TANUI GROUP HOLDINGS

Ruakura Development

Ruakura Tuumata Sub-Catchment ICMP

17 November 2022

BLOXAM BURNETT & OLLIVER

Document control

Project identification		
Client	Tanui Group Holdings	
Client representative	Brian Croad, Manager, Regulatory Affairs, Tainui Group Holdings	
BBO details	Bloxam Burnett & Olliver (BBO) Level 4, 18 London Street, Hamilton 3240	
BBO representative	Jarred Stent	
BBO rep. contact details	027 477 1134	jstent@bbo.co.nz
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Checked by	Constantinos Fokianos		17 November 2022
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1. Introduction

The Ruakura Urban Development Sub-Catchment Integrated Catchment Management Plan (SC-ICMP) has been prepared for the Hamilton City Council (HCC) by Tanui Group Holdings (TGH) Ruakura Industrial Development Limited to support a request for a Private Plan Change for an area of land identified as Ruakura Tuumata. The Ruakura Tramway development comprises approximately 68Ha of land. The area is currently zoned industrial, and the Private Plan Change is requested to rezone the area to medium density residential.

1.1 Sub-Catchment ICMP Scope and Area

The SC-ICMP relates to the area in Hamilton located south of Fairview Downs, east of Wairere Drive and north of Ruakura Innovation Park (Figure 1-1). The eastern boundary will be formed be the proposed minor arterial, currently referred to as Spine Road.

Figure 1-1 - Location of Ruakura Tramway Development

The land that is proposed to be developed falls within the wider Ruakura catchment. An ICMP document for the Ruakura catchment was commissioned by HCC, but the final document did not become operative. The proposed Ruakura Tuumata development will have to consider impacts on the downstream sub-catchments (to the north and west). The upstream sub-catchments (to the south and east) also fall within the land holdings of TGH and have been identified for future development. To reduce potential constraints on these future developments, the proposed Ruakura Tuumata development will therefore also consider impacts on the upstream sub-catchments.

This SC-ICMP is prepared to ensure that the Ruakura Tuumata development is integrated into the existing downstream and potential future upstream sub-catchment, thereby promoting the sustainable management of Hamilton City's natural and physical resources.

1.2 Supporting Documents

This SC-ICMP is supported by the following technical reports which are provided as attachments to this report:

(a) Ruakura Tuumata Sub-Catchment ICMP Infrastructure Report by BBO dated November 2022 (Appendix A).

(b) Ruakura Tuumata Sub-Catchment ICMP Stormwater System Report by BBO dated November 2022 (Appendix B).

(c) Tuumata Plan Change – Geotechnical Investigation Report by CMW dated November 2022 (Appendix C).

(d) Tramway Plan Change Area Rezoning – Ecological Impact Assessment by Boffa Miskell dated August 2022 (Appendix D).

(e) TRAMWAY PROPOSED PLAN, Contamination Assessment, prepared by 4SIGHT Consulting for CMW Geosciences Limited, dated April 2022 (Appendix E).

(f) Ruakura Development – Powells/Tramway Road Drains Watercourse Classification Memorandum prepared by Boffa Miskell dated March 2022 (Appendix F).

(g) An Assesment Of The Potential Impact That Any Expansion And Development Of The Ruakura Estate Might Have On Cultural Values And Manawhenua prepared by NaMTOK Consultancy Ltd, dated November 2011 (Appendix G).

(h) Ruakura Land Development Plan: Archaeological Assessment prepared by Opus, dated March 2015 (appendix H).

(i) Archaeological Authority, granted by Pouhere Taonga Heritage New Zealand, dated August 2015 (appendix I).

1.3 Purpose of the Sub-Catchment ICMP

The purpose of this SC-ICMP is:

- To provide guidance on the integrated management of water, wastewater and stormwater within the sub-catchment.
- To provide an integrated management approach to avoid the cumulative adverse effects of all new stormwater activities within the sub-catchment as far as practicable and otherwise minimise these effects.
- To provide an integrated management approach to minimize the whole of life costs of stormwater infrastructure within the sub-catchment as well as the potential future upstream development.
- To ensure that the effects of the stormwater discharges are mitigated in accordance with HCC's stormwater discharge consent.

1.4 Key Infrastructure Projects

The Ruakura Tuumata development will be connected to the existing/future infrastructure through the following key infrastructure projects:

Roading:
The eastern transport corridor is a minor arterial corridor that provides connection through the Ruakura zone in a north / south direction from Ruakura Road in the south to Webb Drive in the north. The eastern transport corridor will also have an east / west connection out to the Wairere / Fifth Ave roundabout which fronts the Tuumata development and provides the primary transport connection point.

Wastewater:
A new 1000mm diameter gravity line (Far Eastern Interceptor) is under construction (due for completion in December 2022) along the Eastern transport corridor alignment. This gravity line runs from North of the ECMTR to the north and connects into the existing interceptor at the boundary of the Chedworth development.

Water Supply:
A new 400mm diameter line is to be installed from the reservoir stub connection (due for completion in Q2 2023) along the Eastern transport corridor alignment. This water main runs from the reservoir stub connection, which is fed by the Ruakura reservoir, heading north and connects into the existing watermains at the boundary of the Chedworth development.

1.5 Key Outcomes

The key outcomes of the Ruakura Tuumata SC-ICMP are:

- Options for best-practicable sustainable integrated three water management for water, wastewater and stormwater within the sub-catchment
- Identify constraints and demands for three water infrastructure that are to service the development and confirm proposed infrastructure and infrastructure capacity can appropriately service the proposed development.

2. Strategic Context

Development of the Ruakura Tuumata site is influenced by statutory central and regional government policies, plans and resource consents and HCC policies and plans. Non-statutory policy and planning documents that will influence sub-catchment management and development must also be considered.

2.1 Legislation/Key Policy Documents

The documents in Table 2-1 are currently viewed as relevant for the Ruakura Tuumata development.

Table 2-1 – Legislation/Key Policy Documents for Ruakura Tuumata development

Document	Summary
National Legislation	
Resource Management Act 1991 (RMA)	Discharge of contaminants into the environment is controlled by the Act (Section 15) which includes stormwater. No person may discharge any water into water or onto land unless the discharge is expressly allowed for in a national environmental standard, regional plan or resource consent.
Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010	The Act is a co-management agreement with Waikato Raupatu River Trust (Waikato-Tainui) and Waikato Regional Council. It establishes the Waikato River Authority which will set the primary direction for the Waikato River through a "vision and strategy" to protect the health and wellbeing of the Waikato River for future generations
National Policy Statements	
National Policy Statement for Freshwater Management 2020 (NPS-FM)	NPS-FM 2020 sets a national framework for how freshwater is to be managed across the country. It includes 14 policies, which direct Councils to limit and / or avoid further loss in the extent and values of freshwater systems and prioritise the improvement of degraded systems while maintaining the health and well-being of all others.
Regional Policy Statement	
Waikato Regional Policy Statement (WRPS)	WRPS provides an overview of the resource management issues of the region and states objectives identifying the desired end state of the region' natural and physical resources, including freshwater bodies, riparian areas and wetlands. It includes the policies and methods set out to achieve the objectives as well as the monitoring and evaluation procedures to be used to confirm the effectiveness of the WRPS. The WRPS recognises the Waikato River's Te Tura Whaimana o Te Awa o Waikato – the Vision and Strategy for the Waikato River as the primary direction-setting document for the Waikato River and its catchments.
Waikato Regional Plan	The Waikato Regional Plan is intended to provide direction regarding the use, development and protection of natural and physical resources in the Waikato region. It includes requirements for efficient use of water, stormwater discharges and changes or disturbances to watercourses.
Waikato Sub Regional Three Waters Strategy	The purpose of the Strategy is to provide an over-arching vision and series of measurable goals to facilitate an integrated, efficient and responsive sub regional approach to urban three waters management across Hamilton City Council, Waikato District Council and Waipa District Council. Working across jurisdictional boundaries, the Strategy demonstrates how the Partner Councils are taking a smarter approach to integrated Three Waters management.

