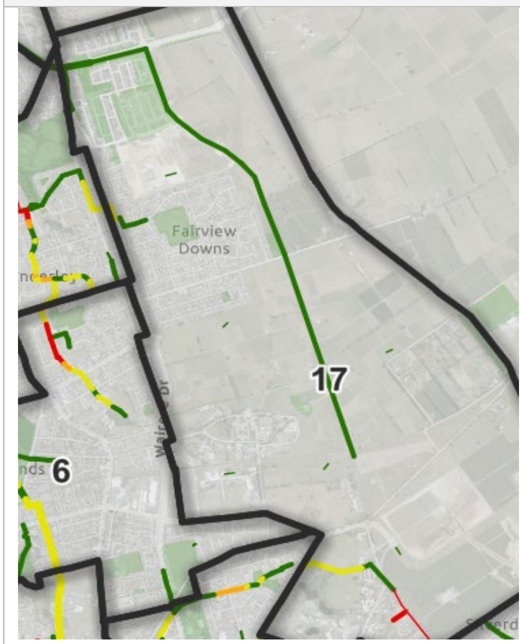
<td>
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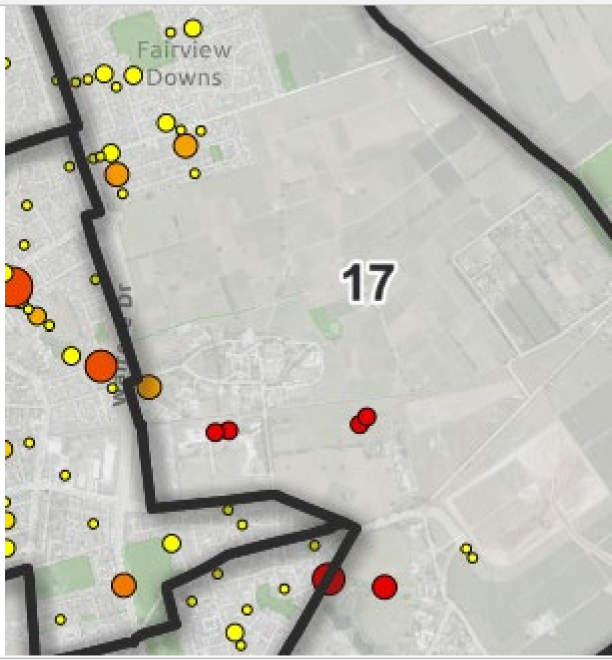
<td>
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<td>Fig 1.4 - 2061 Performance – Wet Weather overflows</td>
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<td>Silverdale Pipe Diversion $4.4m</td>
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<td>LTP Funded projects</td>
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1.6 Other Comments

Area 18 – Peacocke: Wastewater Assessment

1.1 Description

Area (ha), age of development, hydrologic sub-catchment it's located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Key Network Features

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.00	2
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	1.30	1
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.00	1

1.3 Key Network Features

The Peacocke area is largely undeveloped and consists of rural land.

Large scale construction is underway on the bulk infrastructure required to open this are up. A large transfer pumpstation and 7km of dual rising mains discharging to the head of the Far Eastern Interceptor will receive flows from a new trunk gravity network and associated network pumpstations throughout the catchment.

A portion of area 12 will also be diverted to the new infrastructure. This comprises of a small portion of the gravity network and the flows from SPS025 Fitzroy, SPS075 Splitt, and SPS080 Te Anau.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.

4	Scale of funded interventions in the current LTP	Strategic Infrastructure funded in LTP
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.
6	2061 Modelled Local and Trunk Wet weather overflows	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Strategic Infrastructure funded in LTP
9	Scale of investment to service "step change" in demand in long term. Excludes treatment plants	

1.5 Example supporting Evidence used to inform assessment

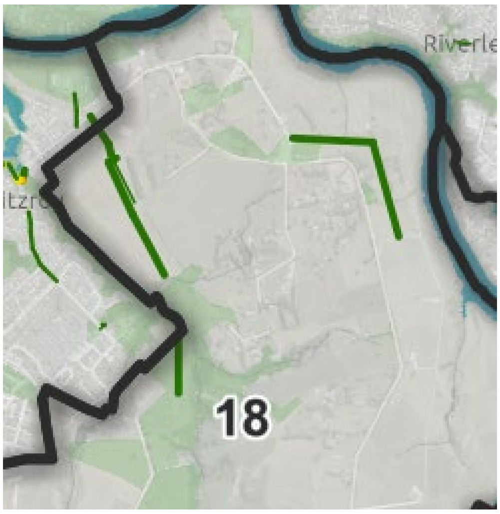


Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

Fig 1.2 - 2031 Wet Weather Overflows

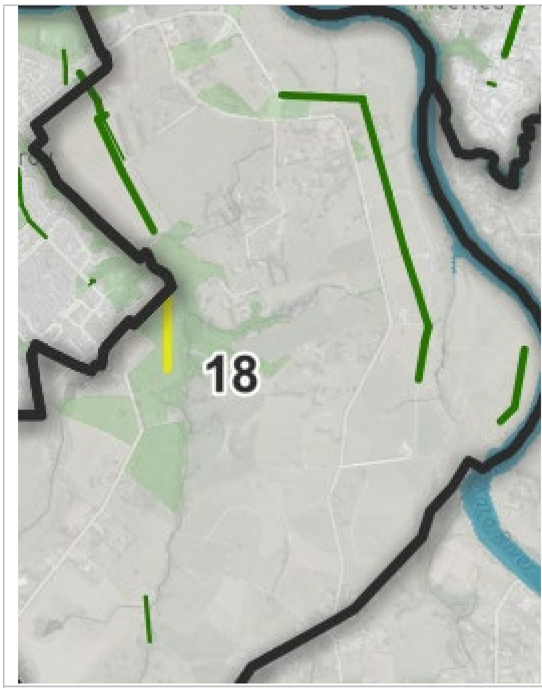


Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

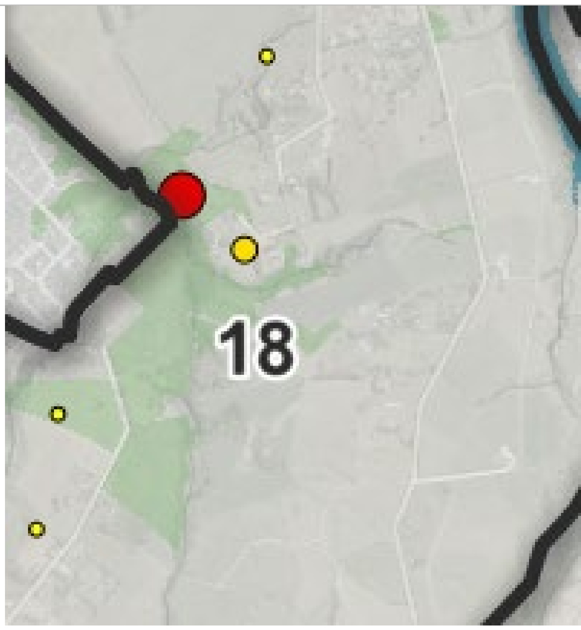


Fig 1.4 - 2061 Performance – Wet Weather overflows

1.6 Other Comments

With the catchment being largely undeveloped local infrastructure can be designed and built to meet the needs of new densities. Existing bulk network infrastructure that has been designed and built using lower densities will need to be assessed and upgraded according to the additional flows the higher densities produce.

Area 19 – Temple View: Wastewater Assessment

1.1 Description

Area (ha), age of development, hydrologic sub-catchment it's located in, water demand management area its serviced by, wastewater interceptor its serviced by, any other key features. Population information used for the modelling included in the assessment.

1.2 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.77	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.26	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.00	2

1.3 Key Network Features

The Temple View area was developed in the 1950s and came into the HCC boundary in 2004, from Waipa District Council.

It served by a gravity network and is essentially split into two systems each with their own pumpstation discharging through a shared rising main. The residential area on the West discharges to SPS137 Temple View and the area to the East discharges to SPS121 Church College. These stations discharge through a pressure gravity main to SPS119 Karen. Karen then discharges downstream of SPS021 Dinsdale into the Trunk Mains in Rifle Range Road and to the Western Interceptor.

The majority of the gravity network on the East discharging to SPS137 has been renewed in the last 5 years and the land owned by The Church of the Latter day Saints to the West is undergoing extensive development currently.

1.4 Summary of key considerations against each criteria

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of developed area has flows <50% pipe full in dry weather conditions. Remainder is largely undeveloped, so assumption is that area will be developed with future proofed infrastructure.
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	No modelled overflows

3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Temple view discharges into constrained western network at Karen SPS
4	Scale of funded interventions in the current LTP	Upper Western Interceptor duplication identified in the most recent Wastewater Master plan but not funded in the current LTP.
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	
6	2061 Modelled Local and Trunk Wet weather overflows	
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Bulk Storage, pump station, rising main from Temple View $20m+
9	Scale of investment to service "step change" in demand in long term. Excludes treatment plants	

1.5 Example supporting Evidence used to inform assessment

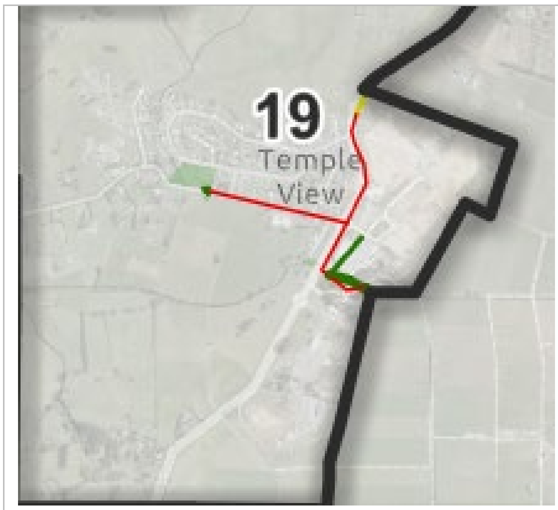
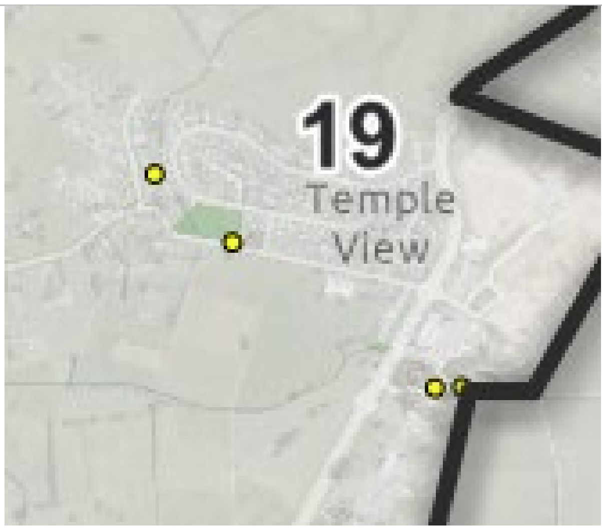


Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

Fig 1.2 - 2031 Wet Weather Overflows

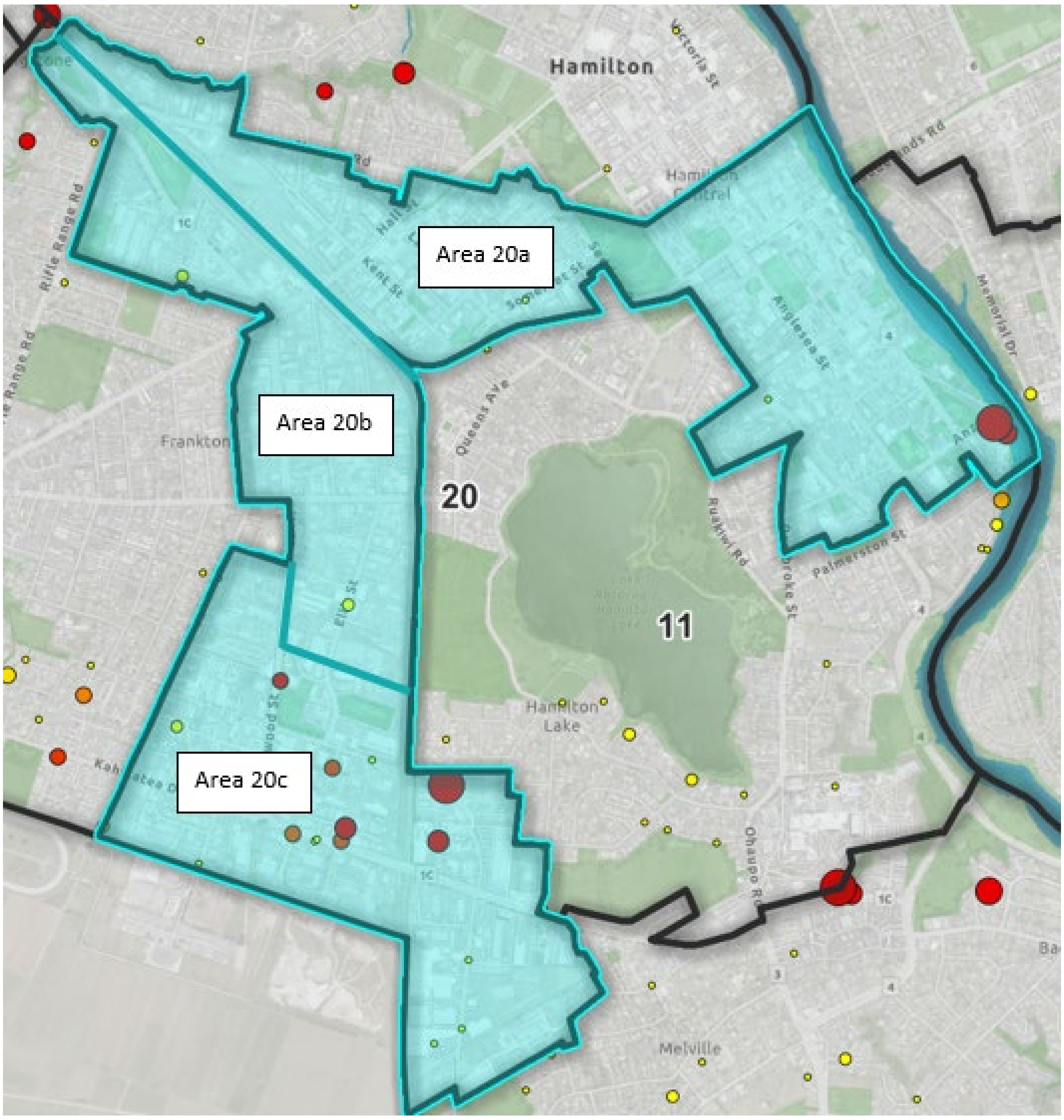
	
Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.	*Fig 1.4 - 2061 Performance – Wet Weather overflows*
	Temple View Storage Stage 1 $16m Temple View Storage Stage 2 $6.2m
LTP Funded projects	Master Planned Investment

1.6 Other Comments

It is likely that local smaller infrastructure will need to be upgraded to cope with the increased densities. Local public network infrastructure in private properties may also need to be relocated to Road reserve to allow full buildout of sections.

Area 20 – Other: CBD/Frankton Village/ Kahikatea Drive Wastewater Assessment

For the purpose of the wastewater assessment, Area 20 has been divided into three distinct parts defined by the network servicing the area. See Figure below. While this area is not currently used for residential land use, it is located in or near to the CBD and the 800 m walkable catchment.



OVERALL AREA 20 - Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.88	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.54	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.43	2

Area 20a – Other: Between Railway and River

1.1 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.83	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	2.41	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	2.22	2

1.2 Key Network Features

This area is predominantly commercial with relatively recent mixed use development. The area also includes the Frankton Village centre, Stockyards, railway sidings. This area is serviced by local and trunk reticulation with the majority discharging to High SPS (SPS033), Seddon SPS (SPS072) discharging to central interceptor at Richmond Street.

The area also include the CBD bounded by the railway in the North and the boundary of Area 11 in the south. This area is serviced by local and trunk reticulation. Key pumpstations servicing this area are Clarence SPS and Hillsborough SPS. The Hillsborough SPS pumps flow across the river to the eastern interceptor.

1.3 Summary of key considerations against each criterion

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local and trunk networks <50% pipe full in dry weather with sections of trunk main 100%+ full.
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	3 low volume/low frequency overflows. Overflows at Hillsborough alleviated by recently completed SPS upgrade. Area discharges to Seddon SPS which has capacity constraints
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Majority of area discharges to central interceptor via Seddon SPS
4	Scale of funded interventions in the current LTP	Hillsborough SPS Upgrade complete. Bulk Storage in Area 7 will alleviate receiving interceptor capacity
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local and trunk networks <50% pipe full in dry weather with sections of trunk main 100%+ full.
6	2061 Modelled Local and Trunk Wet weather overflows	3 low volume/low frequency overflows. Overflows at Hillsborough alleviated by recently completed SPS upgrade. Area discharges to Seddon SPS which has capacity constraints
7	2061 Modelled Strategic Interceptor pipeline utilisation	Majority of area discharges to central interceptor via Seddon SPS

	under dry weather flow conditions (winter)	
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Seddon SPS Upgrade recommended to accommodate growth $3m
9	Scale of investment to service "step change" in demand in long term. Excludes treatment plants	

1.4 Supporting Evidence used to inform assessment

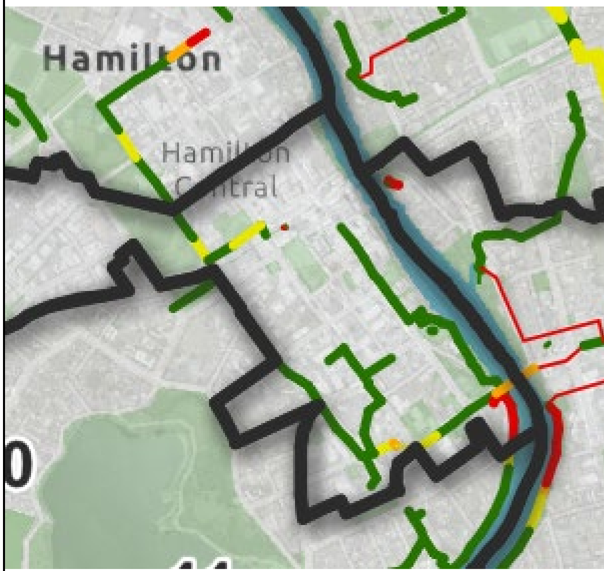


Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

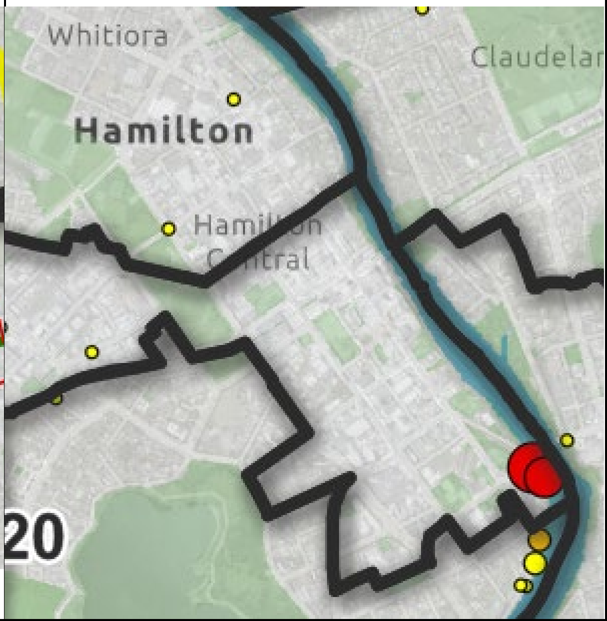


Fig 1.2 - 2031 Wet Weather Overflows

Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

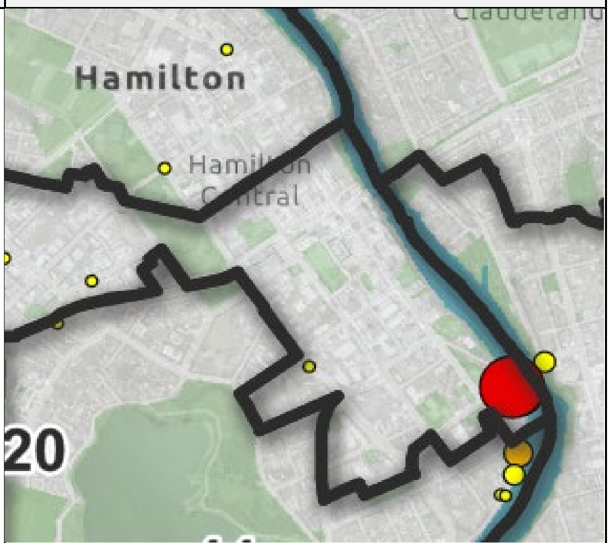


Fig 1.4 - 2061 Performance – Wet Weather overflows

Area 20b – North of Killarney Rd: Wastewater Assessment

1.5 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.4	2
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	1.84	2
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	1.60	2

1.6 Key Network Features

This area is predominantly commercial and industrial. The area is serviced by local and trunk reticulation discharging to West SPS (SPS086). The West SPS discharges into Pukeko St trunk main which drains to the Western Interceptor along Rifle Range Rd.
The area also includes industrial/commercial land bounded by Killarney Rd in the north and Peregrine Pl in the south.

1.7 Summary of key considerations against each criterion

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of developed area has flows <50% pipe full in dry weather conditions.
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	1 low frequency overflow. But alleviated through western mid section duplication
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Recently completed western mid-section duplication will alleviate interceptor capacity constraints
4	Scale of funded interventions in the current LTP	Western mid section duplication recently completed.
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of developed area has flows <50% pipe full in dry weather conditions.
6	2061 Modelled Local and Trunk Wet weather overflows	1 low frequency overflow. But alleviated through western mid section duplication
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Recently completed western mid-section duplication will alleviate interceptor capacity constraints
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Western mid section duplication recently completed.

9	Scale of investment to service “step change” in demand in long term. Excludes treatment plants	West SPS and rising main upgrade. Upgrade 500m long 375mm dia pipeline to Rifle Range Rd Western Interceptor

1.8 Supporting Evidence used to inform assessment

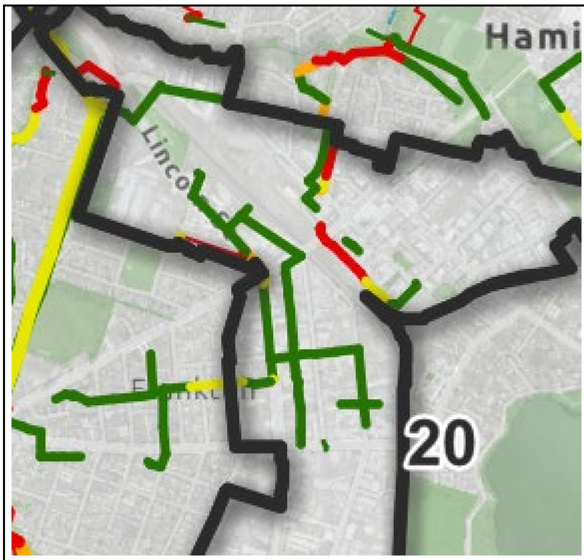


Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

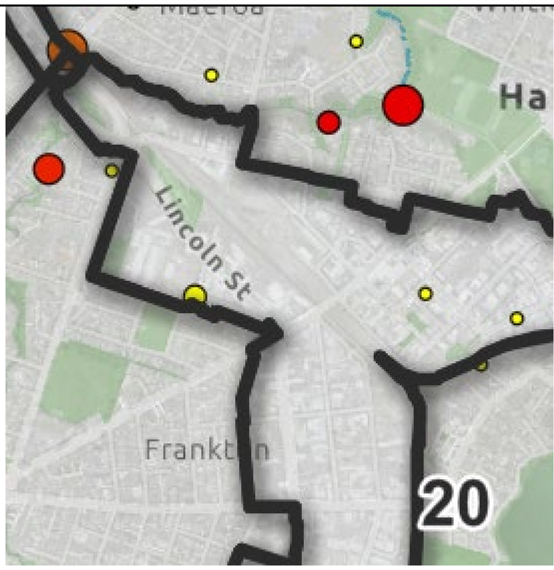


Fig 1.2 - 2031 Wet Weather Overflows

Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

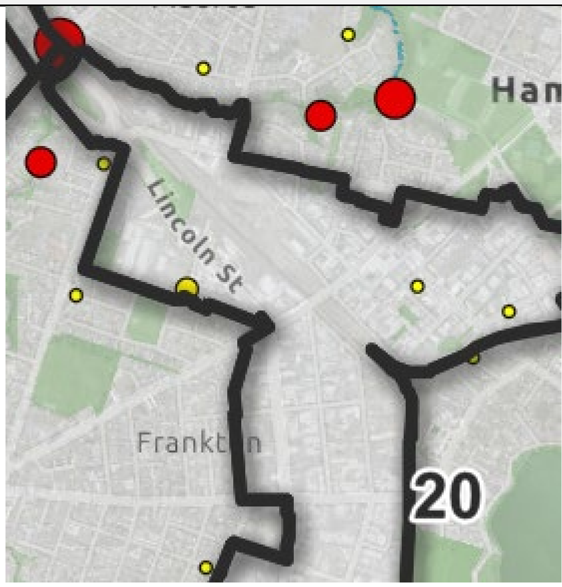


Fig 1.4 - 2061 Performance – Wet Weather overflows

Area 20c – Other- South of Killarney Rd: Wastewater Assessment

1.9 Assessment Summary

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.40	3
OVERALL ASSESSMENT (NEAR TERM WEIGHTED)	3.37	3
OVERALL ASSESSMENT (EXCLUDING LONG TERM)	3.46	3

1.10 Key Network Features

This area is predominantly commercial and industrial with a small pocket of residential development at the end of Quentin Dr. The area is serviced by local and trunk reticulation discharging into the upper section of western interceptor

1.11 Summary of key considerations against each criterion

#	Criterion	Assessment
1	2031 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local and trunk network < 50% pipe full under dry weather conditions.
2	2031 Modelled Local and Trunk Wet weather overflows (Refer to matrix of overflow frequency / volume used to guide the assessment)	Several low flow/low volume overflows. Several mid frequency/volume overflows and two high frequency/high volume overflows
3	2031 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Discharges into constrained upper western interceptor
4	Scale of funded interventions in the current LTP	Upper Western Interceptor duplication identified in the most recent Wastewater Master plan but not funded in the current LTP.
5	2061 Modelled Local and Trunk pipeline Utilisation under dry weather flow conditions (winter)	Majority of local and trunk network < 50% pipe full under dry weather conditions.
6	2061 Modelled Local and Trunk Wet weather overflows	Several low flow/low volume overflows. Several mid frequency/volume overflows and two high frequency/high volume overflows
7	2061 Modelled Strategic Interceptor pipeline utilisation under dry weather flow conditions (winter)	Discharges into constrained upper western interceptor
8	Scale of investments identified in current Master Plans to service historic 2061 growth	Upper Western Interceptor duplication identified in the most recent Wastewater Master plan but not funded in the current LTP.

9	Scale of investment to service "step change" in demand in long term. Excludes treatment plants

1.12 Supporting Evidence used to inform assessment

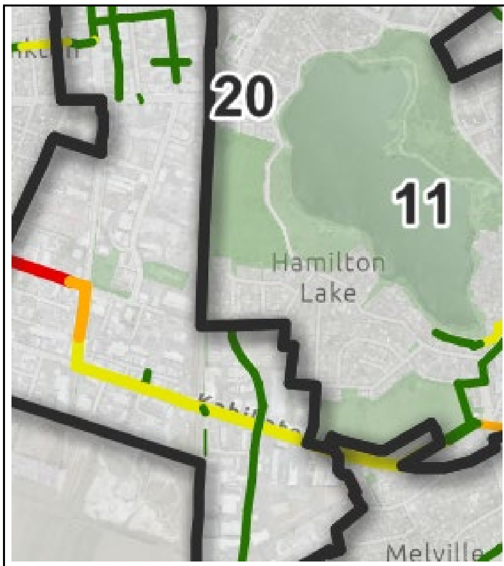


Fig 1.1 - 2031 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

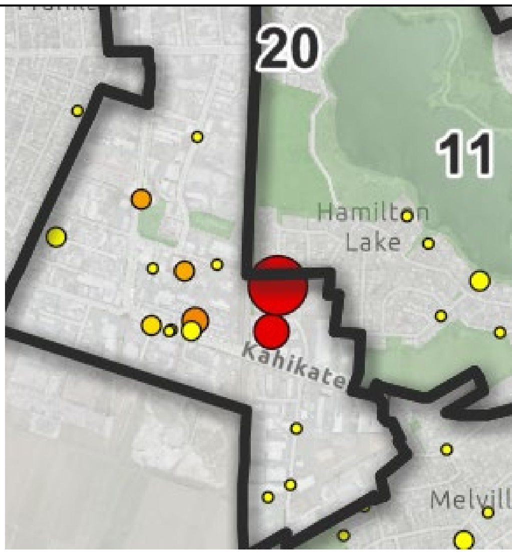


Fig 1.2 - 2031 Wet Weather Overflows

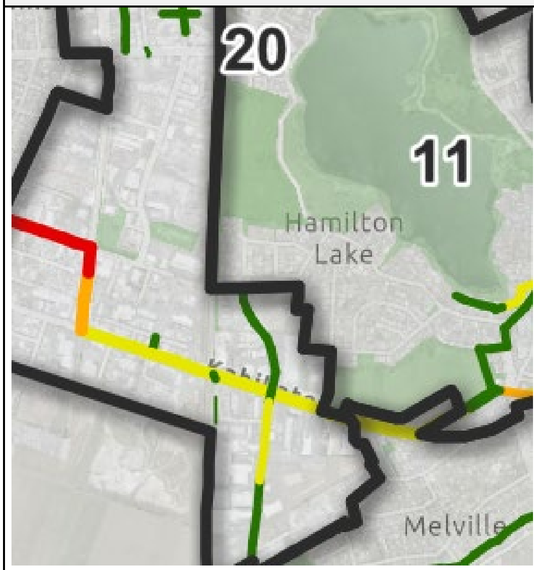


Fig 1.3 - 2061 Dry Weather Pipe Utilisation Performance. Interceptor and Trunk mains only.

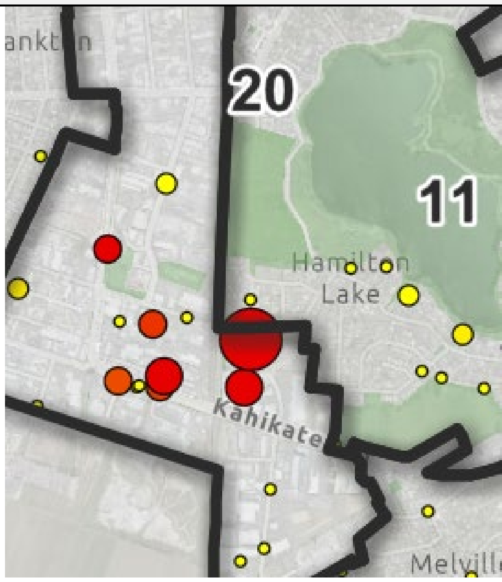


Fig 1.4 - 2061 Performance – Wet Weather overflows

APPENDIX E – STORMWATER ASSESSMENT SUMMARY REPORTS

Area 1 – Flagstaff: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	1.71	2

1.2 Key Area Features

The Flagstaff East study area is approximately 790 Ha in size with three discharge outlet locations; small sections discharge to the north (Otamngenge Stream) and south (Kirikiriroa Stream), while the bulk of the study area is drained by the Te Awa O Katapaki Stream. The study area is combination of relatively newly developed land and greenfield development areas that are slated to be developed in the near future. The upper section of the study area contains the greenfield areas (Rototuna North) which are currently being developed, the lower section of the study area is almost completely developed.

The upper reaches of the Te Awa O Katapaki Stream have generally been heavily modified through construction of farm drainage systems, with the lower reaches remaining relatively unmodified as the stream exists a deeply incised gully.

An Integrated Catchment Management Plan (ICMP) has been developed for the Flagstaff East study area, however the focus of the ICMP was generally around infrastructure planning for the greenfield development areas.

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• Te Awa O Katapaki ICMP has been developed for this area. Technical studies have been undertaken for the catchment in support of the ICMP. • Otamngenge catchment also has an ICMP, however is now out of date. • 20% of catchment not covered by any ICMP.
Known flood hazard data	• Detailed flood hazard modelling available for most of area (~75%). • 156 buildings affected by some level of hazard (low hazard or greater). • 2 buildings affected by high hazard.
Existing treatment devices or opportunities	• Large percentage of area drains to centralised devices. Most do not meet current SW requirements. • Opportunities to implement centralised devices are generally good, mostly through reset of existing devices.

Watercourse quality risks	• 5 available monitoring sites within area. • Sediment data is good. • MCI data is fair.
Watercourse erosion risk	• Low to moderate erosion susceptibility watercourse. • Mix of high-impervious brownfield and greenfield areas. Moderate change in impervious cover expected.
SW network capacity	• No mapped pipe capacity data available, however available stormwater modelling report that supports the ICMP documents minimal capacity issues.
sites of cultural significance	• Known cultural sites – not located within watercourse or location not considered to be at risk.

1.4 Evidence Used to Support Assessment

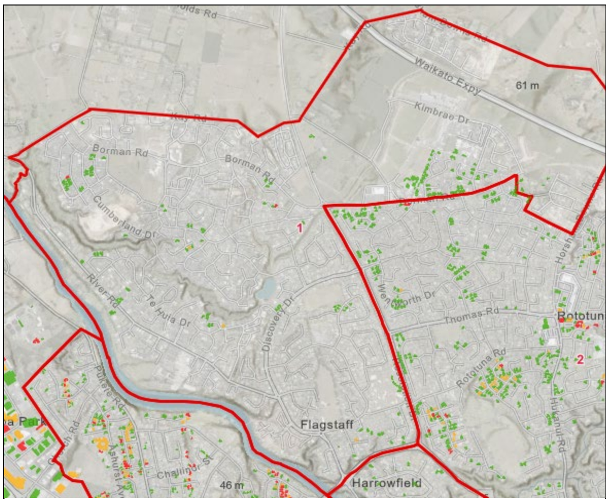


Fig 1.1 – Buildings Intersected by Flood Hazard: Flagstaff East is mix of newer developed area and greenfield, with minimal existing buildings at risk.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

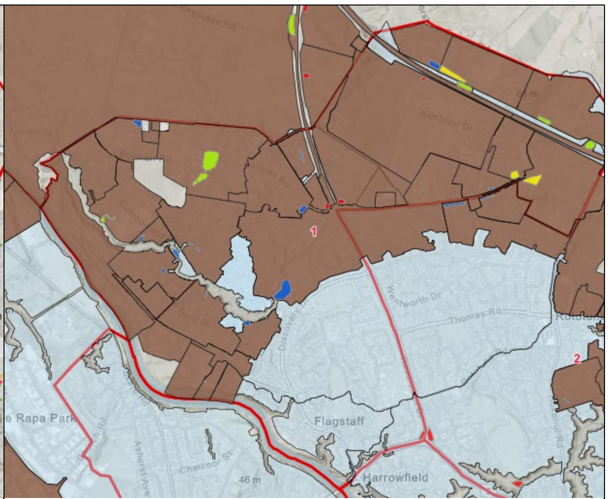
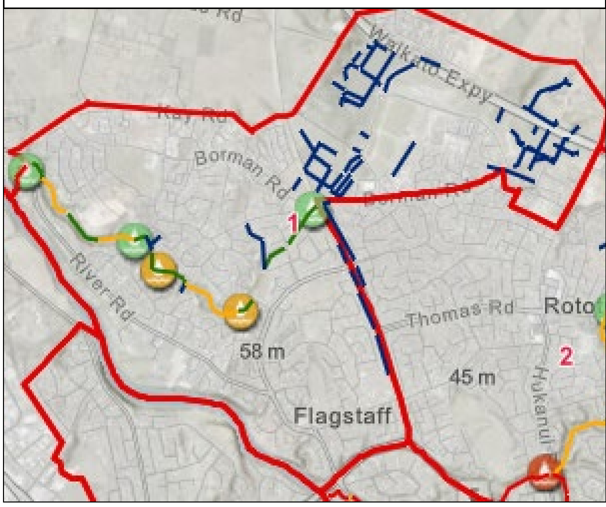


Fig. 1.2 – Existing Stormwater Treatment: Devices have either been constructed for newer development areas or are planned as part of development for much of the area. Older devices will not provide treatment to current standards. Southern portions of area generally untreated.