Te Ture Whaimana o Te Awa o Waikato (Vision and Strategy for the Waikato River)	Te Ture Whaimana o Te Awa o Waikato sets out a vision whereby 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.
District Policy	
Hamilton City Council District Plan (HCDP)	The HCDP offers a framework for integrated resource management regarding the use, development or protection of land and associated natural and physical resources. The HCDP provisions include requirements for the preparation of integrated catchment management plans, sub-catchment integrated catchment management plans and water impact assessments. There are also provisions which set standards such as water efficiency, surface permeability, and building coverage. Together with the Regional Infrastructure Technical Specifications (RITS), the HCDP is a key tool for on-going management within the sub-catchment.

The resource consent relevant to three-waters within the Ruakura Tuumata development are stated in Table 2-2.

Table 2-2 - Relevant Resource Consents

City Consent	Consent Number	Consent Holder	Expiry
Water Take	113941	HCC	2044
Stormwater (City Wide)	105279	HCC	2036
Wastewater	114674	HCC	2027

2.2 Three Waters Master Planning, Integration and Hierarchy

The term "three waters" refers to the three key areas of strategic water management (including associated infrastructure) within the City – comprising water supply, wastewater, and stormwater.

Three waters integration recognises that there is significant interaction between the three types of waters, surrounding natural water systems and land and that it is beneficial to consider their interconnectedness. To ensure protection of the environment and the ongoing availability of services to growth areas, they need to be managed in an integrated manner.

The HCDP adopts a best-practice hierarchy for three waters management based on principles for sustainable resource management, environmental protection, and efficiency. In addition, the RITS and HCDP offer detailed information on the range of water sensitive techniques which are available for greenfield developments to minimise the impact of development.

The development and implementation of Best Practicable Option's should have regard to and reflect the established hierarchy for the management of the three waters (as outlined in the RITS):

- *Minimise Demand (water supply, wastewater)*
- *Reuse (stormwater)*
- *Treat & Dispose to Ground (stormwater)*
- *Treatment & Detention (stormwater)*
- *Reticulation (stormwater, wastewater)*

The ideal stormwater management system for a developed site is one that replicates the undeveloped scenario. A range of water sensitive techniques are available to minimise the impact of development and enhance the environment.

2.3 Strategic Objectives

One of the purposes of ICMPs is for HCC to define and set objectives for its catchments. Strategic objectives for integrated catchment management planning have been developed by HCC to guide decision making. These common strategic objectives have been set across all catchments within the HCC jurisdiction (Table 2-3).

Table 2-3 – HCC ICMP Strategic Objectives

#	Strategic Objective
1	Protect Freshwater Systems Maintain protect and enhance freshwater ecosystems and natural drainage systems by safeguarding the life-supporting capacity, improving water quality where degraded and protecting significant values of wetlands and outstanding freshwater bodies.
2	Protect Terrestrial Systems Maintain, protect, and enhance indigenous biodiversity values and functions for terrestrial ecosystems and protect significant habitat of indigenous fauna.
3	Kaitiakitanga Give effect to the relationship of tangata whenua as kaitiaki of receiving water bodies and including the relationship of Waikato-Tainui with the Waikato River.
4	Stormwater Management Stormwater management, related to land use and development, shall encourage and enable low impact design and incorporate best practicable mitigation measures to minimise actual and potential adverse effects on: • Receiving water bodies in terms of quantity and quality of stormwater discharges. • Locations and communities subject to flood hazards. • Natural groundwater levels. • Baseflows for freshwater systems.
5	Wastewater Management Wastewater management shall incorporate best practicable options and be managed so that: • Conveyed network volumes are minimised, (e.g. by demand management and management of stormwater infiltration) • Dry weather overflows are prevented, and wet weather overflows are minimised.
6	Water Supply Management Water supply is planned and provided for in a way that meets existing and future requirements to: • Provide firefighting water supply (flow and pressure) by conforming to the Code of Practice for Fire Fighting Water Supplies • Meet domestic, commercial, and industrial water demand. • Ensure water consumption is managed to minimise peak and total demand.

7	Three Waters Management Three waters networks are planned, managed, and operated in an integrated manner to: • Meet existing and future development requirements whilst maintaining human and ecosystem health. • Meet design standards, consent conditions and regulatory levels of service. • Ensure assets, technology and resources have capacity, redundancy (n+1), knowledge and plans to prevent or cope with unplanned events. • Minimise the need for new infrastructure including by optimising the use of existing assets.

3. Sub-catchment / Site Description and Context

3.1 The Site

The SC-ICMP is for the Ruakura Tuumata development (Figure 3-1). The boundaries of the site include Fairview Downs, AG Research Centre, and Wairere Drive. A proposed minor arterial, currently referred to as Spine Road, will form the eastern boundary of the site.

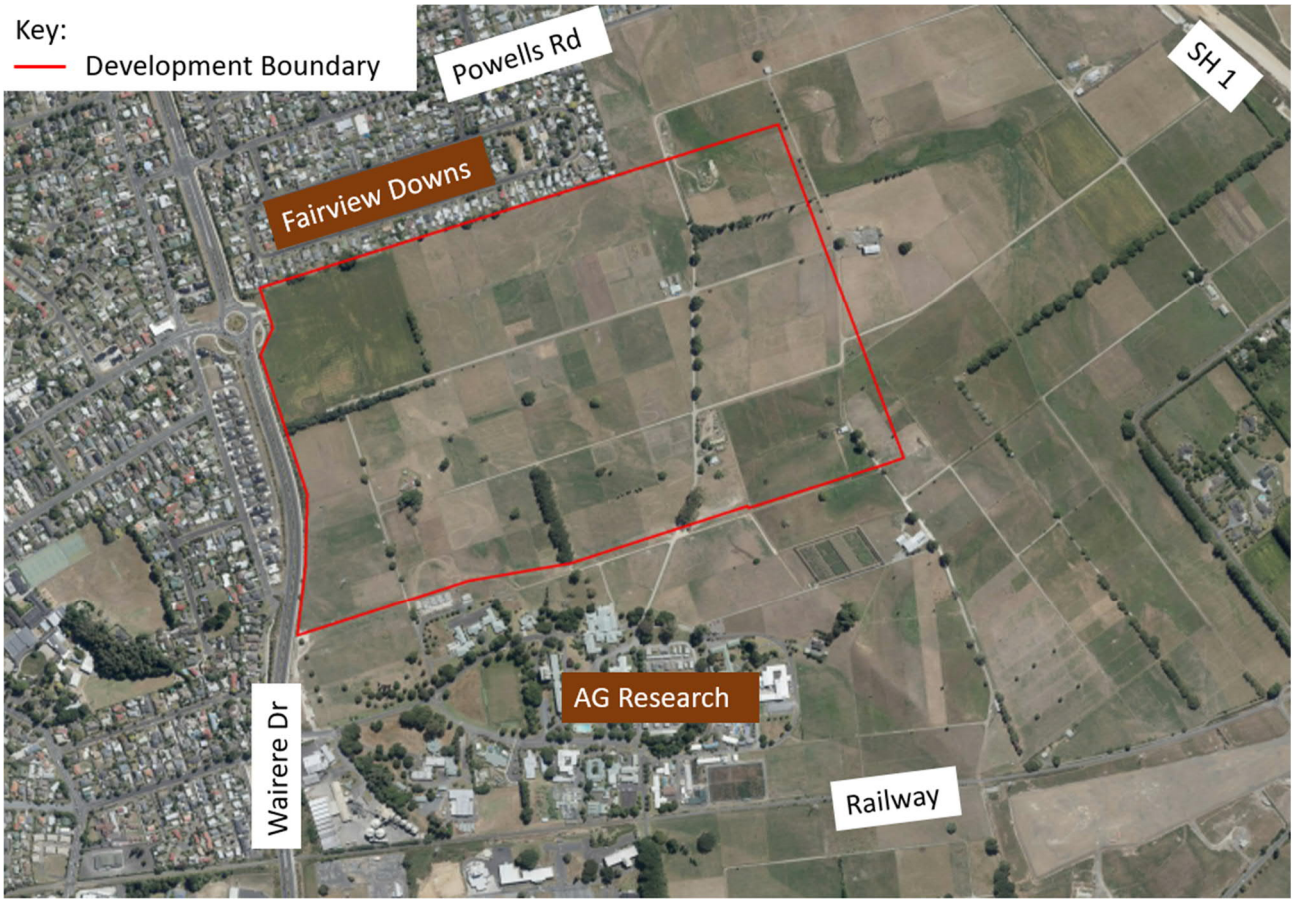


Figure 3-1 - Sub-catchment ICMP Area

3.2 Historic and Current Land Uses

On the earliest available aerial photographs (Retrolens), the entire area covered by the development is used for farming. The existing land use, according to the Land Cover Database 5.0, is High Producing Exotic Grassland. Hence in the past 80 years, the land use has changed very little. In the north-eastern corner of the development there is a depression in the terrain. During large rainfall events, this depression becomes part of the overland flow path. In the earliest aerial photographs, these depressions appear to be covered in the wetland plants which are currently no longer present.

Vegetation on the site is mainly grazed pasture grasses and exotic tree species used for hedging and shelterbelts. There is a small stand of kahikatea trees. These trees are relatively young and around 5m tall.

3.3 Topography and Catchment Boundaries

The topography of the site is presented in Figure 3-2. Most of the site is relatively flat at an elevation of 39-40m RL. There are some terraces in the south-western corner, with a maximum elevation of 45m RL, and

along the eastern boundary, with a maximum elevation of 45m RL. The depression in the north-eastern corner has an invert elevation of approximately 38.7m RL, a minimum of 0.5m below the surrounding plains.

Figure 3-2 – Topography Map of Ruakura Tuumata Development

The Ruakura Tuumata development falls within the Kirikiriroa stream catchment. Due to the existing development and agriculture in the catchments, there are no longer any natural streams in the catchment, other than the gully systems. Within the area used for agriculture, runoff is mostly conveyed via agricultural drain which discharge into upstream manholes of the HCC reticulation network. This network conveys the stormwater through the existing development, discharging into the gully systems at various locations.

3.4 Overland Flow Paths and Flooding

A catchment delineation was carried out based on the latest available LiDAR data (2019) to determine the overland flow paths of runoff within the development. The results show that the Ruakura Tuumata development is within three separate upstream branches of the Kirikiriroa Stream catchment (Figure 3-3). Most of the land within the development currently drains toward the north-western corner. It enters the HCC stormwater reticulation network at a manhole along Wairere Drive, 200m south of the Fifth Avenue roundabout. Upstream runoff from the area that includes the AG Research centre currently enters the development through the southern boundary. The railway line forms the upstream boundary of the Kirikiriroa stream catchment.

Due to the terrace in the south-western corner (Figure 3-2), the land in that corner of the development currently discharges in a south-westerly direction towards the point of minimum elevation along Wairere Dr. During large rainfall events, the runoff flows onto Wairere Dr and then enters the HCC stormwater reticulation network.