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.



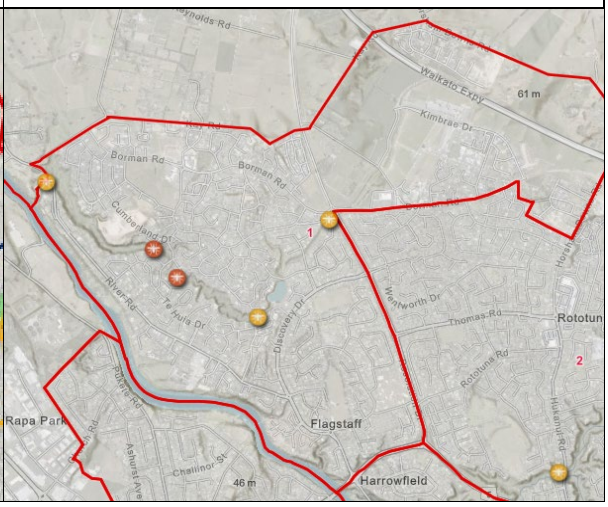


Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.	Fig 1.4 – Macroinvertebrate Index (MCI) data.
Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low. *Sediment quality data: Red = poor, orange = moderate, green = good.*	*MCI data: Red = poor, orange = fair, green = good.*

1.5 Other Comments:

As an identified growth cell, a funded strategic stormwater program exists for the section of the study area covered by the growth cell. A total of $13 Million has been funded within the current Long-Term Plan (LTP), however this funding is for growth areas only.

Stream erosion protection and brownfield flooding/stormwater management are also funded for this area as a part of the City-Wide Waters programme. A total of $700,000 is funded in the current LTP across both erosion protection and brownfield flooding/stormwater management.

Area 2 – Huntington: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.29	2

1.2 Key Area Features

The Huntington study area is approximately 670 Ha in size and is centred around the northernmost tributary of the Kirikiriroa Stream. Development in the north of the area (Rototuna North) is relatively recent, through to older development area is the south of the area. The Kirikiriroa gully is one of the most extensive and important gully systems within the HCC jurisdictional area. The gully is known to both be at a significant risk from erosion, and to contain several Significant Natural Areas (SNAs).

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• No ICMP currently available for most (75%) of area. • Watercourse walkover data available for the majority of stream reaches. • Partial coverage of flood hazard modelling.
Known flood hazard data	• Detailed flood hazard modelling available for less than 50% of area. • 716 buildings affected by some level of hazard (low hazard or greater). • 47 buildings affected by high hazard.
Existing treatment devices or opportunities	• Approximately 50% of catchment drains to centralised devices. Most do not meet current SW requirements. • Opportunities to implement centralised devices are generally good, mostly through reset of existing devices.
Watercourse quality risks	• 3 available monitoring sites within area. • Sediment data is fair. • MCI data is fair.
Watercourse erosion risk	• Moderate erosion susceptibility watercourse. • Mix of high-impervious brownfield and greenfield areas. • Moderate change in impervious cover expected.
SW network capacity	• No SW network capacity data. • Approximately 25% of area drains north to TAOK stream which is covered by ICMP modelling - reports minimal capacity issues.
sites of cultural significance	• Known cultural sites – not located within watercourse or location not considered to be at risk.

1.4 Evidence Used to Support Assessment

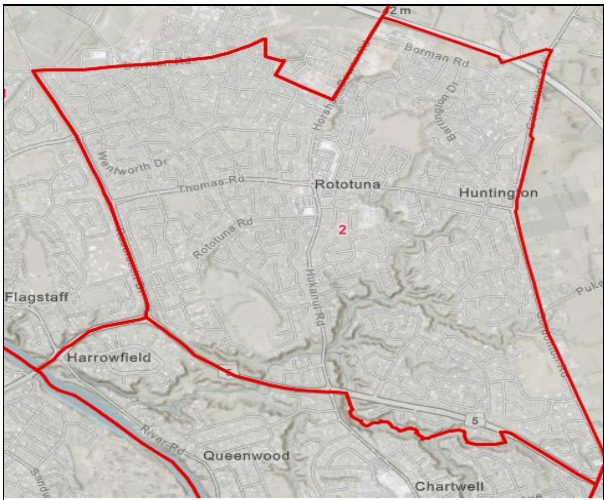


Fig 1.1 – Buildings Intersected by Flood Hazard: Flagstaff East is mix of newer developed area and greenfield, with minimal existing buildings at risk.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

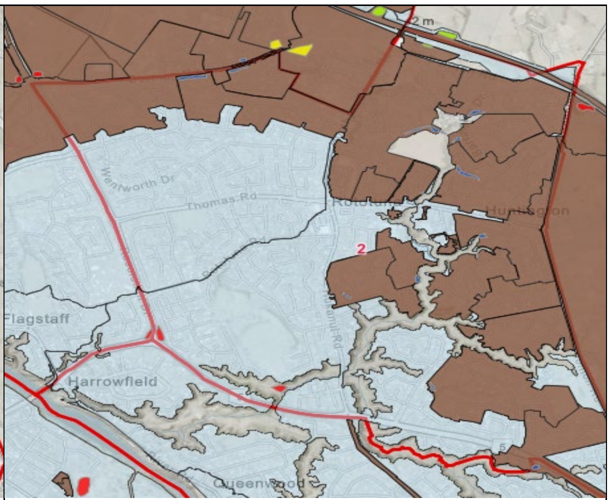


Fig. 1.2 – Existing Stormwater Treatment: Upper (eastern) portion of area

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

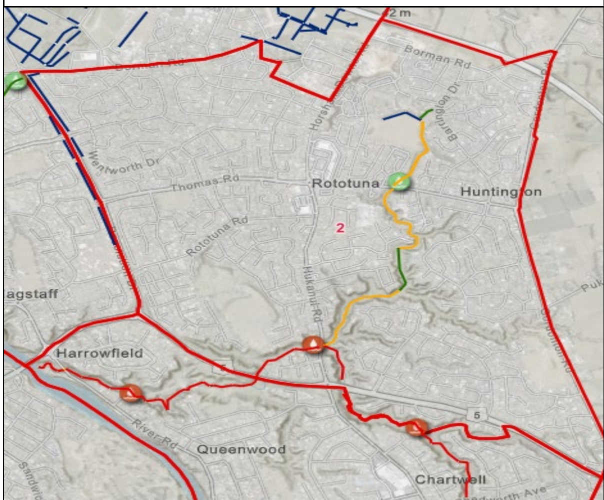


Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

Sediment quality data: Red = poor, orange = moderate, green = good.

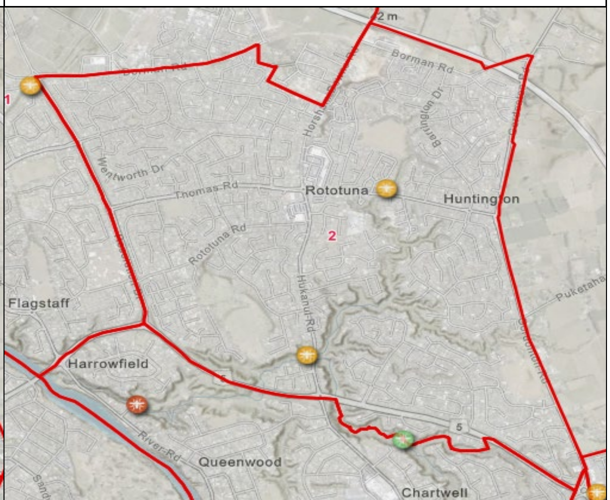


Fig 1.4 – Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.

1.5 Other Comments:

There is currently no funded strategic stormwater programme for the Huntington area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

Erosion control works, brownfield stormwater management and brownfield flood management are all currently funded as part of capital works programs in the Kirikiriroa catchment. Approximately $8.3 million of erosion and restoration funding is available with a further $4.7 million to be shared across stormwater and flood management.

Area 3 – Chartwell: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.29	2

1.2 Key Area Features

The Chartwell study area is approximately 530 Ha in size and spans three catchments on the eastern bank of the Waikato River. The northern section of the study area is part of the Kirikiriroa catchment, the central area drains to the Bankwood Gully and a small southern section drains to the Ranfurly gully system. Approximately 50% of the area drains to the Kirikiriroa system, which is one of the most extensive and important gully systems within the HCC jurisdictional area. The gully is known to both be at a significant risk from erosion, and to contain several Significant Natural Areas (SNAs).

The Chartwell study area is effectively completely developed, with development generally occurring post 1970.

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• No ICMP currently undertaken for the Chartwell area. • One area specific investigation undertaken to date - watercourse walkover (for Kirikiriroa stream). • Some sediment quality and ecological data available through CSDC monitoring, but not sufficient to support ICMP.
Known flood hazard data	• Rapid flood hazard data available for the Chartwell area. • 649 buildings affected by some level of hazard (low hazard or greater). • 74 buildings affected by high hazard. • Refer to Figure 1.1 below
Existing treatment devices or opportunities	• Limited existing stormwater devices – will not be meeting current stormwater requirements. • Opportunities to implement centralized devices are generally good, with open space aligned with piped networks and adjacent to watercourses. • Refer Figure 1.2 below.
Watercourse quality risks	• 8 CSDC monitoring sites within area. • Sediment quality data is poor. • MCI data varies from good to poor. On average data is fair. • Refer Figures 1.3 and 1.4 below.

Watercourse erosion risk	• High erosion susceptibility watercourse. • Some increase in impervious cover expected through redevelopment. • Currently brownfield, but typical lot cover is less than allowed for under NPS-UD. • Refer Figure 1.3 below.
SW network capacity	No known SW network capacity data.
sites of cultural significance	Known cultural sites – not located within watercourse or location not considered to be at risk.

1.4 Evidence Used to Support Assessment

Fig 1.1 – Buildings Intersected by Flood Hazard: Properties are clustered along OLFPs adjoining the Kirikiriroa Gully and along the River.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

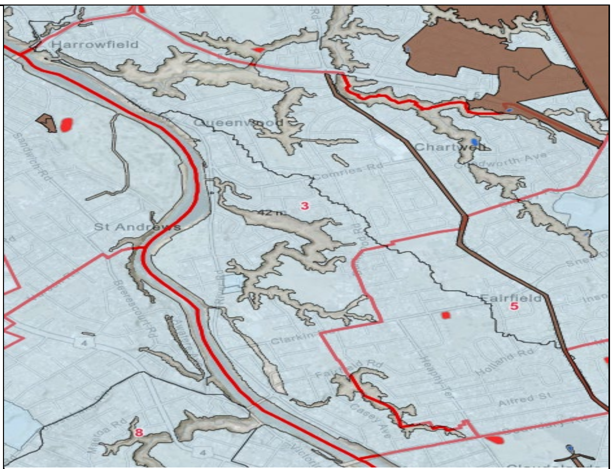


Fig. 1.2 – Existing Stormwater Treatment: Entire area is effectively untreated.

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

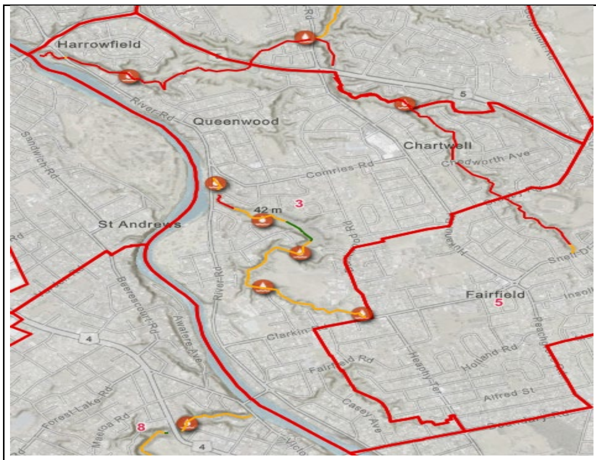


Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

Sediment quality data: Red = poor, orange = moderate, green = good.

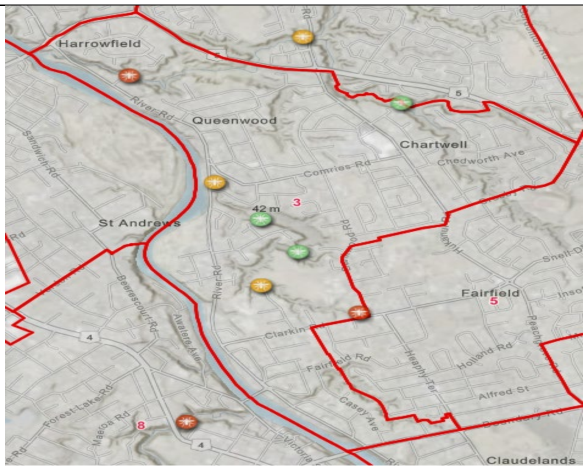


Fig 1.4 – Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.

1.5 Other Comments:

There is currently no funded strategic stormwater programme for the Chartwell area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

Erosion control works, brownfield stormwater management and brownfield flood/stormwater management are all currently funded as part of capital works programs in the Kirikiriroa catchment. Approximately $8.3 million of erosion and restoration funding is available with a further $4.7 million to be shared across stormwater and flood management.

Area 4 – Pukete East: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.00	3

1.2 Key Area Features

The Pukete East study area is approximately 450 Ha in size and runs adjacent to the Waikato River on the western bank of the River, north of the central city area. The study area encompasses sections of the Pukete and St Andrews suburbs which are older suburbs. For the most part stormwater runoff is piped (untreated) directly to the Waikato, with minimal defined streams located in the study area. This also appears to be generally reflective of pre-developed conditions also – i.e., no historic streams have been identified.

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• No ICMP currently available. • No area specific investigations undertaken to date.
Known flood hazard data	• Only rapid flood hazard data available for this area – i.e. detailed flood hazard modelling not undertaken to date. • 1327 buildings affected by some level of hazard (low hazard or greater). • 291 buildings affected by high hazard.
Existing treatment devices or opportunities	• No know existing central treatment measures. • Opportunities to implement centralised devices are limited.
Watercourse quality risks	• No available monitoring data.
Watercourse erosion risk	• No watercourses within area – piped networks generally drain directly to the river.
SW network capacity	• No SW network capacity data.

sites of cultural significance	• Known cultural sites – not located within watercourse or location not considered to be at risk.

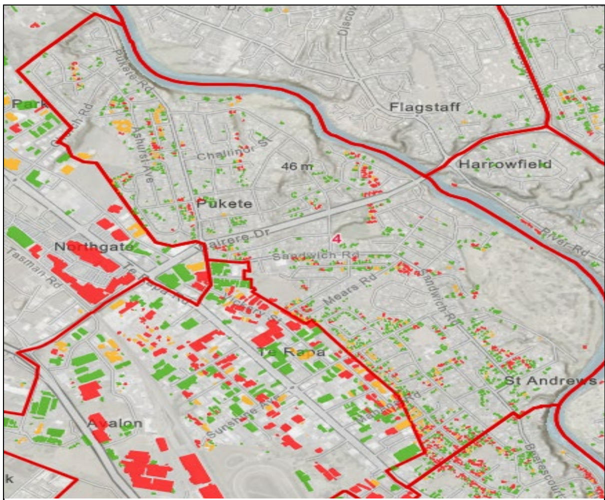


Fig 1.1 – Buildings Intersected by Flood Hazard: Numbers of buildings effected increase in southern area of Huntington as development is older.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

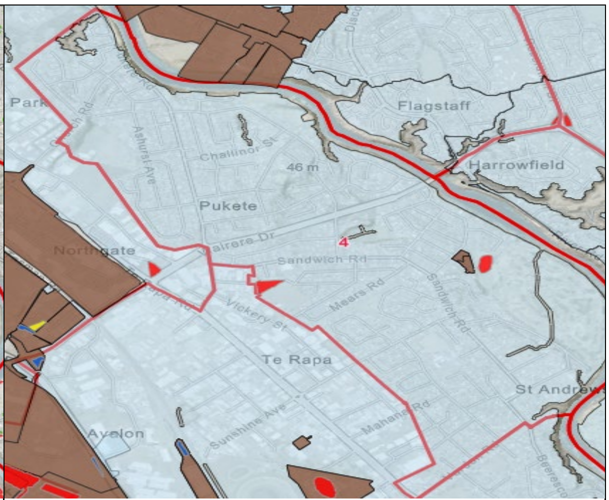


Fig. 1.2 – Existing Stormwater Treatment: Entire area is effectively untreated.

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

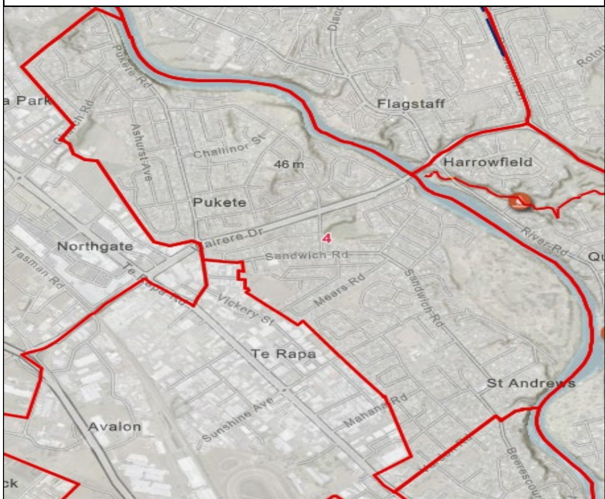


Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

Sediment quality data: Red = poor, orange = moderate, green = good.

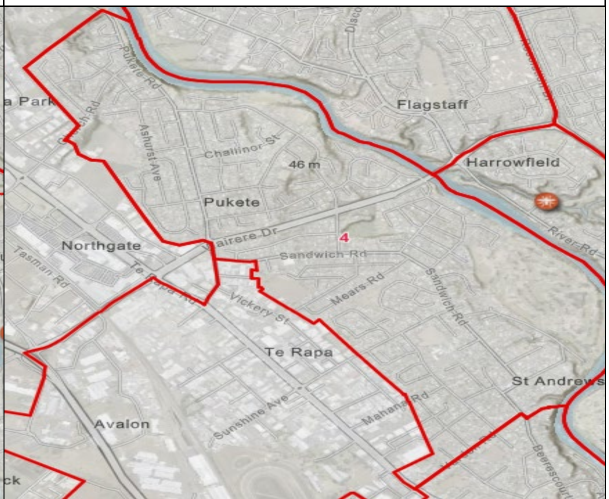


Fig 1.4 – Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.