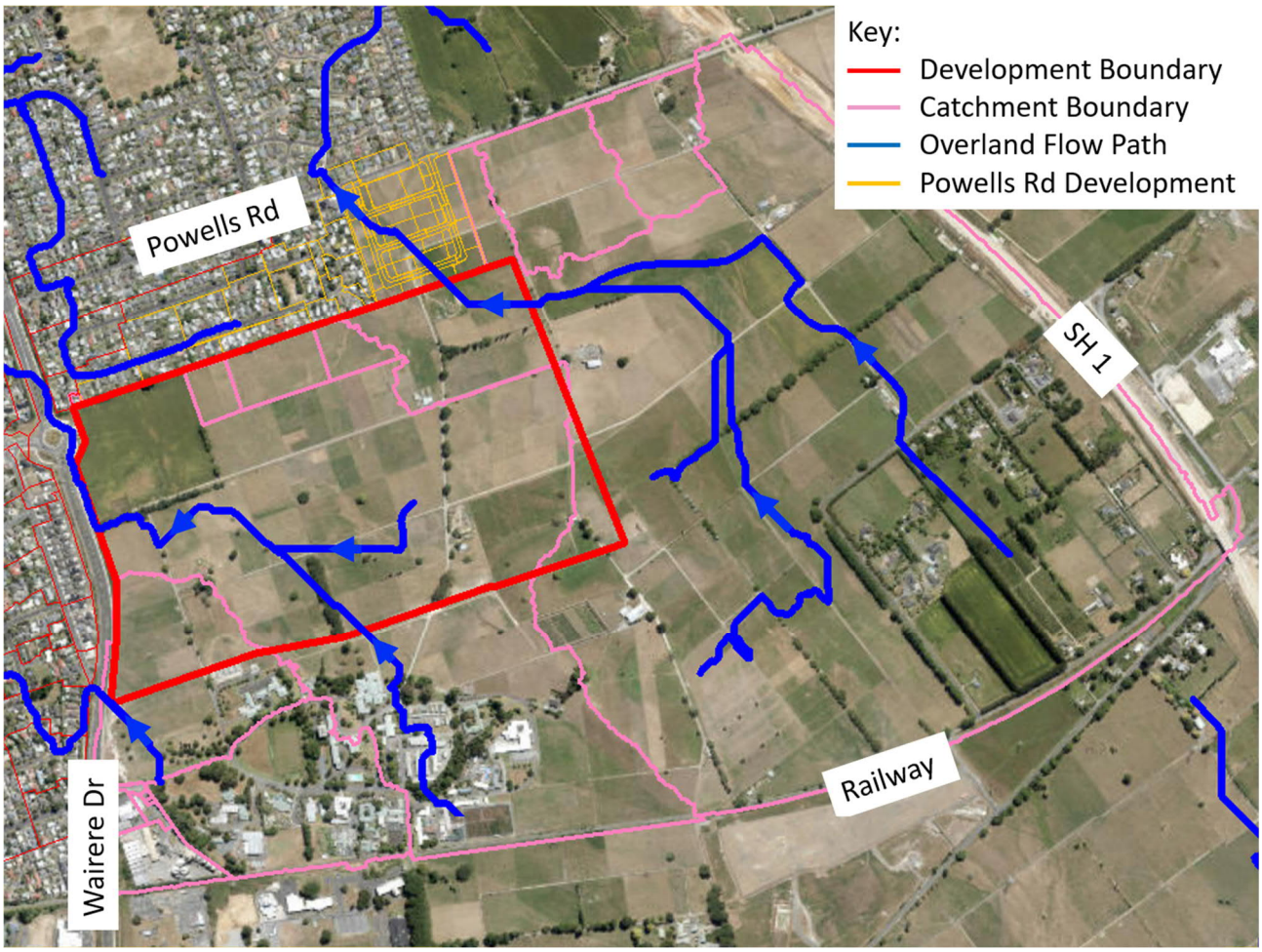


Figure 3-3 – Catchment Delineation showing Existing Catchments and Overland Flow Paths

Upstream runoff from the area between the railway, SH 1 and Powells Rd enters the development through the western boundary. The overland flow path through the north-eastern corner of the development follows the natural depression in the topography (Figure 3-2). Downstream of the Ruakura Tuumata development, the overland flow path would have conveyed the runoff in a northerly direction. As part of the construction of Fairview Downs, an interception pipeline was constructed along the southern boundary of Fairview Downs (the northern boundary of the Ruakura Tuumata development) towards Wairere Dr. As the runoff flow rate was larger than the capacity of the pipeline, ponding would occur in the area that is currently being developed along Powells Rd. Upon completion of the Powells Rd development, the informal attenuation will occur within the Ruakura Tuumata development, before the flow is conveyed via the existing pipeline towards Wairere Dr.

There are two smaller sub-catchments located immediately south of Powells Rd and east of the Powells Rd development. These catchments currently drain to the north via existing culverts underneath Powells Rd. However, during the development of sub-divisions further downstream along this branch of the Kirikiriroa stream, Powells Rd was assumed to be the upstream catchment boundary and hence discharge from these two sub-catchments was not considered during the design of these areas. HCC has asked for these two areas to be diverted to the east instead, and hence these two areas will contribute to the upstream flow entering the development through the eastern boundary.

Along the northern boundary, there are three small sub-catchments within the development. These sub-catchments represent local depressions in the terrain. To ensure that flood waters in these depressions do not flood the houses in Fairview Downs, field sumps were installed that allow the flood water to drain into the pipeline that runs along the northern boundary towards Wairere Dr.

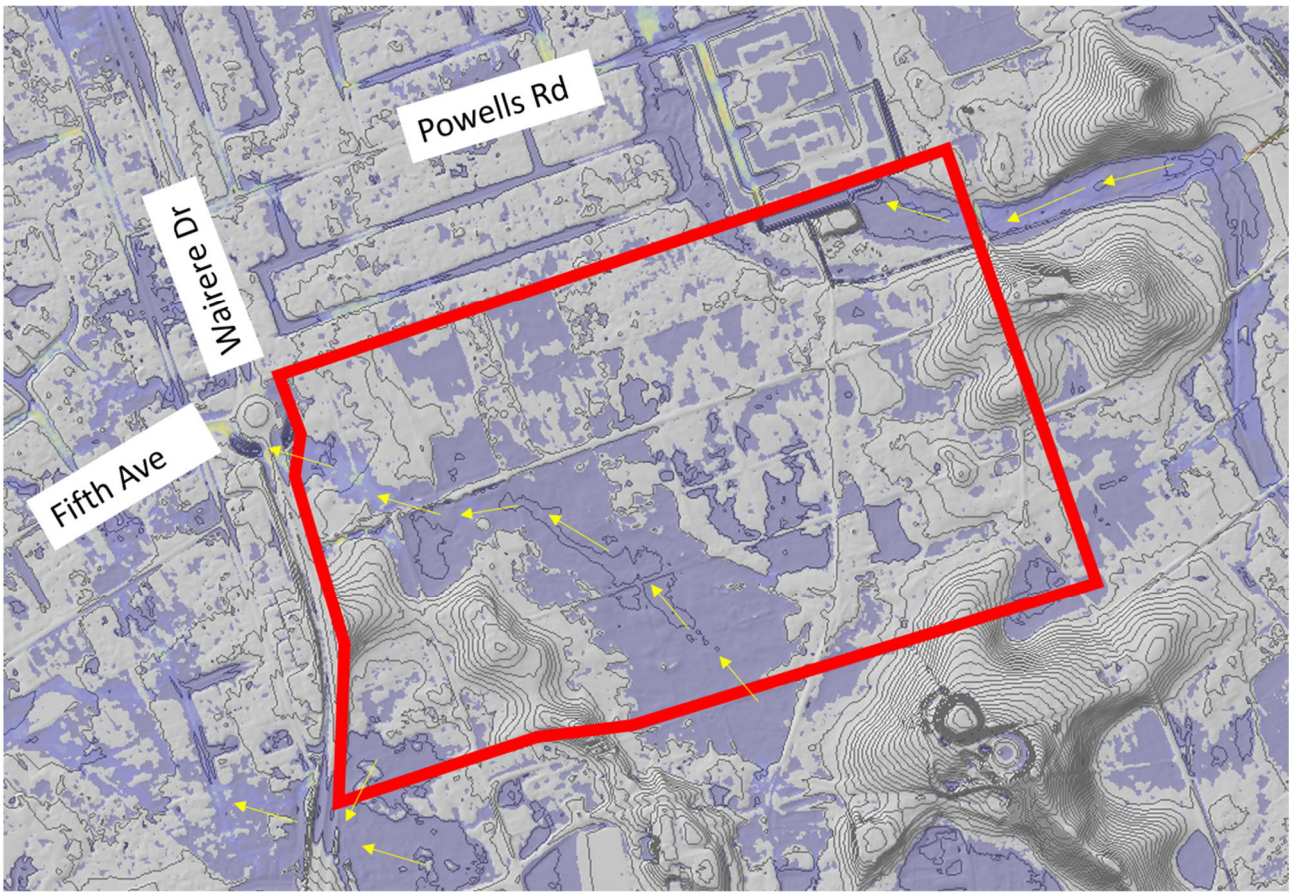


Figure 3-4 – 2D HEC-RAS model results showing overland flow paths

A high level 2D HEC-RAS model, using rain-on-grid and the terrain based on 2019 LiDAR data, was run to confirm the overland flow paths within the development. The results are presented in Figure 3-4 for the 100yr ARI storm, confirming the three different overland flow paths within the development (i.e. in the south-west corner, through the middle and in the north-east corner). Due to the relatively flat land, the 100yr ARI storm would flood a significant area in the middle of the development. Note that the model did not include the HCC stormwater network and hence overestimates flooding within the urban areas downstream of the site.