1.4 Evidence Used to Support Assessment

There is currently no funded strategic stormwater programme for the Pukete East area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

Area 5 – Enderley North: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment for the even weighting and distributed weighting is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.00	3

1.2 Key Area Features

The Enderley North study area is approximately 330 Ha in size discharges to three catchments. The eastern side of the study area drains to the upper Kirikiriroa while the western side drains to either the Bankwood Gully or Ranfurly Gully systems. The Kirikiriroa system is one of the most extensive and important gully systems within the HCC jurisdictional area. The gully is known to both be at a significant risk from erosion, and to contain several Significant Natural Areas (SNAs).

The Enderley North area is effectively completely developed, with development generally occurring post-1970.

1.3 Summary of key considerations against each criteria

1.4

Criteria	Key Considerations
Supporting Stormwater Investigations	• No ICMP currently available. • Partial coverage of one area specific investigation – watercourse walkover.
Known flood hazard data	• Only rapid flood hazard data available for this area. • 1352 buildings affected by some level of hazard (low hazard or greater). • 218 buildings affected by high hazard. • Refer to Figure 1.1 below.
Existing treatment devices or opportunities	• No know existing treatment measures. • Opportunities to implement centralised devices are limited. Construction of centralised treatment would require resumption of private properties. • Refer Figure 1.2 below.
Watercourse quality risks	• 3 CSDC monitoring sites within • area. • Sediment quality data is poor. • MCI data varies from good to poor. On average data is fair.

	• Refer Figures 1.3 and 1.4 below.
Watercourse erosion risk	• Drains to three watercourses – Kirikiriroa and two separate Hamilton East gullies. • Erosion susceptibility data is high to moderate erosion susceptibility. • Moderate increase in impervious cover expected through redevelopment. • Refer Figure 1.3 below.
SW network capacity	• No known SW network capacity data.
Sites of cultural significance	• Known cultural sites – not located within watercourse or location not considered to be at risk.

1.5 Evidence Used to Support Assessment

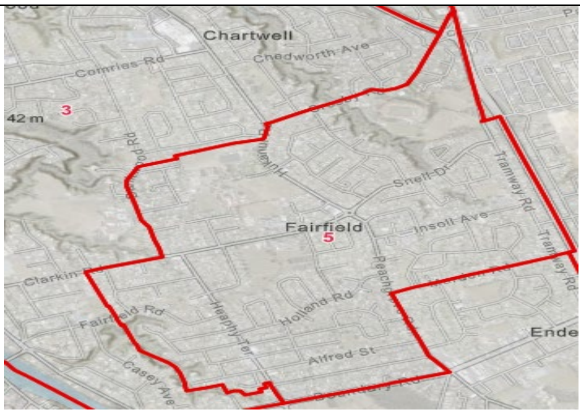


Fig 1.1 – Buildings Intersected by Flood Hazard: Properties are clustered along OLFPs adjoining the Kirikiriroa Gully and along the River. Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

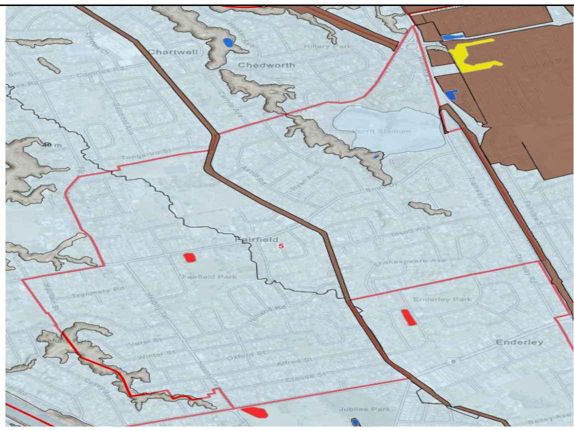


Fig. 1.2 – Existing Stormwater Treatment: Entire area is effectively untreated.
Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

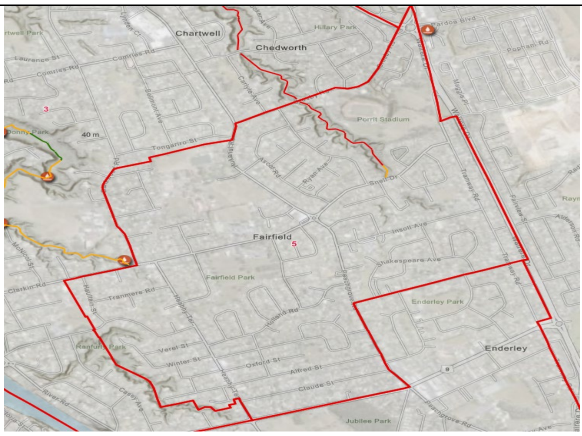


Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

Sediment quality data: Red = poor, orange = moderate, green = good.

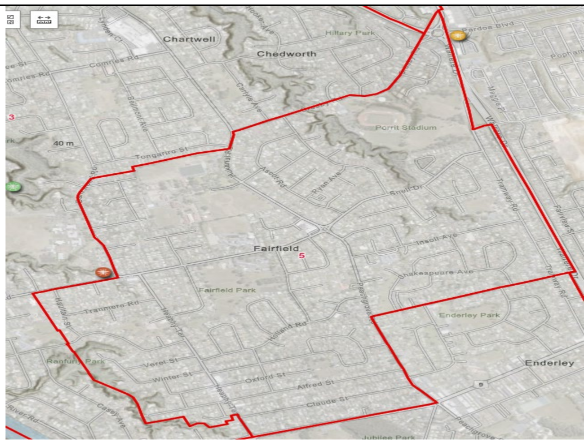


Fig 1.4 – Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.

1.6 Other Comments:

There is currently no funded strategic stormwater programme for the Enderley North area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

Erosion control works, brownfield stormwater management and brownfield flood management are all currently funded as part of capital works programs in the Kirikiriroa catchment. Approximately $8.3 million of erosion and restoration funding is available with a further $4.7 million to be shared across stormwater and flood management.

Area 6 – Claudelands: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.86	3

1.2 Key Area Features

The Chartwell study area is approximately 360 Ha in size discharges to three catchments. The eastern side of the study area drains to the upper Kirikiriroa while the western side drains to either the Bankwood Gully or Ranfurly Gully systems. The Kirikiriroa system is one of the most extensive and important gully systems within the HCC jurisdictional area. The gully is known to both be at a significant risk from erosion, and to contain several Significant Natural Areas (SNAs).

The Chartwell area is effectively completely developed, with development generally occurring post-1970.

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• No ICMP currently available for this area. • No area specific investigations undertaken to date.
Known flood hazard data	• Only rapid flood hazard data available for this area. • 1351 buildings affected by some level of hazard (low hazard or greater). • 105 buildings affected by high hazard.
Existing treatment devices or opportunities	• No know existing treatment devices. • Some opportunity to implement centralized devices – particularly around Claudelands Park.
Watercourse quality risks	• 1 CSDC monitoring sites within area • Sediment data is fair. • MCI data is fair.

Watercourse erosion risk	• No walk-over data available for either the Bankwood or Ranfurly gully systems. • Kirikiriroa stream is highly susceptible to erosion, however only 20% - 25% drains to this watercourse.
SW network capacity	• No known SW network capacity data.
sites of cultural significance	Known cultural sites – not located within watercourse or location not considered to be at risk.

1.4 Evidence Used to Support Assessment

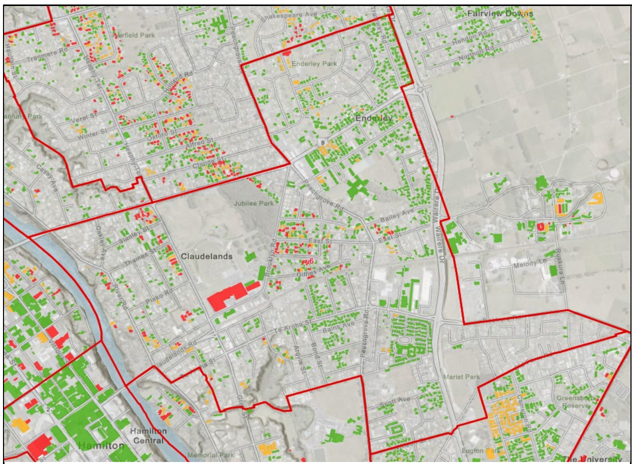


Fig 1.1 – Buildings Intersected by Flood Hazard: Properties are clustered along OLFPs adjoining the Kirikiriroa Gully and along the River.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

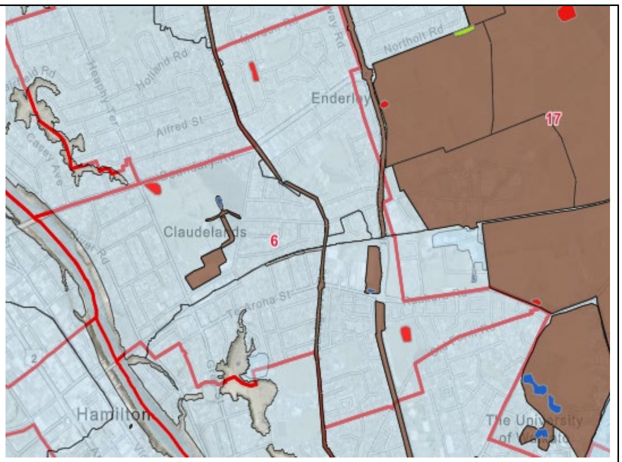


Fig. 1.2 – Existing Stormwater Treatment: Entire area is effectively untreated.

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

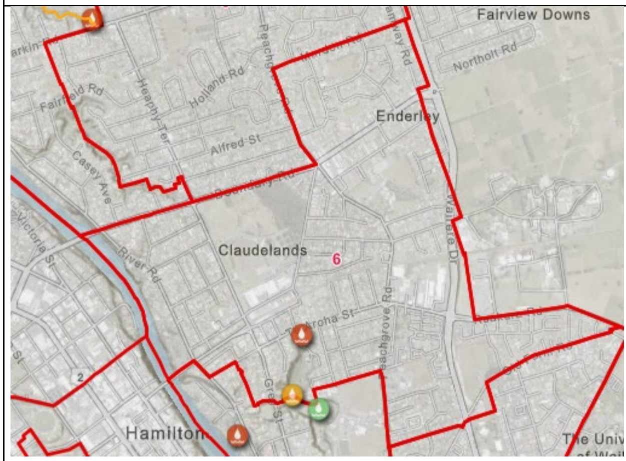


Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

Sediment quality data: Red = poor, orange = moderate, green = good.

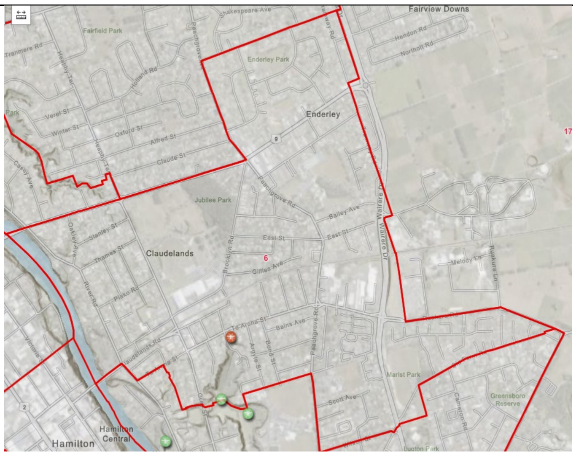


Fig 1.4 – Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.

1.5 Other Comments:

There is currently no funded strategic stormwater programme for the Chartwell area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

Erosion control works, brownfield stormwater management and brownfield flood management are all currently funded as part of capital works programs in the Kirikiriroa catchment. Approximately $8.3 million of erosion and restoration funding is available with a further $4.7 million to be shared across stormwater and flood management.

Area 7 – Hamilton East: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.14	3

1.2 Key Area Features

The Hamilton East study area is approximately 350 Ha in size. The area is drained by a small gully system at the northern extent of the area (Ranfurly Gully), the small gully system which runs through the Hamilton Gardens and multiple pipes that drain directly to the Waikato River.

Hamilton East is one of the oldest areas in Hamilton City, with development occurring since the 19th century. Given the age of some of the development in this area, drainage practices are expected to be poor.

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• No ICMP currently undertaken for the Hamilton East area. • Some stormwater modelling (hazard modelling only) available for part of area.
Known flood hazard data	• Detailed flood hazard modelling available for approximately 50% of area. Remainder covered by rapid. • 861 buildings affected by some level of hazard (low hazard or greater). • 140 buildings affected by high hazard.
Existing treatment devices or opportunities	• Minimal existing stormwater devices – will not be meeting current stormwater requirements. • Some opportunity to implement centralised devices with open space along watercourse.
Watercourse quality risks	• Insufficient data for assessment
Watercourse erosion risk	• No watercourse assessment data available.
SW network capacity	• No SW network capacity data.

	• Known issues with secondary flow paths based on rapid flooding data – i.e., lack of engineered flow paths causing significant inundation of private properties.
sites of cultural significance	• Known cultural sites – not located within watercourse or location not considered to be at risk.

1.4 Evidence Used to Support Assessment

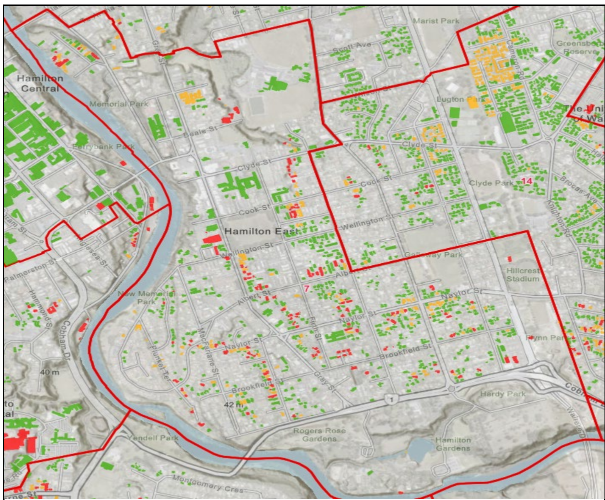


Fig 1.1 – Buildings Intersected by Flood Hazard - Hamilton East is an older developed area with private properties constructed over overland flow paths.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

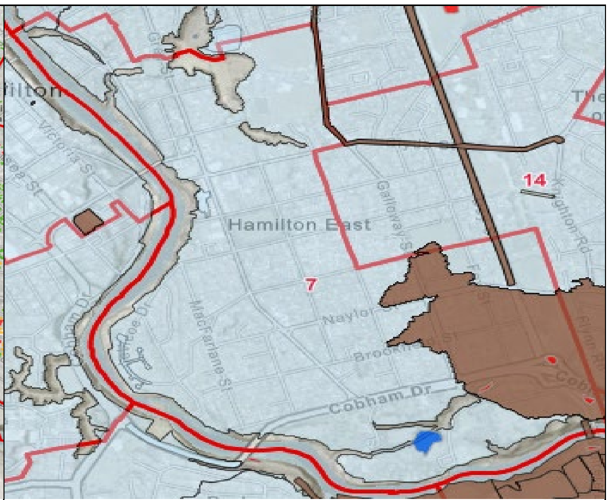


Fig. 1.2 – Existing Stormwater Treatment: Entire area is effectively untreated. South-eastern corner proposed to be treated by a future device.

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

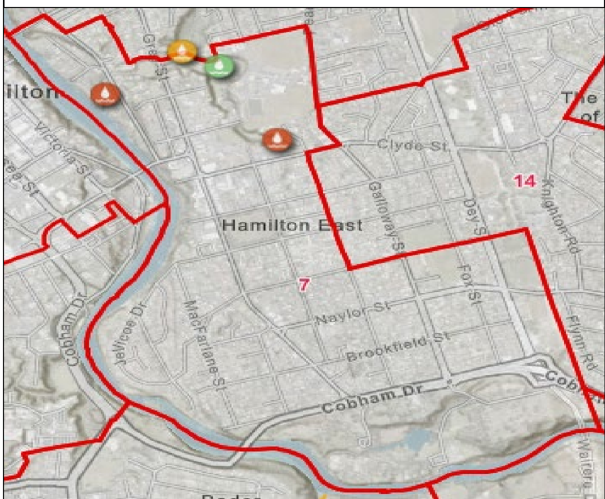


Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

Sediment quality data: Red = poor, orange = moderate, green = good.

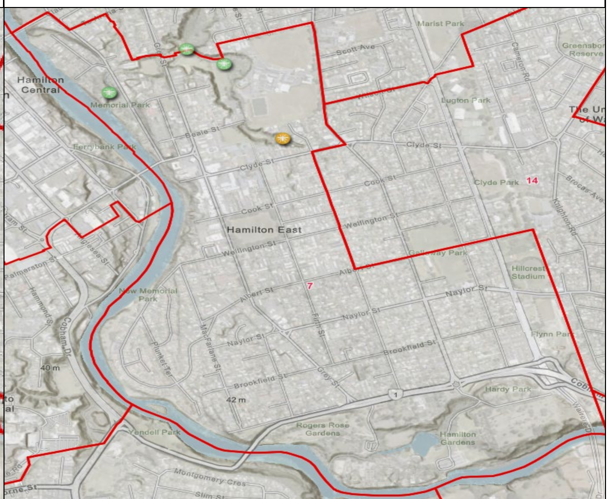


Fig 1.4 – Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.

1.5 Other Comments:

There is currently no funded strategic stormwater programme for the Hamilton East area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

Area 8 – Beerescourt: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.86	3

1.2 Key Area Features

The Beerescourt study area is approximately 500 Ha in size and is located immediately north of the Hamilton CBD. The Beerescourt area is located at the outlet of the Waitawhiriwhiri stream, with the majority of the area either draining to the stream, or directly to the Waikato River. Ground levels within the area vary from around 56 mRL to approximately 17 mRL – 18 mRL along lower lying areas adjacent to the Waitawhiriwhiri stream and River. The majority of the area is relatively flat with level varying between 34 mRL and 37 mRL.

Development in this area has been occurring since the early 1900's and it is expected that stormwater drainage design & practices will likely reflect this history.