3.5 Geology and Soils

CMW carried out a geotechnical investigation of the site (Appendix C). The current general landform, together with associated features located within and adjacent to the site are presented in Figure 3-5. The site can be split into two general landforms. The first comprises a broad terrace that makes up most of the site and is essentially near level with existing ground levels ranging from 39m RL in the west to 41m RL in the east with a locally depressed channel (38.6m RL) in the north-eastern corner. The second landform comprises four ridges of Walton Subgroup that rises to 45m RL on the western, southern, and south-eastern site boundaries.

The published Geology of the Waikato area map (No 4) depicts the regional geology for the area as comprising cross-bedded pumice sand, silt and gravel with interbedded peat of the Hinuera Formation, and the ridges comprising pumiceous mud, silt, sand and gravel with muddy peat beds of the Walton Subgroup overlain by fine grained volcanic ash. Based on the known history of the site and surrounding land levels, some superficial depths of fill could be anticipated as a result of soft landscaping.

The ground conditions encountered and inferred by CMW from the site investigation were considered generally consistent with the published geology.

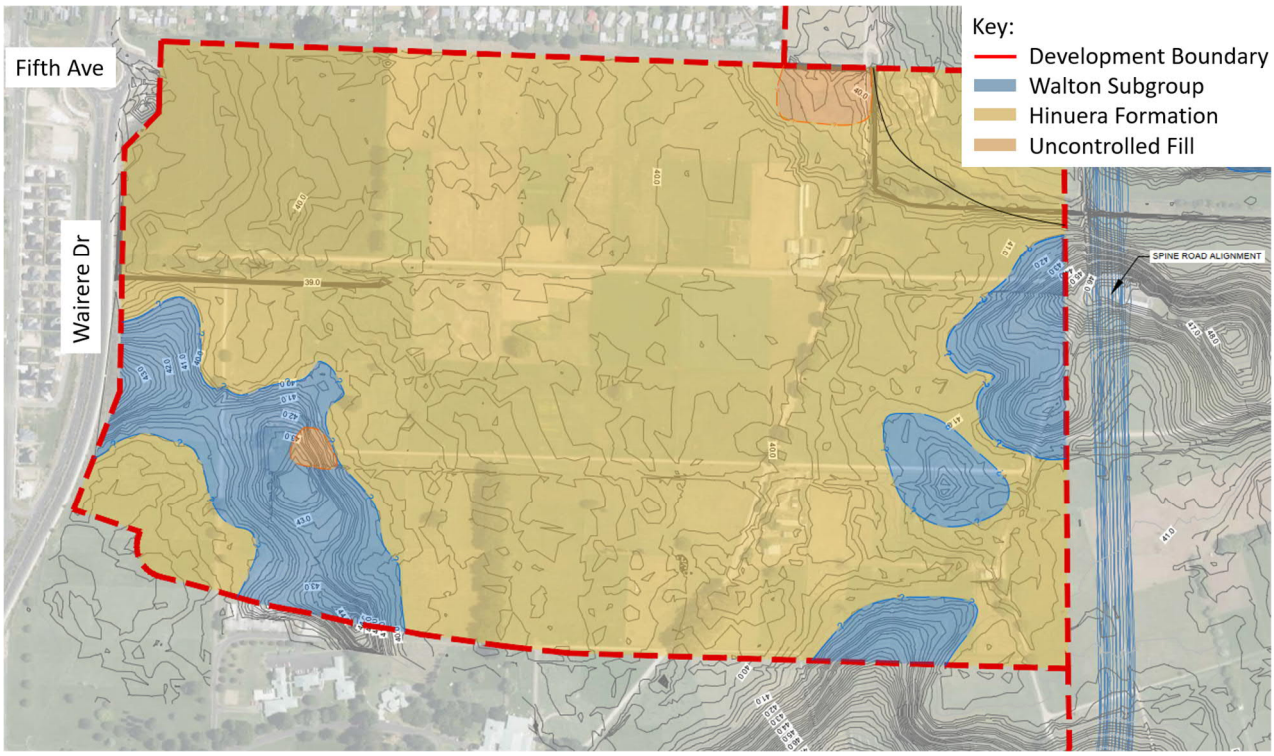


Figure 3-5 - Local Geology

Liquefaction occurs in loose saturated cohesionless soils that are subject to cyclic shear loading during an earthquake. This process leads to pore pressure build-up, soil grains moving into suspension and temporary loss of strength causing vertical and lateral ground deformation. Susceptibility of the soils at the site was assessed with respect to geological age and compositional criteria. Results from the assessment showed that much of the Hinuera Formation sand and lenses of the Walton Subgroup liquefy during the 0.25g ULS event. The layers of Hinuera Formation sand that liquefy are several metres thick and generally continuous between test locations.

Following the onset of liquefaction, the liquefied soils behave as a very weak undrained material, which can give rise to lateral spreading where a free face is present within the vicinity of the site or where proposed cut and fill batters are proposed over or within liquefied soils. Liquefaction analysis results show that stiffened raft type foundations, with or without geogrid reinforced ravel rafts will be required.

To mitigate lateral spread magnitudes to less than 100mm, slope stability analyses results show that a 1m thick cohesive fill cap, constructed to achieve an undrained shear strength of at least 120kPa, is required within 100m of the wetland and swales.

Across the organic silt and Uncontrolled Fill areas, further investigation and design is required to define the extent of those areas and develop specific mitigation measures, including undercuts and/or surcharging.

3.6 Hydrogeology

Landcare Research identifies the site and generally having moderately-well drained soils. Along the terraces in the south-west corner and along the eastern boundary, the soils are either imperfectly or poorly drained (Figure 3-6). The soil moisture regime is identified as high (Figure 3-7).

This is in general agreement with site investigation carried out by CMW (Appendix C). In more than 50% of the boreholes, groundwater was encountered within 1m below ground-level and in more than 75% of boreholes, groundwater was encountered within 2m below ground-level.

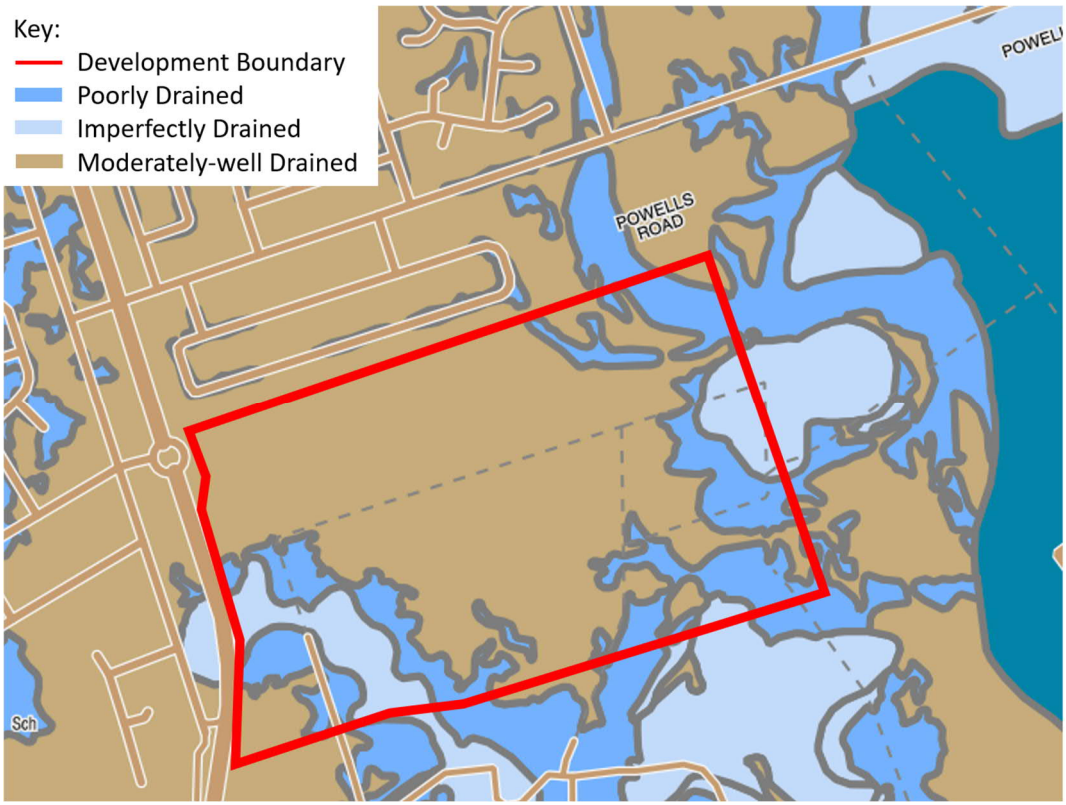


Figure 3-6 - Soil Drainage obtained from S-Map Online

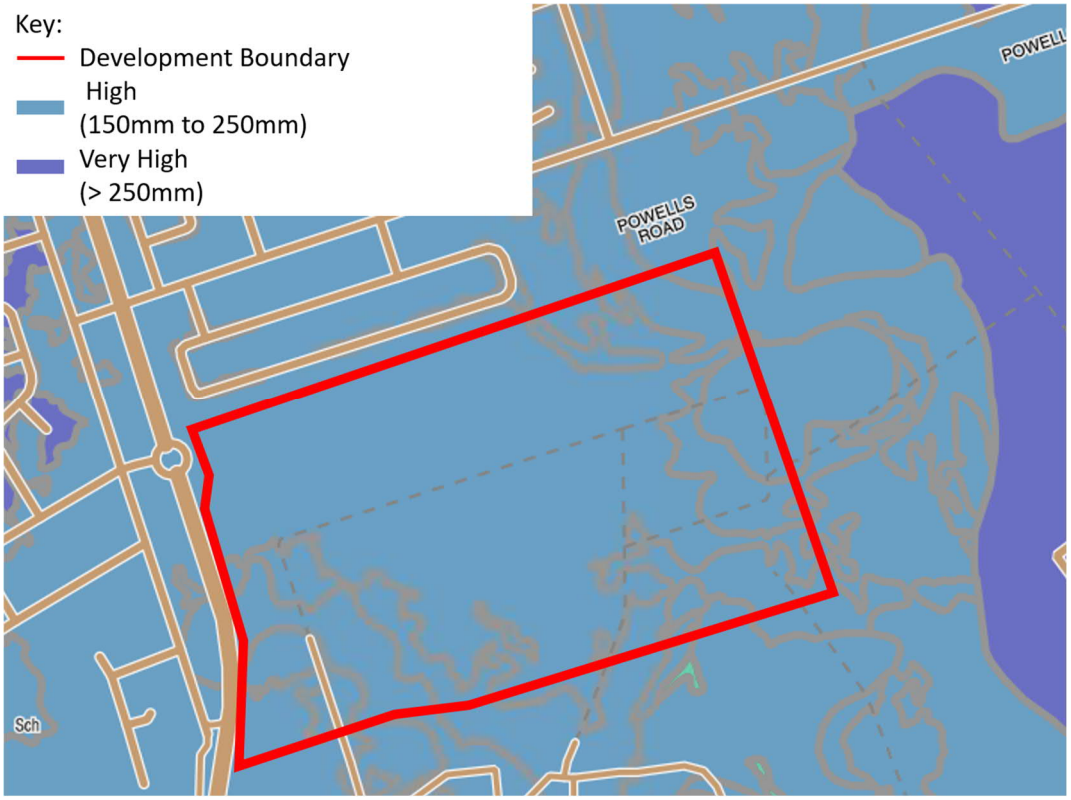


Figure 3-7 - Soil Moisture obtained from S-Map Online

The Waikato River is the only significant surface water body in the vicinity of the site, located at approximately 2.5km from the western boundary of the site. Immediately downstream of the site, any surface flow is currently discharged into HCC's stormwater reticulation network. The network generally

follows the topography and hence the downstream network discharges into the upstream reaches of the Kirikiriroa stream. The distance from the site to the Waikato River via Kirikiriroa stream is approximately 6km.

3.7 Contaminated Land

4Sight Consulting prepared a contamination assessment in April 2022 to assess potential implications for a proposed plan change (PPC). The PPC is seeking to rezone the Site from industrial to provide a mixed-use zone for medium density urban residential development, a suburban centre and associated infrastructure. Refer to Appendix E.

The assessment included:

- Conducting a desk top assessment to determine the nature and extent of potentially contaminating activities that have occurred or currently are occurring at the Site, including:
  - A review of selected publicly available information for the site, including council files and aerial photographs to confirm the nature and extent of activities or industries on the HAIL that are, have been, or might have been undertaken on the Site; and
  - A review of existing environmental reports for the Site.
- A Site visit to identify current areas of potential environmental concern, and to confirm potential historic environment risk areas.
- Summarising the findings of the previous contaminated site assessment reports.
- Comment on the adequacy, suitability, and technical robustness of the reports, and identify potential gaps (if any) in understanding of contaminated land matters relevant to the Site; Identify and map areas of potential environmental concern that may influence the suitability of the proposed PPC
- Identification of potential consent requirements under the NESCS and WRP, and
- Provide recommendations for further contaminated land investigation to support development of the Site.

The key findings of this assessment are:

- The Site has been used for as an agricultural research farm over the period for which historical records are available (1938 – present). This includes livestock grazing, livestock management, hay/silage growing, and specific areas of agricultural research including animal investigation and weed management. Additionally, landfilling, waste disposal and solvent disposal to ground have also been undertaken associated with the farming activity. The potential for isolated impacted areas associated with these activities is considered to be high.
- A variety of investigations have been conducted across the Site from 2013 to 2021. These historic investigations have included desk-based assessments, preliminary site investigations and detailed site investigations. These investigations have confirmed the presence of contaminants at selected locations across the Site, including historic landfills and historic building removals, however investigations undertaken to date are considered limited in scope and have not fully addressed all potential contaminating activities.
- There is the potential that ongoing use of the Site for AgResearch pasture/vegetation trials has resulted in additional areas of potential environmental concern since the previous investigations undertaken.
- Further investigation will be required to identify known data gaps and to characterise areas of potential human health and environmental concern through targeted soil sampling, and to prepare reports to support the consent process associated with the future land use change, subdivision, and development, following the PPC. The activities requiring further investigation include:
  - Historic landfill activities (Southern Landfill Area).
  - Use of the Site for agricultural research trials with potential for persistent pesticide and heavy metal contamination.
  - Filling of the former farm drain at the Site, and within a small area in the north of the Site.