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• No ICMP currently available. • Two investigations available - flood hazard data and watercourse walkover.
Known flood hazard data	• Detailed flood hazard modelling available for most of area. • 1364 buildings affected by some level of hazard (low hazard or greater). • 240 buildings affected by high hazard.
Existing treatment devices or opportunities	• No know existing treatment devices. • Opportunities to implement centralised devices are generally good, with open space aligned with piped networks and adjacent to watercourses.
Watercourse quality risks	• 1 CSDC monitoring sites within area. • Sediment data is poor. • MCI data is good.

Watercourse erosion risk	• Moderate erosion susceptibility watercourse. • Limited change in impervious cover expected as current landuse is highly impervious.
SW network capacity	• No SW network capacity data. • Results of frequent flood events (2y, 10y ARI) from detailed flood study shows impacts on properties in multiple locations. • Known lack of engineered secondary flow paths.
sites of cultural significance	• Known cultural sites – PA site appears to be located in gully downstream of Te Rapa Road.

1.4 Evidence Used to Support Assessment

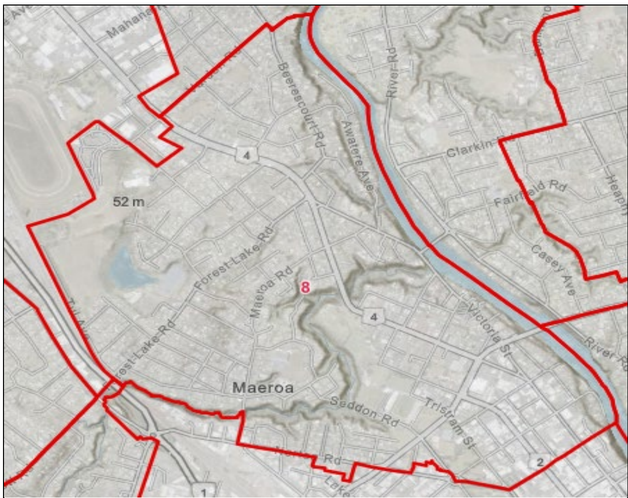


Fig 1.1 – Buildings Intersected by Flood Hazard: Flagstaff East is mix of newer developed area and greenfield, with minimal existing buildings at risk.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

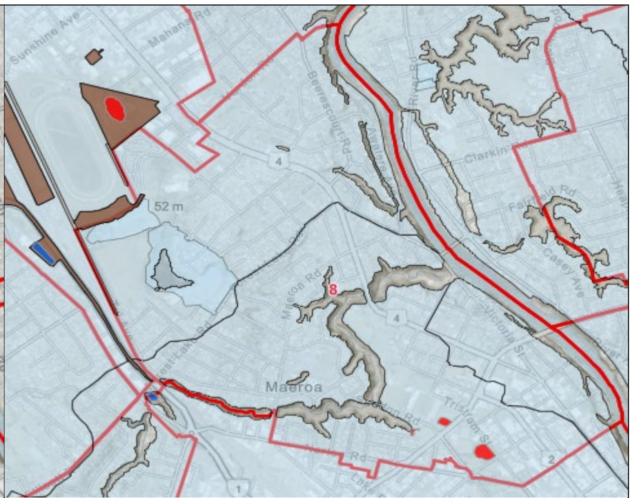


Fig. 1.2 – Existing Stormwater Treatment: Entire area is effectively untreated.

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

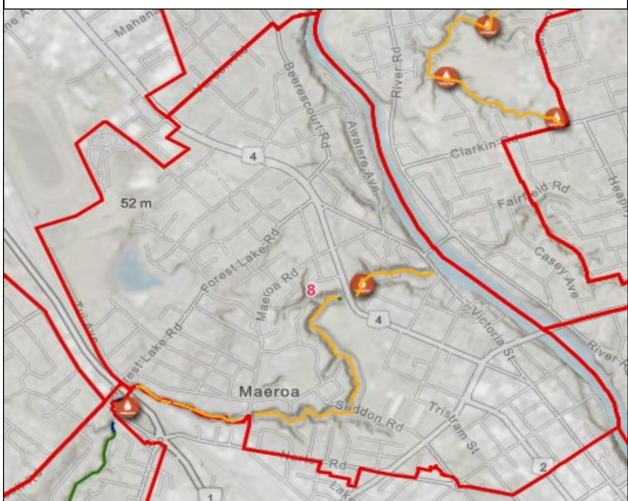


Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

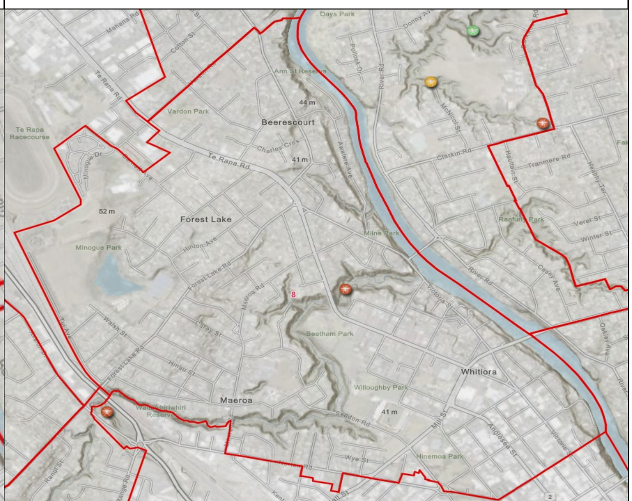


Fig 1.4 – Macroinvertebrate Index (MCI) data shown as points with traffic-light colouring.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low. *Sediment quality data: Red = poor, orange =* moderate*, green = good.*	

1.5 Other Comments:

There is currently no funded strategic stormwater programme for the Beerescourt area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

Erosion control works, brownfield stormwater management and brownfield flood management are all currently funded as part of capital works programs in the Waitawhiriwhiri catchment. Approximately $1.2 million of erosion and restoration funding is available with a further $4.6 million to be shared across stormwater and flood management.

Area 9 – Crawshaw: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.43	2

1.2 Key Area Features

The Crawshaw study area is approximately 430 Ha in size and occupies the upper reaches of the Rotokauri stream catchment. Levels vary from approximately 60 mRL in the headwaters to 33 mRL the outlet of the area. Most surface flows discharge in a northerly direction into the upstream end of the Rotokauri greenway drainage system, with a small amount of the area draining to the Waitawhiriwhiri stream to the south. The majority of the primary drainage system outlets to the Waitawhiriwhiri stream. No natural watercourses remain in the Crawshaw area, and generally no engineered flow paths have been provided for secondary flows.

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• No ICMP currently available. • Downstream SW investigations undertaken for Rotokauri ICMP or District Plan (flood modelling).
Known flood hazard data	• Detailed flood hazard modelling available for most of area. • 1890 buildings affected by some level of hazard (low hazard or greater). • 67 buildings affected by high hazard.
Existing treatment devices or opportunities	• No know existing treatment measures. • Opportunities to implement centralised devices are limited. Construction of centralised treatment would require resumption of private properties.
Watercourse quality risks	• No watercourses within area. Downstream watercourse is Rotokauri Greenway.
Watercourse erosion risk	• No watercourses within area. Downstream watercourse is Rotokauri Greenway.
SW network capacity	• No SW network capacity data.

sites of cultural significance	• Known cultural sites – not located within watercourse or location not considered to be at risk.

1.4 Evidence Used to Support Assessment

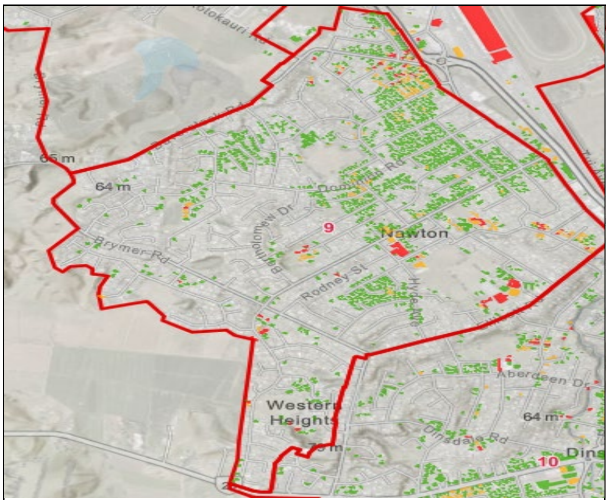


Fig 1.1 – Buildings Intersected by Flood Hazard Crawshaw – significant numbers of building affected by low hazard. Small numbers of properties affected by higher hazard toward catchment outlets.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

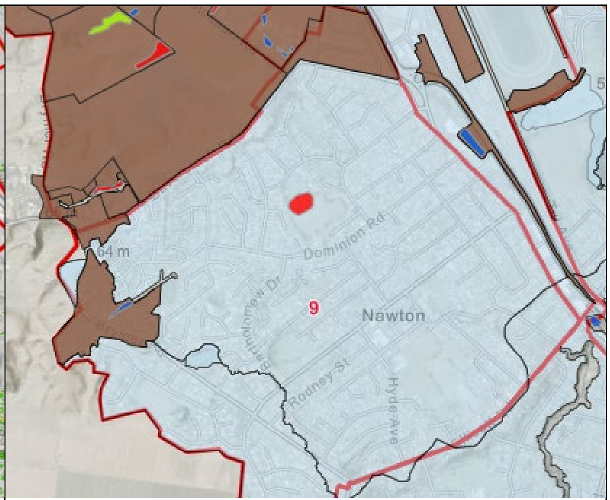


Fig. 1.2 – Existing Stormwater Treatment: Entire area is effectively untreated.

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

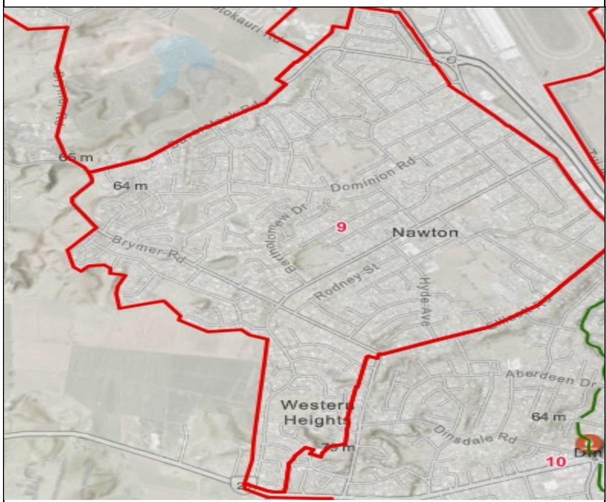


Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

Sediment quality data: Red = poor, orange = moderate, green = good.

Fig 1.4 Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.

1.5 Other Comments:

There is currently no funded strategic stormwater programme for the Crawshaw area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

Significant strategic stormwater infrastructure investment is currently funded the 2021 Long Term Plan (LTP) downstream (associated with the Rotokauri Greenway Corridor). This provides a downstream system with capacity to receive urbanised flows, making upgrade of infrastructure to service Crawshaw simpler. However, it is unlikely to improve drainage for the area itself.

Area 10 – Dinsdale North: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.43	2

1.2 Key Area Features

The Dinsdale North study area is approximately 460 Ha in size and is bisected by the Waitawhiriwhri watercourse. The Waitawhiriwhri Stream varies from a highly modified drain at the upstream extent of the area to a highly incised gully at the downstream, although the channel remains in a highly modified state. While ground levels in the area vary form approximately 70 mRL to 27 mRL, the majority of the area is relatively flat varying around 34 mRL to 36 mRL.

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• No ICMP currently available. • Two investigations available - flood hazard data and watercourse walkover.
Known flood hazard data	• Detailed flood hazard modelling available for most of area. • 2088 buildings affected by some level of hazard (low hazard or greater). • 80 buildings affected by high hazard.
Existing treatment devices or opportunities	• No know existing treatment devices. • Some opportunity to implement centralised devices with open space along watercourse.
Watercourse quality risks	• 3 available monitoring sites within area. • Sediment data is poor. • MCI data is fair.
Watercourse erosion risk	• Low erosion susceptibility watercourse. • Limited change in impervious cover expected as catchment is already developed at a high impervious cover level.
SW network capacity	• No SW network capacity data. • Available FHM study (Waitawhiriwhri catchment) indicates flooding impacts in frequent events (2y ARI).

sites of cultural significance	• Known cultural sites – not located within watercourse or location not considered to be at risk.

1.4 Evidence Used to Support Assessment

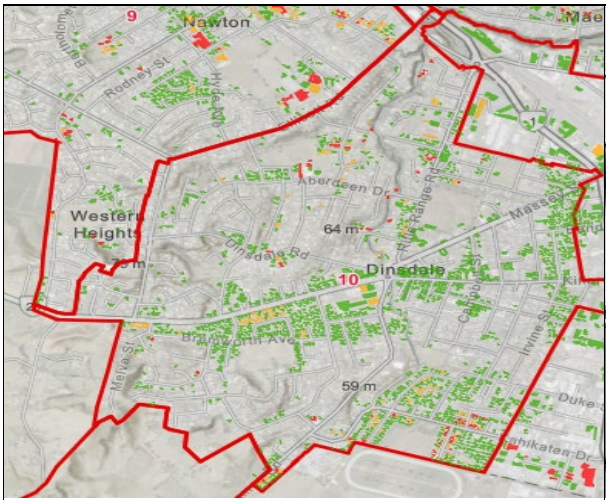


Fig 1.1 – Buildings Intersected by Flood Hazard: Dinsdale is an older developed area with significant numbers of buildings at risk.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

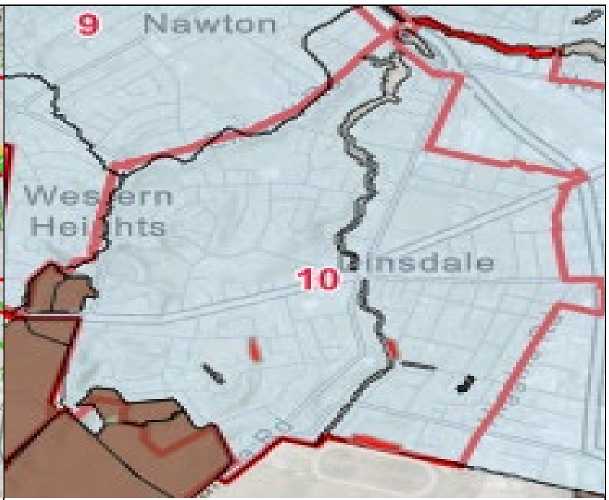


Fig. 1.2 – Existing Stormwater Treatment: Entire area is effectively untreated.

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

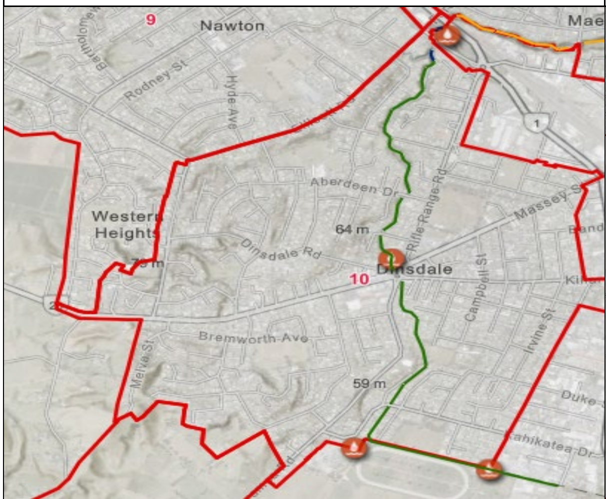


Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

Sediment quality data: Red = poor, orange = moderate, green = good.

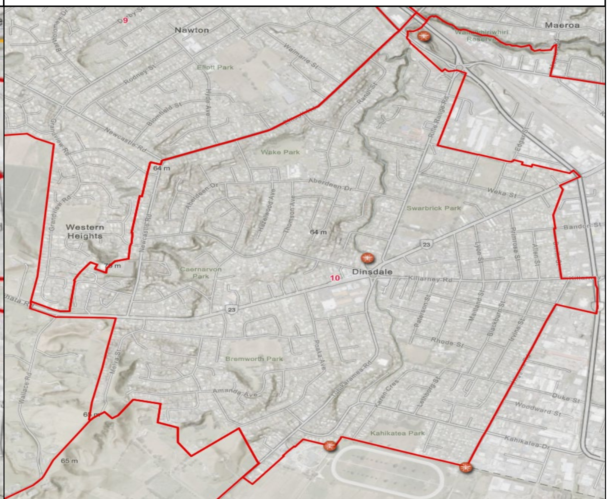


Fig 1.4 – Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.

1.5 Other Comments:

There is currently no funded strategic stormwater programme for the Dinsdale North area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

Erosion control works, brownfield stormwater management and brownfield flood management are all currently funded as part of capital works programs in the Waitawhiriwhiri catchment. Approximately $1.2 million of erosion and restoration funding is available with a further $5.4 million to be shared across stormwater and flood management.

Area 11 – Hamilton Lakes: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.43	2

1.2 Key Area Features

The Hamilton Lake study area is approximately 330 Ha in size and located immediately adjacent to the Hamilton CBD. A significant proportion (approx. 35%) of the area is taken up by the lake and its immediate catchment. The western side of the area drains into a low-capacity reticulated network system in the upper Waitawhiriwhiri catchment, the eastern side drains to either a small gully adjacent to the hospital or the CBD pipe system.

Ground elevations vary from approximately 55 mRL is the hills surrounding the lake to 20 mRL around the outlet to the Waikato River.

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• No ICMP currently available. • A number of SW investigations available - flood hazard data, quality/ecology and brownfield stormwater investigation underway.
Known flood hazard data	• Detailed flood hazard modelling available for most of area. • 405 buildings affected by some level of hazard (low hazard or greater). • 26 buildings affected by high hazard.
Existing treatment devices or opportunities	• No know existing treatment devices. • Opportunities to implement centralised devices are generally good, with open space aligned with piped networks and adjacent to watercourses.
Watercourse quality risks	• Several sediment quality available monitoring site within Lake. • No MCI data available. • Sediment data is fair.
Watercourse erosion risk	• No data – limited waterways within or downstream of this catchment.

SW network capacity	• No SW network capacity data. • Available FHM study indicates flooding impacts on properties in frequent events, indicating capacity issues.
sites of cultural significance	• Known cultural sites – PA site appears to be located adjacent to Graham Park. May be at risk form increased SW flows.