- Existing buildings and farm buildings where there is potential for impact to soil associated with hazardous building materials (asbestos and lead) or hydrocarbons or other chemicals associated with workshop and laboratory activities.
- Greenhouses, with potential for persistent pesticide and heavy metal contamination.
- Sheep dips and an oral drenching area, with potential for pesticide and heavy metal contamination.
- Electricity transformers, with potential for hydrocarbon and potential use of PCB containing oils.
- Electrical transmission tower, with potential for contaminants associated with tower maintenance activities (heavy metals).
- Storage and use of agricultural and horticultural chemicals.
- Solvent disposal areas (within the Southern Landfill).
- Historic building demolition and removals, with potential for use of hazardous building material; and
- Burn pile within concrete bunkers at the Site, with potential for heavy metal, hydrocarbon, and asbestos contamination.

- Based on known and potential contamination at the Site, and the likely soil disturbance associated with residential development following the PPC, resource consent under the NESCS will be required. The activity status of the consent will be dependent on the extent of investigation completed. Based on the historic investigations completed to date, and assuming further investigation is completed to address data gaps, it is considered likely that the application can be made as a restricted discretionary activity.
- It is considered likely that remediation will be required at selected locations across the Site to facilitate future land use change, subdivision and development following the PPC. The scope and nature of remediation will be confirmed following completion of DSI report/s at the Site, and is considered likely to be achieved using standard remediation practices (i.e. offsite disposal, on Site encapsulation, reuse in suitable land use areas, or a combination of these approaches). On this basis, known and potential contamination at the Site is considered highly unlikely to restrict or preclude a change of land use from rural to residential, commercial and/or open space following remediation.
- Consent under the WRP will be required if remedial work is undertaken. It is considered likely that this will be necessary to support the proposed development.

3.8 Freshwater Environment

Due to the historic land-use of the site, no natural watercourses remain in within the site boundaries. This agrees with the water classification by the Waikato Regional Council. Instead, artificial farm drains have been created to convey the stormwater to the discharge locations of the HCC stormwater reticulation network. These farm drains are typically straight and have steep-sided, uniform, trapezoidal or U-shaped geometries. Periodic maintenance, including spraying and excavations, will have been carried out to maintain discharge capacity of the drains.

There are 2 main drains within the site, the Reeves Close Drain and the Tramway Road Drain. The Reeves Close Drain is located in the north-eastern corner of the site and ends at the manhole along northern boundary of the site near Reeves Close. The Tramway Road Drain runs east-west towards the manhole along Wairere Drive, 200m south of the Fifth Avenue roundabout. A watercourse classification memorandum of the drains was carried out by Boffa Miskell (Appendix F). The drains have been classified as intermittent. The Tramway Road Drain has a narrow vegetated riparian area that includes established exotic canopy trees and understorey plants and a few native tree species. The riparian vegetation along Reeves Close Drain typically consists of rank grasses with small area of weeds or exotic shelterbelt trees.

No putative wetlands were identified either on aerial imagery or during the site walkovers. The vegetation on site is not representative of wetland habitats, and therefore, as per the definition of NPS-FM, no natural inland wetlands were identified within the project footprint.

3.8.1 Water Quality

Boffa Miskell carried out a water quality analysis as part of the ecology assessment (Appendix D). The analysis indicated that the water quality of all sampled drains reflects the natural characteristics of the local peat soils (such as pH values below 6.0), but also the shallow groundwater infiltration and groundwater quality, as well as the existing agricultural land uses. The sampled waterways receive ongoing inputs of sediment (reflected in increased turbidity), bacterial pathogens, and inorganic nutrients. The concentration of zinc in all the waterways except the Kirikiriroa Stream tributary at Wairere Drive exceeded the ANZECC guideline value for 90% protection of aquatic species; however, zinc concentrations obtained in 2012 are below Hamilton urban and rural average levels which have been shown to be generally above ANZECC guideline values. In the Percival Road drain, copper also exceeded the guideline value for 90% aquatic species protection. The concentration of iron in most of the waterways is likely to reduce dissolved oxygen concentrations.

It is likely that low dissolved oxygen concentrations (resulting from algal growths, low or no summer flow, and elevated summer temperatures) will be near or below the tolerance levels of all but the most tolerant species (i.e., eels and black mudfish) for a large proportion of the year in most sub-catchment waterways. In addition, concentrations of faecal bacteria make the water unsuitable for human contact or livestock.

3.8.2 Aquatic Ecology

Fish communities of the Ruakura Tuumata development waterways were investigated previously as part of the wider Assessment of Ecological Effects for the Ruakura Structure Plan Area. No fish were captured or observed within the Tramway Road drain on either sampling occasion. This is unlikely to have changed since 2013 as the extensive piped network this drain is connected to poses a significant fish passage barrier. Shortfin eels (Anguilla australis) were captured and observed in the Powells Road drain reach within the Reeves Close drain during the 2013 survey. During relocation work in 2021, shortfin eels and longfin eels and an elver were captured and relocated from two separate reaches of the Powell's Road drain into the drains within the development. The Reeves Close drain has been included in the waterways that are potential habitat for mud fish as per Section 2.6.2 of the Ruakura South NFMP.

Macroinvertebrate diversity was found to be low in both drains. MCI scores ranged from 67.71 to 99.14, which are low scores indicating poor to fair water and/or habitat quality.

3.9 Terrestrial Ecology

Shelterbelts are a common component of the vegetation within the project footprint. These shelter belts are dominated by exotic trees. The understorey/ground cover is typically limited. Though shelterbelts associated with drains or watercourses contain some dense patches of mostly exotic species. Native species are occasionally present, the native basket grass was occasionally noted in dense patches within some of the shelterbelts.

Individual trees are occasionally scattered throughout the project footprint. These trees are all exotic. There is a small stand of kahikatea trees. The kahikatea trees are relatively young and around 5 m tall. The understorey is dominated by pasture grasses. A couple of small tree stand habitats are present on site. These trees stand habitats are dominated by exotic trees. The understorey of the tree stands is limited, often containing pasture or long rank grass.

Given the fragmented nature of the vegetated habitats and the lack of native vegetation species or communities present, the ecological value of the vegetation on the site is low.

An acoustic bat and bat roost survey were carried out as part of the ecological assessment. The results of these surveys showed that long-tailed bats are occasionally using the habitat features within the site.

However, the sparse occurrence of activity observed during this survey suggests that the site does not form part of a significant commuting corridor and thus does not provide significant habitat connectivity. While only one feeding buzz and very low levels of bat activity were observed, the site does contain potential roost habitats. Several very large trees were noted to have bat roosting potential such as loose bark, knothole cavities or epiphyte growth. Furthermore, long-tailed bat passes have been recorded previously in Ruakura though generally at very low levels.