1.4 Evidence Used to Support Assessment

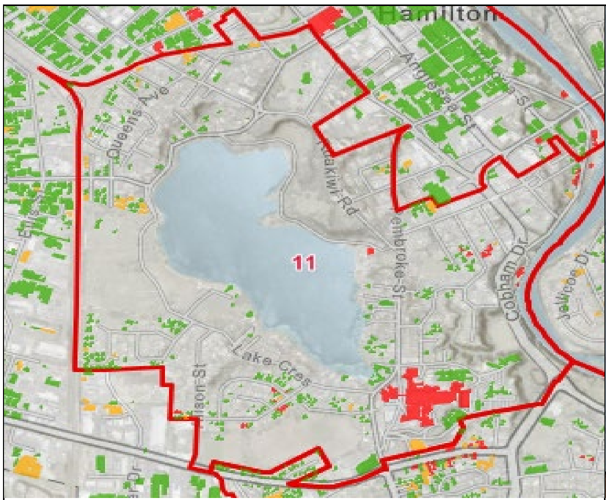


Fig 1.1 – Buildings Intersected by Flood Hazard Hamilton Lake - Relatively few buildings impacted by flooding. Hospital falsely identified due to size of the building

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

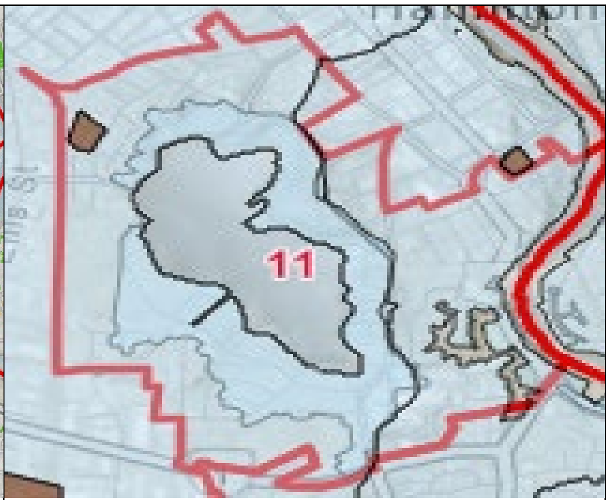


Fig. 1.2 – Existing Stormwater Treatment: Entire area is effectively untreated.

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

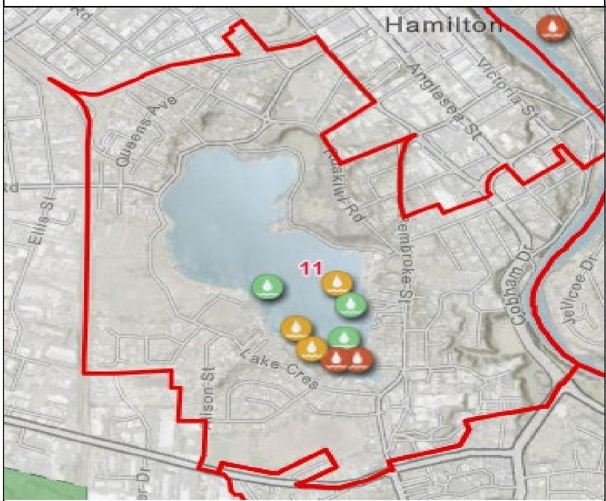


Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

Sediment quality data: Red = poor, orange = moderate, green = good.

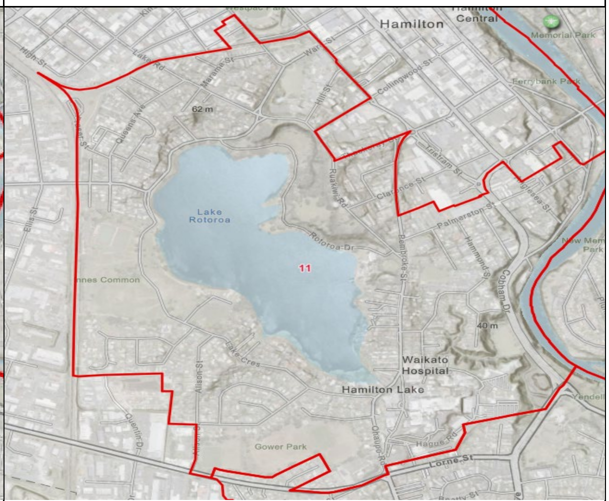


Fig 1.4 – Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.

1.5 Other Comments:

There is currently no funded strategic stormwater programme for the Hamilton Lake area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

Area 12 – Mangakootukutuku/Bader: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.71	3

1.2 Key Area Features

The Mangakootukutuku and Bader study area is approximately 700 Ha in size and is mainly made up of the western tributary of the Mangakootukutuku stream. A small portion of area on the eastern side of the area drains to the eastern tributary. Areas draining to the western tributary tend to be older brownfield development areas while those portions which drain to the eastern tributary are newer areas associated with the Peacocke growth cell.

Ground levels vary from 55 mRL to 60 mRL in the upper reaches of the area to 24 mRL to 26 mRL around the outlet to the Waikato River (invert of gully levels are up to 10m – 15m lower than this).

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• ICMP and supporting investigations practically completed. • ICMP focused on greenfield portion of catchment.
Known flood hazard data	• Detailed flood hazard modelling available for most of area. • 1580 buildings affected by some level of hazard (low hazard or greater). • 75 buildings affected by high hazard.
Existing treatment devices or opportunities	• No know existing treatment devices. • Some opportunity to implement centralised devices
Watercourse quality risks	• 7 available monitoring sites within area. • Sediment data is mostly poor. • MCI data varies from good to poor. On average data is good.

Watercourse erosion risk	• Overall moderate erosion susceptibility watercourse. • Limited change in impervious cover expected as catchment is already developed at a high impervious cover level.
SW network capacity	• SW network capacity information available in ICMP. • Less than 75% of pipes at or over capacity in 10y event.
sites of cultural significance	• Known cultural sites – flour mill and PA site appears to be located adjacent gully/stream. May be at risk form increased SW flows.

1.4 Evidence Used to Support Assessment

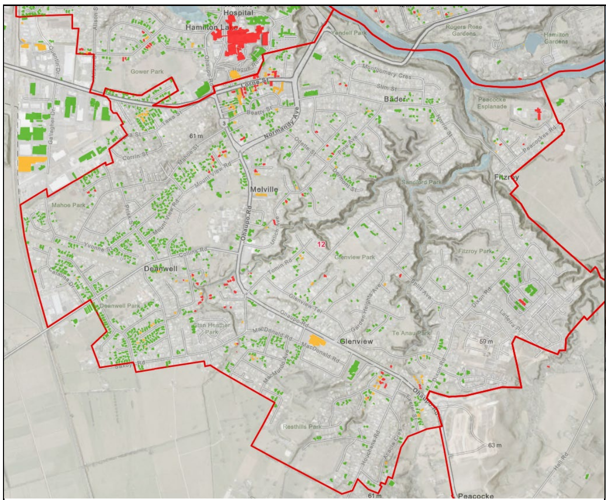


Fig 1.1 – Buildings Intersected by Flood Hazard Mangakootukutuku – moderate number of buildings.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

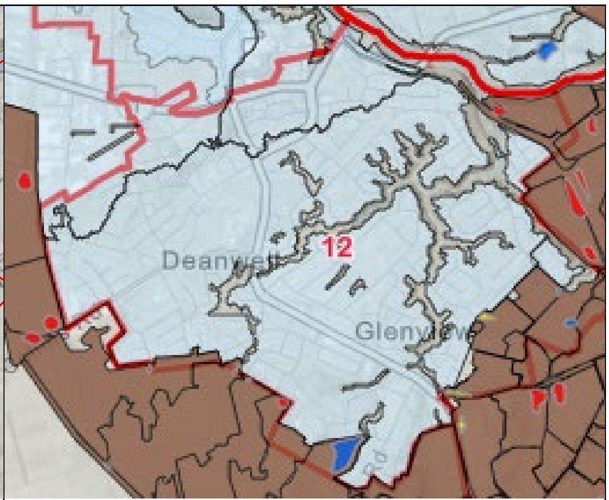


Fig. 1.2 – Existing Stormwater Treatment:

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

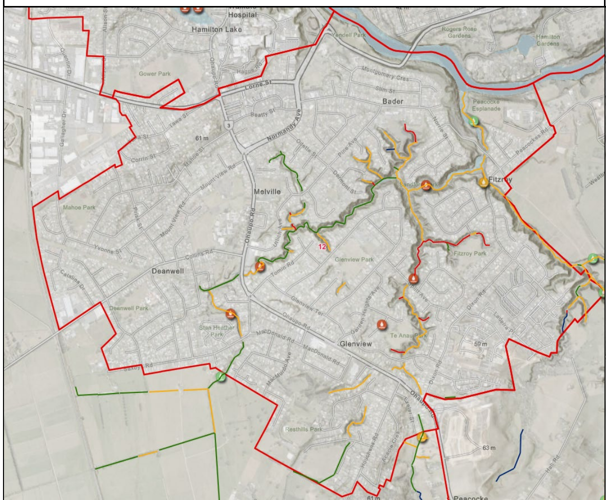


Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

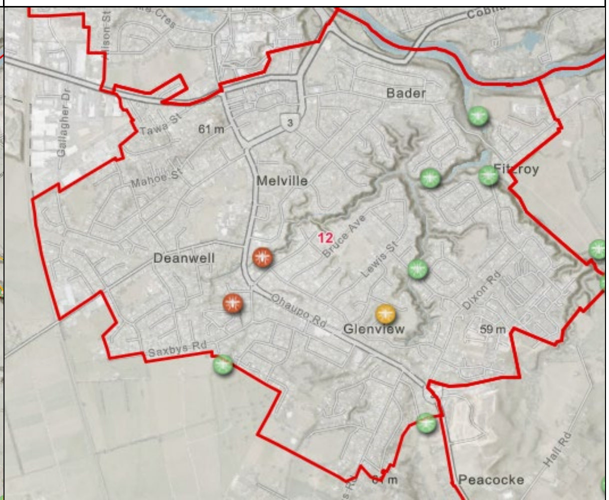


Fig 1.4 – Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.

Sediment quality data: Red = poor, orange = moderate, green = good.	

1.5 Other Comments:

There is currently no funded strategic stormwater programme for the Mangakootukutuku and Bader area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

Erosion control works, brownfield stormwater management and brownfield flood management are all currently funded as part of capital works programs in the Mangakootukutuku catchment. Approximately $3.6 million of erosion and restoration funding is available with a further $1.6 million to be shared across stormwater and flood management.

Area 13 – Hillcrest East: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	3.29	3

1.2 Key Area Features

The Hillcrest East study area is approximately 360 Ha in size and mostly runs along the western bank of the Mangonua Stream in the southeast of the city. A small section of the study area drains directly to the Waikato River through a small gully in the south. Drainage paths are typically short, with flows piped laterally into the Mangonua Stream.

Ground levels in the area vary from around 60 mRL in the upper reaches to closer to 40 mRL along the banks of the Mangonua Stream (although the stream bed itself sits approx. 15m lower than this).

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• No ICMP currently available. • No area specific investigations undertaken to date.
Known flood hazard data	• Only rapid flood hazard data available for this area. • 810 buildings affected by some level of hazard (low hazard or greater). • 110 buildings affected by high hazard.
Existing treatment devices or opportunities	• No know existing treatment devices. • Opportunities to implement centralised devices are limited. Construction of centralised treatment would require resumption of private properties.
Watercourse quality risks	• 4 available monitoring sites within area. • Sediment data is poor. • MCI data varies from good to poor. On average data is good.
Watercourse erosion risk	• Only partial coverage of walk-over data (approximately 40% of waterway). • Where walkover is available, erosion/restoration project underway (Mangonua Gully) • Limited change in impervious cover expected as catchment is already developed at a high impervious cover level.

SW network capacity	• No SW network capacity data.
sites of cultural significance	• Known cultural sites – several PA sites appears to be located adjacent gully/stream. May be at risk from increased SW flows.

1.4 Evidence Used to Support Assessment

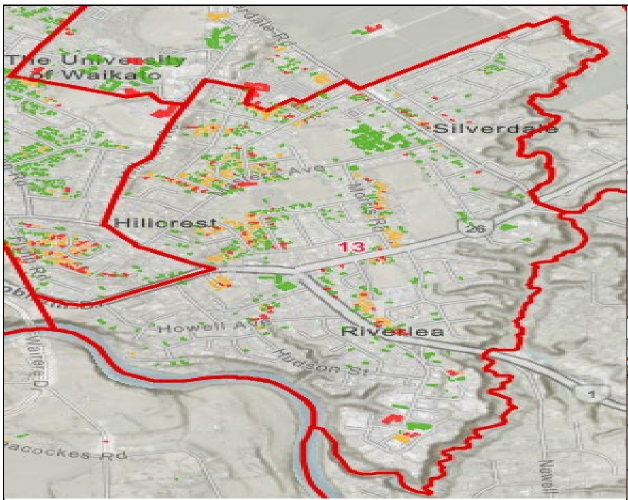


Fig 1.1 – Buildings Intersected by Flood Hazard: Flagstaff East is mix of newer developed area and greenfield, with minimal existing buildings at risk.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

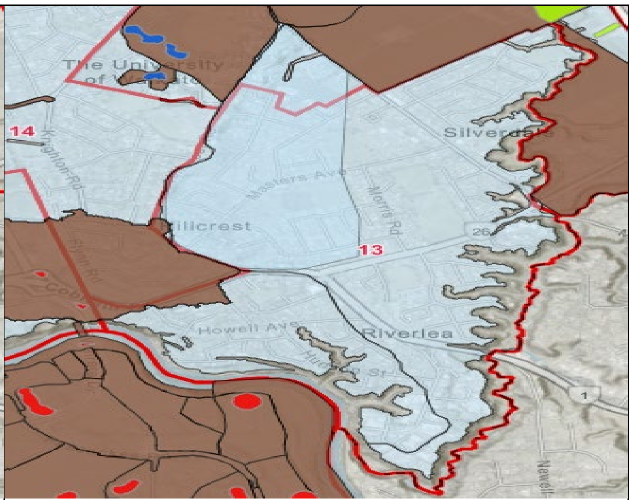


Fig. 1.2 – Existing Stormwater Treatment: Entire area is effectively untreated.

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

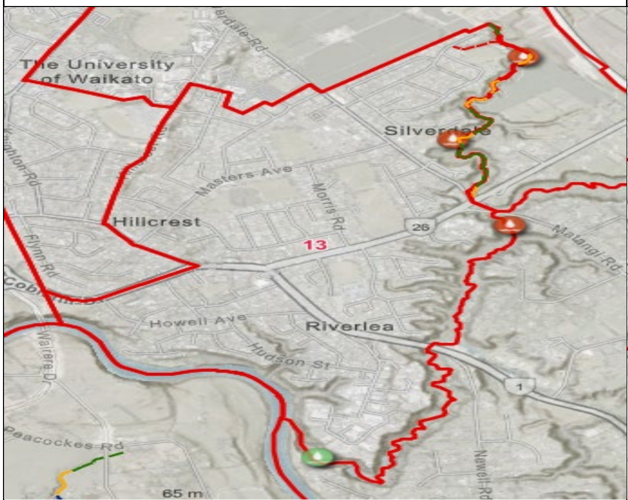


Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

Fig 1.4 – Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.

Sediment quality data: Red = poor, orange = moderate, green = good.	

1.5 Other Comments:

There is currently no funded strategic stormwater programme for the Hillcrest East area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

Area 14 – Greensboro: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.86	3

1.2 Key Area Features

The Greensboro study area is approximately 210 Ha in size and in located in the south-eastern sector of the city. The majority of the area does not have well defined overland flow paths, with much of this area actually being internally draining, with reticulation piped into the Ranfurly Gully system. A small area in the south of the Greensboro area is drained to the Waikato River through the gully system that runs through the gardens.

Ground levels vary from approximately 60 mRL in the highest parts of the area to around 39 mRL in the central ponding areas. While there is reasonable elevation difference across the area, higher ground is limited to the eastern extent of the area and mostly Greensboro is relatively flat, vary between 39 mRL and 41 mRL.

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• No ICMP currently available. • Limited area of detailed flood hazard information available.
Known flood hazard data	• Detailed flood hazard modelling available for most of area. • 1147 buildings affected by some level of hazard (low hazard or greater). • 110 buildings affected by high hazard.
Existing treatment devices or opportunities	• Some treatment along Wairere Drive upgrade corridor, none outside of this. • Central green corridor provides some opportunity to implement centralised devices.
Watercourse quality risks	• Discharges to two watercourses south/north. • 1-3 monitoring locations at northern outlet of area, none in south. • Sediment data fair. • MCI data is fair.

Watercourse erosion risk	• No watercourse assessment data.
SW network capacity	• No SW network capacity data.
sites of cultural significance	• Known cultural sites – not located within watercourse or location not considered to be at risk.

1.4 Evidence Used to Support Assessment

Fig 1.1 – Buildings Intersected by Flood Hazard Greensboro – Large number of buildings affected by flood hazards due to area not having secondary flow outlets.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

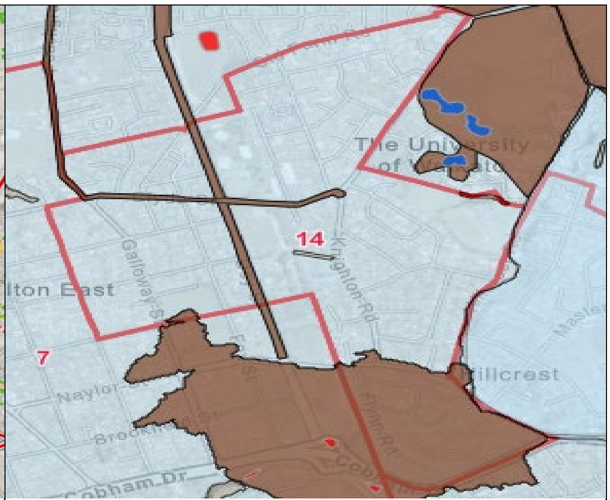


Fig. 1.2 – Existing Stormwater Treatment: Entire area is effectively untreated. A small section in the south is flagged for a future device.

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Fig 1.4 – Macroinvertebrate Index (MCI) data.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low. *Sediment quality data: Red = poor, orange = moderate, green = good.*	*MCI data: Red = poor, orange = fair, green = good.*

1.5 Other Comments:

There is currently no funded strategic stormwater programme for the Greensboro area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

Erosion control works, brownfield stormwater management and brownfield flood management are all currently funded as part of capital works programs in the Hamilton East catchment. Approximately $460k of erosion and restoration funding is available with a further $2.4 million to be shared across stormwater and flood management.

Area 15 – Rotokauri: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	1.43	1

1.2 Key Area Features

The Rotokauri-Waiwhakareke study area is approximately 710 Ha in size with two outlet locations – one in the southern section which discharges to Lake Rotokauri and one in the northern section which discharges to the Ohote Stream. The study area has historically been used for agricultural purposes (farming) with very high level of land clearing and modification of natural waterways. The study area is currently (or will be soon) being developed through the Rotokauri South and Rotokauri North development areas. HCC are currently leading a strategic stormwater network capital works project to develop a central stormwater conveyance and treatment corridor servicing the southern area (The Greenway corridor).

Ground levels vary from approximately 55 mRL – 60 mRL in the higher locations to 28 mRL – 30 mRL at the outlets. The majority of the area is very flat with little hydraulic grade.

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• ICMP and subsequent infrastructure planning undertaken in 2013-15.
Known flood hazard data	• Greenfield development area.
Existing treatment devices or opportunities	• Greenfield development area.
Watercourse quality risks	• 4 MCI sites within southern central drainage channel. • Sediment data is good. • MCI data is fair.

Watercourse erosion risk	• Watercourse is a farm drain and will be re-developed in Greenway project.
SW network capacity	• Greenfield development area.
sites of cultural significance	• Known cultural sites – not located within watercourse or location not considered to be at risk.

1.4 Evidence Used to Support Assessment

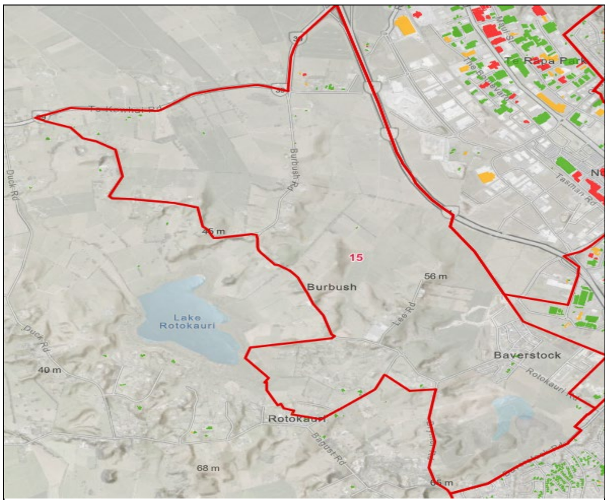


Fig 1.1 – Buildings Intersected by Flood Hazard: Rotokauri is a rural greenfield area with minimal existing buildings at risk.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

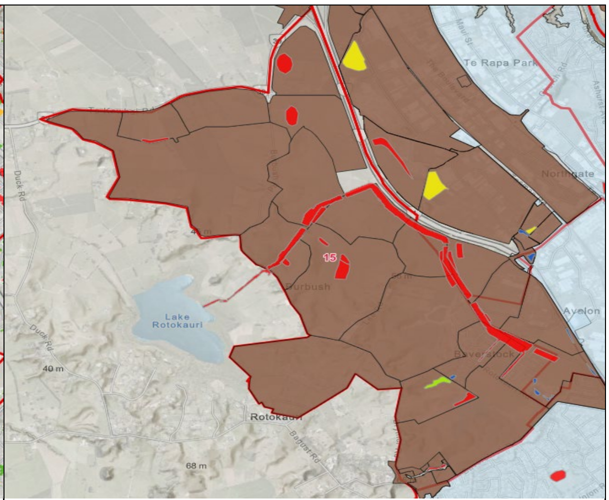


Fig. 1.2 – Existing Stormwater Treatment: Growth cell will Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

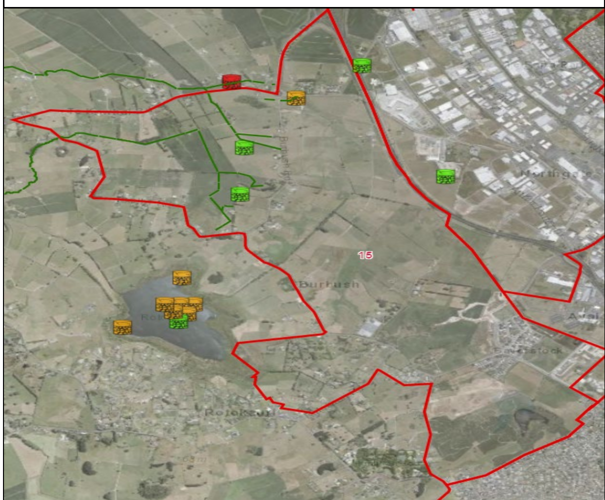


Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

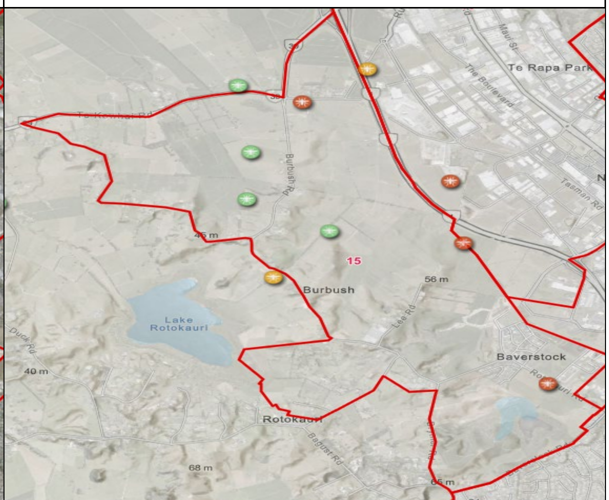


Fig 1.4 – Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.

Sediment quality data: Red = poor, orange = moderate, green = good.	

1.5 Other Comments:

A significant strategic stormwater capital works programme to support growth is funded under the current HCC Long term Plan (Plan) and 30 year infrastructure plan. Currently there is $62 Million funded for stormwater quality & quantity management within the LTP and a further $207 Million proposed to be funded under the 30-year plan. A key part of this is the Greenway project.

Area 16 – Te Rapa: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2	2

1.2 Key Area Features

The Te Rapa study area is approximately 920 Ha in size and spans five different catchments in the north of the City; the Te Rapa stream, the Mangaheka, the Pukete stream and two smaller gully systems north and south of the Fonterra processing plant. Approximately 25% drains to the Mangaheka which is very flat with existing drainage constraints due to lack of hydraulic grade. Around 30% drains to the Te Rapa stream which is piped in it's upper reaches then discharges in farmland adjacent to the Fonterra processing plant. Around 30% drains to the Pukete stream which is also piped in it's upper reaches before discharging to an incised gully system which has been heavily modified through the WWTP. The remaining areas are rural and drain to smaller incised gullies feeding directly into the Waikato River.

1.3 Summary of key considerations against each criteria

Criteria	**Key Considerations**
Supporting Stormwater Investigations	• ICMP and subsequent infrastructure planning drafted (or completed) for greenfield and most of the brownfield area. • No studies in the area draining to
Known flood hazard data	• Only rapid flood hazard data available for this area (for building footprint assessment). • 215 buildings affected by some level of hazard (low hazard or greater). • 50 buildings affected by high hazard.
Existing treatment devices or opportunities	• Mixture of brownfield and greenfield areas. • Opportunities to implement centralised devices (in brownfield) are generally good.
Watercourse quality risks	• 7 available monitoring sites within area. • Sediment data is fair. • MCI data is fair.

Watercourse erosion risk	• Area discharges to three main streams. • Te Rapa stream is generally high erosion susceptibility watercourse. • Te Otamanui/Mangaheka stream is a generally low erosion susceptibility watercourse. • No watercourse data for Pukete Stream.
SW network capacity	• SW network capacity data available for Te Rapa Boulevard, but not other areas. • No capacity issues for Te Rapa Boulevard. • Significant capacity issues identified for sections of Te Otamanui/Mangaheka.
sites of cultural significance	• Known cultural sites – not located within watercourse or location not considered to be at risk.

1.4 Evidence Used to Support Assessment

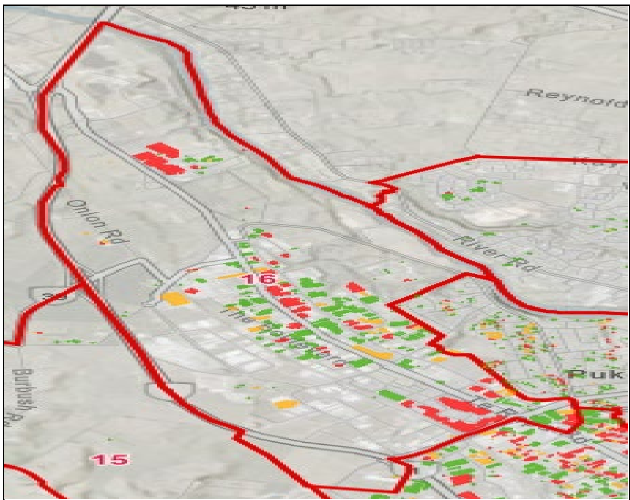


Fig 1.1 – Buildings Intersected by Flood Hazard Te Rapa – significant amounts of greenfield and new development, so relatively small number of buildings at risk.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

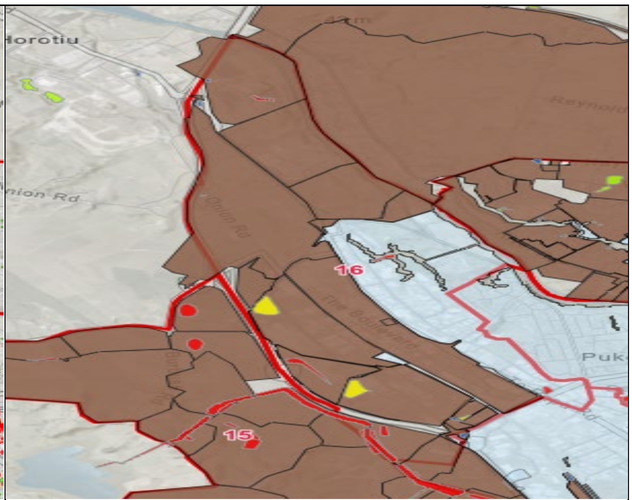


Fig. 1.2 – Existing Stormwater Treatment: Newer developed areas are treated, however most treatment catchment shown above are for future devices.

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

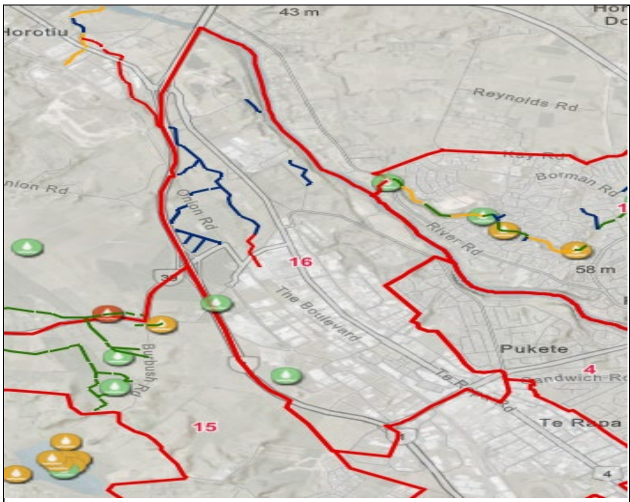
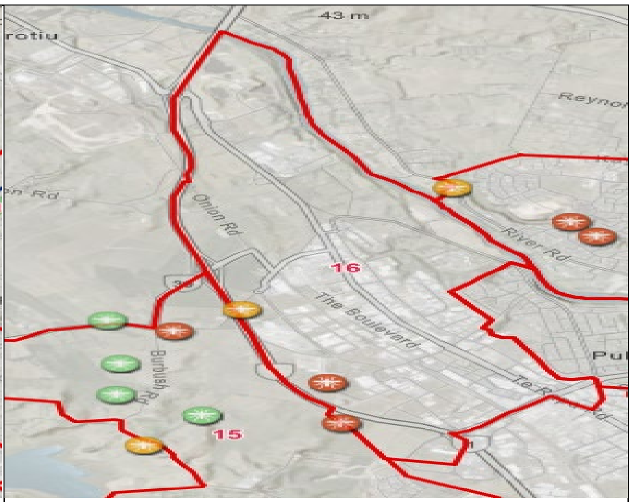
	

Fig 1.3 – Watercourse assessment data and sediment quality monitoring points. *Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.* *Sediment quality data: Red = poor, orange = moderate, green = good.*	*Fig 1.4 – Macroinvertebrate Index (MCI) data.* *MCI data: Red = poor, orange = fair, green = good.*

1.5 Other Comments:

There is currently no funded strategic stormwater programme for the brownfield areas of the Te Rapa area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

Area 17 – Ruakura: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2.43	2

1.2 Key Area Features

The Ruakura study area is approximately 1,000 Ha in size and is located along the eastern bounds of the Hamilton City jurisdictional area. The western side of the area is the headwaters of the Kirikiriroa stream, while the eastern side currently drain underneath the Waikato Expressway in multiple locations and towards the Mangawara. A section of the southern part of the study area drains into the Mangaonua Stream.

The Ruakura area is very flat, with ground levels typically within the 37 mRL to 40 mRL range. Some higher elevations exist (up to 50 mRL), however these are isolated.

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• No Council-led ICMP, however developer-led ICMPs in development for all greenfield parts of the study area.
Known flood hazard data	• Only rapid flood hazard data available for this area. • 806 buildings affected by some level of hazard (low hazard or greater). • 32 buildings affected by high hazard.
Existing treatment devices or opportunities	• Mixture of brownfield and greenfield areas. • Opportunities to implement centralised devices (in brownfield) are limited, however this represents a small portion of the area.
Watercourse quality risks	• 2 CSDC monitoring sites within area. • Insufficient data – classified high as drains to 2 watercourses.
Watercourse erosion risk	• Significant proportion of the study area drains into the Kirikiriroa which is highly susceptible to erosion. • Significant change in impervious cover expected.

SW network capacity	• No SW network capacity data. • Significant proportion of the area drains to existing Council network which is unlikely to have capacity due to catchment area or low-capacity farm drain network on western side of WEX.
sites of cultural significance	• Known cultural sites – not located within watercourse or location not considered to be at risk.

1.4 Evidence Used to Support Assessment

Fig 1.1 – Buildings Intersected by Flood Hazard Ruakura – area is majority greenfield.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

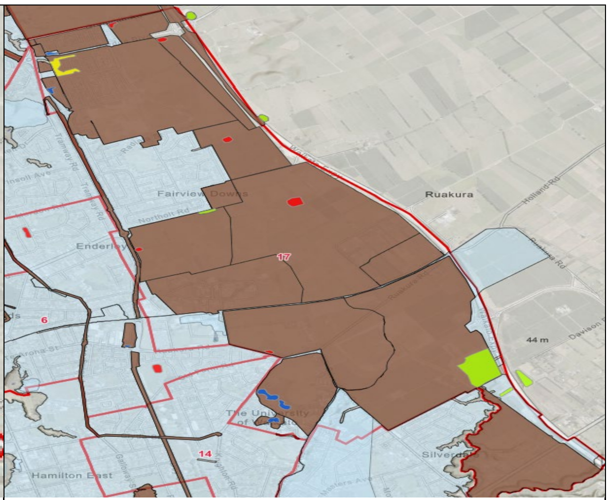


Fig. 1.2 – Existing Stormwater Treatment:

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

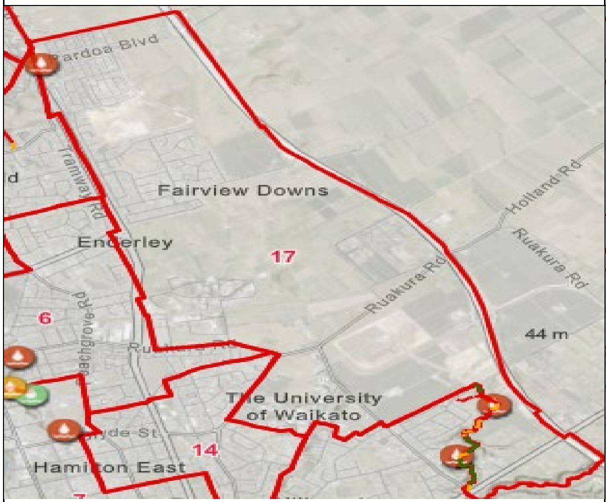


Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

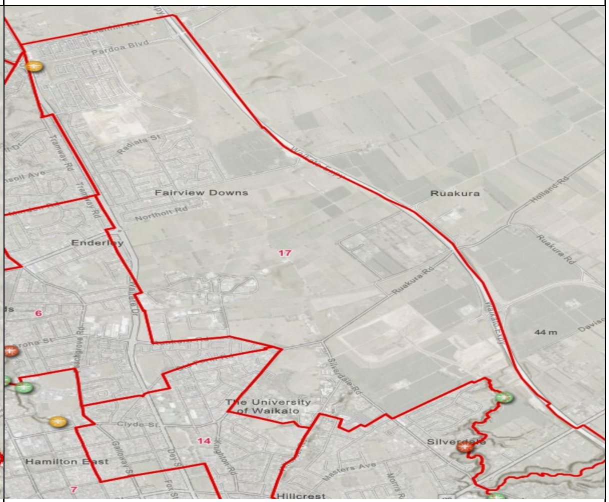


Fig 1.4 – – Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.

Sediment quality data: Red = poor, orange = moderate, green = good.	

1.5 Other Comments:

There is currently no funded strategic stormwater programme for the brownfield sections of the Ruakura area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

Erosion control works, brownfield stormwater management and brownfield flood management are all currently funded as part of capital works programs in the Kirikiriroa catchment. Approximately $8.3 million of erosion and restoration funding is available with a further $4.7 million to be shared across stormwater and flood management.

The Ruakura area is an identified growth cell area, however strategic stormwater infrastructure has generally been identified as developer-led. $4 million is current funded through the current LTP for stream erosion protection and restoration works for the Mangaonua stream.

Area 18 – Peacocke: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

	RAW SCORE	ROUNDED SCORE
OVERALL ASSESSMENT (EVEN WEIGHTING)	2	2

1.2 Key Area Features

The Peacocke study area is approximately 690 Ha in size, with the majority of the area falling within the eastern branch of the Mangakootukutuku stream. A small section along the eastern extent of the study area drains directly to the Waikato River.

Ground levels in the study area vary from approximately 65 mRL in the upper catchment to 28 mRL in the lower areas. The Mangakootukutuku stream is a deeply incised gully through most of the area.

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• ICMP and subsequent infrastructure planning undertaken.
Known flood hazard data	• Greenfield development area.
Existing treatment devices or opportunities	• Greenfield development area.
Watercourse quality risks	• 7 available monitoring sites within area. • Sediment data is good. • MCI data varies from good to poor. On average data is good.
Watercourse erosion risk	• Significant change in impervious Low to Moderate erosion susceptibility watercourse. • cover expected.
SW network capacity	• Greenfield development area.

sites of cultural significance	• Known cultural sites – several PA sites appears to be located adjacent gully/stream. May be at risk form increased SW flows.

1.4 Evidence Used to Support Assessment

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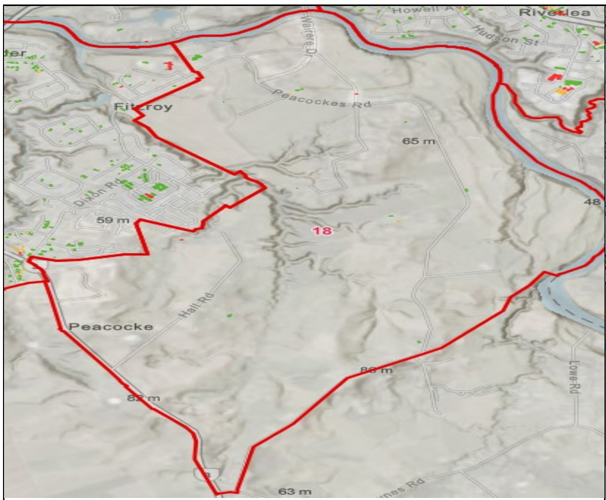
<td>
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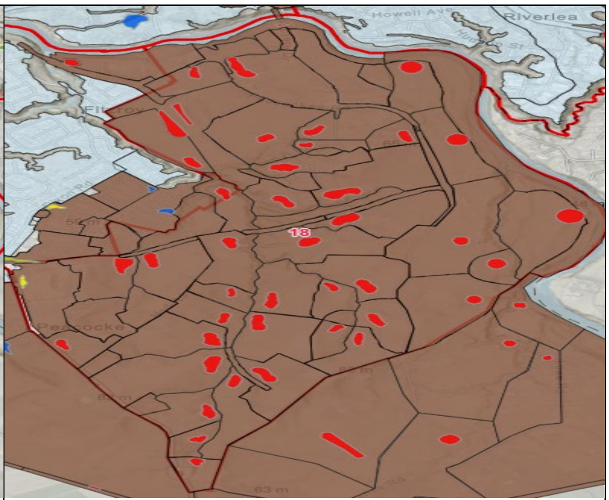
<td>
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<tr>
<td>Fig 1.1 – Buildings Intersected by Flood Hazard Peacocke – minimal buildings at risk as the area is greenfield.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.</td>
<td>Fig. 1.2 – Existing Stormwater Treatment: Greenfield growth cell, with all future land to be treated.

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.</td>
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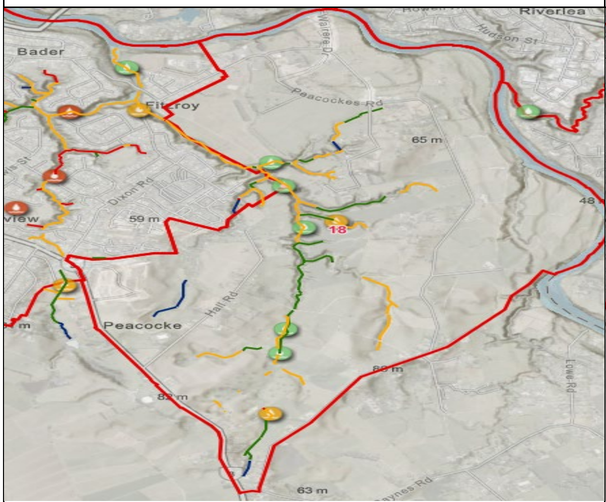
<td>
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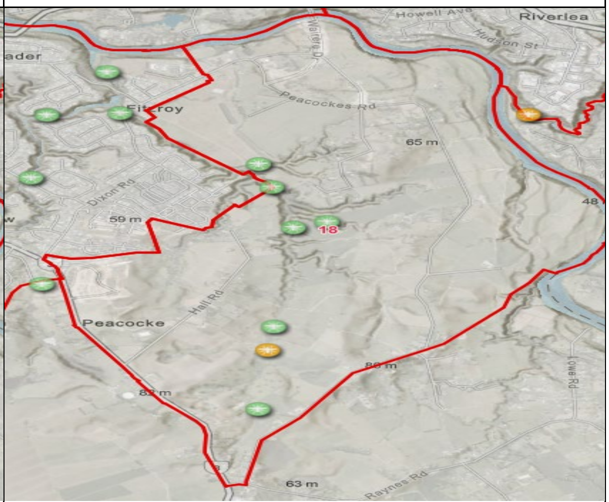
<td>
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<td>Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

Sediment quality data: Red = poor, orange = moderate, green = good.</td>
<td>Fig 1.4 – Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.</td>
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1.5 Other Comments:

As an identified growth cell, a funded strategic SW program exists for the area covered by the growth cell.

Area 19 – Temple View: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure assessment is shown below.

Overall stormwater assessment

OVERALL ASSESSMENT (EVEN WEIGHTING)	2.14	2

1.2 Key Area Features

The Temple View study area is approximately 440 Ha in size and is located at the southwestern extent of the Hamilton City area. The southern half of the study area drains to the Waipa River while the northern half drains into the farm drain system that makes up the upper Waitawhiriwhiri stream system.

Ground levels vary from approximately 70 mRL along the upper catchment to around 30 mRL in the lower sections. The southern section is occupied by the Temple View development area (draining to the Waipa River), while the northern section is currently undeveloped.

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• No ICMP. • Detailed flood hazard modelling completed. • Partial monitoring data available in Waitawhiriwhri stream.
Known flood hazard data	• Only rapid flood hazard data available for this area. • 135 buildings affected by some level of hazard (low hazard or greater). • 6 buildings affected by high hazard.
Existing treatment devices or opportunities	• Mixture of brownfield and greenfield areas. • Opportunities to implement centralised devices (in brownfield) are generally good – land constraints are minimal.
Watercourse quality risks	• Limited monitoring available immediately downstream of study area.
Watercourse erosion risk	• Limited data on downstream watercourse condition.
SW network capacity	• Mostly greenfield.

	• Significant proportion of area drains to farm drain system outside of HCC jurisdiction which is expected to have limited capacity.
sites of cultural significance	• Known cultural sites – not located within watercourse or location not considered to be at risk.

1.4 Evidence Used to Support Assessment

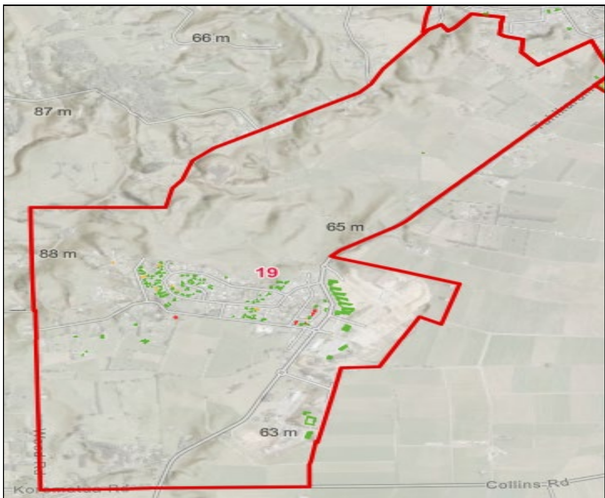

Fig 1.1 – Buildings Intersected by Flood Hazard Temple View – Relatively few buildings at risk as this is a newer development area.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

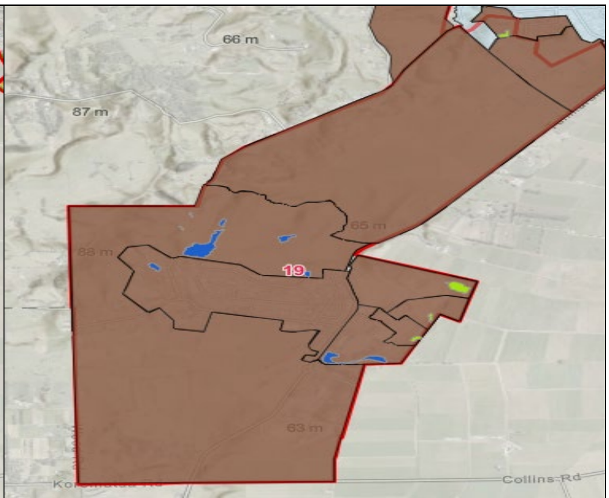

Fig. 1.2 – Existing Stormwater Treatment: Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

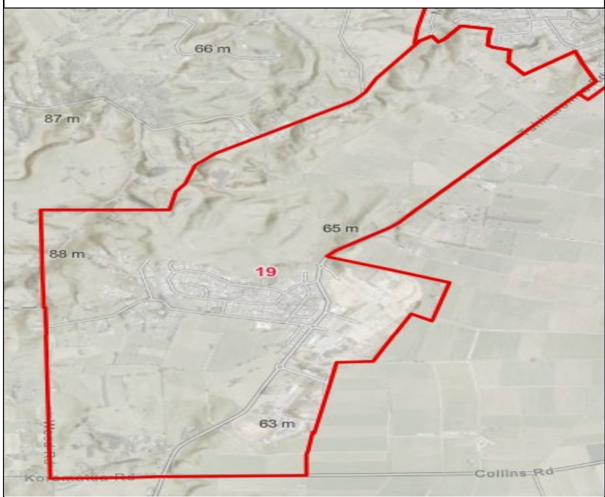

Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

Sediment quality data: Red = poor, orange = moderate, green = good.

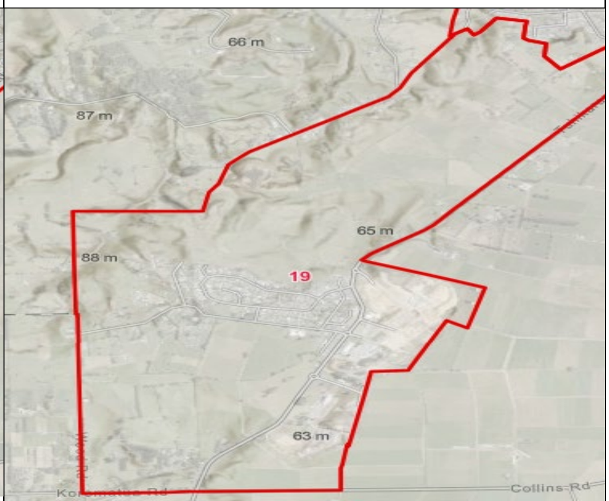

Fig 1.4 – Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.

1.5 Other Comments:

There is currently no funded strategic stormwater programme for the Temple View area. Strategic stormwater infrastructure expected to be constructed by developer.

Area 20 – City CBD: Stormwater Assessment

1.1 Assessment

The overall stormwater infrastructure is shown below.

Overall stormwater assessment

OVERALL ASSESSMENT (EVEN WEIGHTING)	1.57	2

1.2 Key Area Features

The City Centre study area is approximately 450 Ha in size and includes the Hamilton CBD area, and sections of Frankton. The CBD area is drained directly to the Waikato River through reticulated networks. The Frankton sections of the study area drain via reticulation to the Waitawhiriwhiri stream.

Ground levels vary from approximately 55 mRL along the upper catchment around Lake Rotorua to around 35 mRL in the lower sections of the CBD and Frankton areas.

1.3 Summary of key considerations against each criteria

Criteria	Key Considerations
Supporting Stormwater Investigations	• No ICMP prepared for this area. • Detailed flood hazard modelling completed. • No receiving environment studies undertaken, however no watercourses within the study area.
Known flood hazard data	• Detailed flood modelling undertaken as part of Waitawhiriwhiri catchment. • 606 buildings affected by some level of hazard (low hazard or greater). • 21 buildings affected by high hazard. Building intersection results skewed by large building footprints in this area.
Existing treatment devices or opportunities	• City Centre area is fully developed, no known treatment devices/interventions. • Opportunities to implement centralised devices (in brownfield) are poor – however, development will likely be large-scale with treatment able to be integrated into development.
Watercourse quality risks	• No watercourses remaining in City Centre area.
Watercourse erosion risk	• No watercourses remaining in City Centre area.
SW network capacity	• Network capacity mapping not available for City Centre.

	• Detailed stormwater modelling undertaken for the City Centre show limited ponding or flooding in the 2y and 10y ARI events.
sites of cultural significance	• Known cultural sites – not located within watercourse or location not considered to be at risk.

1.4 Evidence Used to Support Assessment

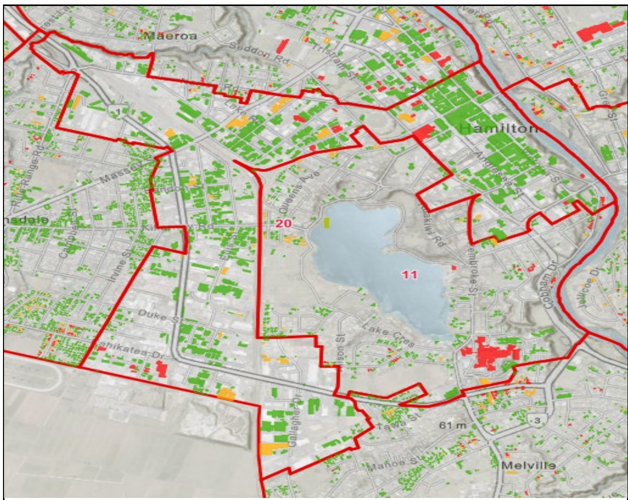

Fig 1.1 – Buildings Intersected by Flood Hazard City Centre – High percentage of buildings effected by low hazard; however are skewed by large building footprints.

Buildings affected by high hazard shown in red, medium hazard in orange, low in green.

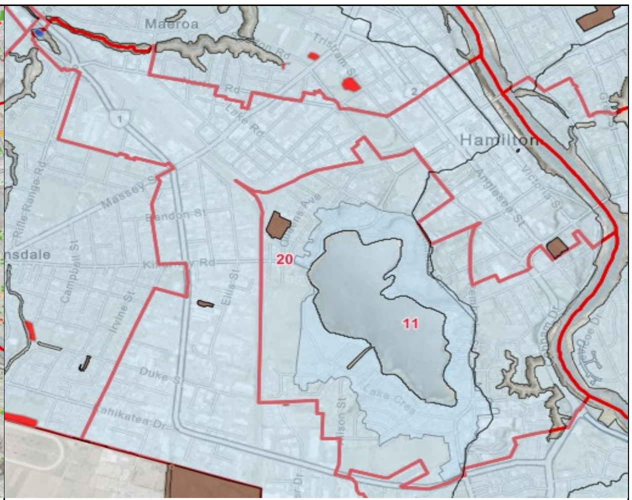

Fig. 1.2 – Existing Stormwater Treatment:

Brown areas indicate catchment draining to devices, grey areas are untreated. SW devices shown in various colours indicating different stages of construction/approval. Red devices are proposed for future.

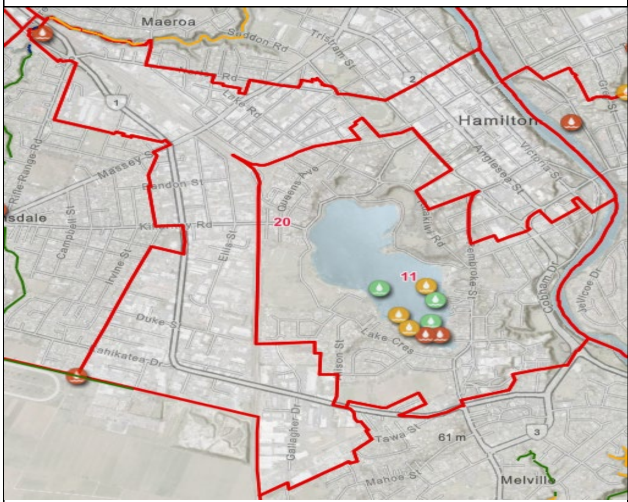

Fig 1.3 – Watercourse assessment data and sediment quality monitoring points.

Watercourse assessment data: Red = high erosion susceptibility, orange = moderate, green = low.

Sediment quality data: Red = poor, orange = moderate, green = good.

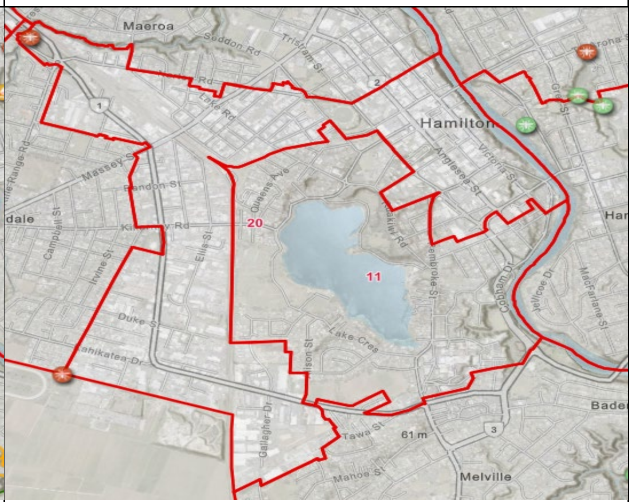

Fig 1.4 – Macroinvertebrate Index (MCI) data.

MCI data: Red = poor, orange = fair, green = good.

1.5 Other Comments:

There is currently no funded strategic stormwater programme for the City Centre area. HCC currently does not have an identified programme of strategic stormwater network upgrade for brownfield areas.

HCC is currently in the process of applying for investment in the CBD under the Infrastructure Acceleration Fund (IAF). However, this will cover strategic stormwater network planning rather than funding assets.