It is likely that copper skinks are the only native lizard to be present on site. Copper skinks are relatively widespread in low numbers throughout the wider Hamilton area and the site was found to contain several potential low, medium, and medium – high quality copper skink habitats throughout the project footprint. Any copper skinks present may be at very low density due to predation by mammalian predators and the site's long history of disturbance. However, given that lizard salvage works in Ruakura South have captured this species, it is likely copper skinks are present within the development.

The habitats available within the site are unlikely to provide permanent habitat, or habitats of specific importance for any 'At Risk' or 'Threatened' avifauna. The habitats may act as a 'stepping-stone', facilitating avifauna movement throughout the area and contributing to the seasonal food and/or structural resources exotic and native birds utilise within this modified landscape.

3.10 Archaeology Values

An archaeological Assessment was prepared by Opus in 2015 for the overall Ruakura Land development plan (Appendix H). Key findings of the assessment are briefly discussed below.

- The literature research and evidence from historic maps identified that the study area was divided up for soldiers in the mid-1860s, however no reports were found to suggest that the land was taken up and farmed in this decade.
- The evidence suggests that drainage works began in the 1870s-1880s, at least one drain is recorded in the southern boundary of the overall Ruakura land area from this time. A sod fence was identified on a map dating to 1883, likely to be a boundary marker or stock fence. The sod fence was not conclusively relocated during the visit; however, it has been formally recorded with NZAA. Evidence for the sod fence, including cut ditches, may be present below the ground and monitoring of earthworks should be undertaken to confirm if there is any evidence for this feature remaining.
- The records and maps did not indicate that any buildings of an agricultural or domestic nature were ever sited within the overall study area prior to 1900. The field evidence failed to identify any such structure, or the remains of, on this land.
- In summary, although the NZAA records did not provide evidence for archaeological sites in the Ruakura Plan Change Area, and the field visit did not identify the presence of any undocumented archaeological sites, research of historic maps indicated the presence of two possible archaeological features. These have subsequently been added to the NZAA file. These features are not located within the proposed Tuumata development site.
- There remains the possibility that undocumented subsurface archaeological features, deposits, or sites are located in the study area concealed below topsoil. The risk of encountering such material is considered to be moderate.
- Considering the general lack of documentary and field evidence for archaeological sites in the study area, and the moderate probability of encountering pre-1900 remains here there are no known reasons to alter or modify the current proposal on archaeological grounds.
- A general authority was sought and granted for the entire development footprint within the study area in 2015 (appendix I). This enables any unexpected archaeological findings during earthworks in this area to be properly managed and recorded.

- The archaeological work, including investigations and monitoring should be detailed in an archaeological management plan. This document should include provisions for undertaking monitoring of earthworks in the location of the documented sod wall/ drain.
- Earthworks should also be monitored, or land inspected following topsoil removal. This should occur on the crest of the low-lying hills, and in a sample range of the low-lying areas.

Figure 3-8 below presents the archaeological findings/proposals regarding the overall Ruakura Land area.

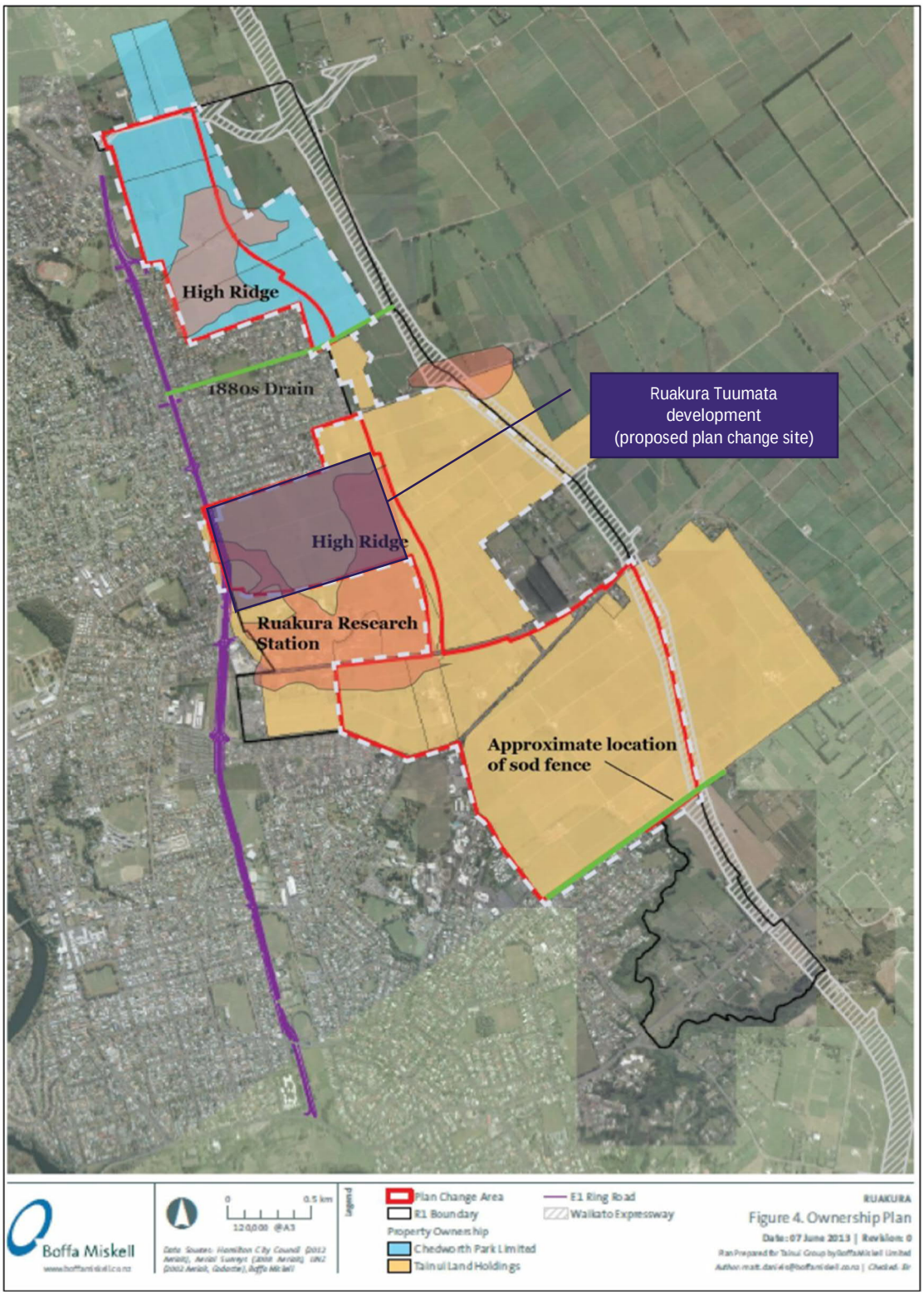


Figure 3-8 – Areas of archaeological interest/potential, including high ridges (highlighted red), the sod fence (in green) and the 1880s drain (in green – note this is outside the study area). Area assessed highlighted with white dashed line.

3.11 Cultural Values

A Cultural Assessment Report was prepared by NaMTOK Consultancy Ltd in November 2011 for the overall Ruakura area (Appendix G). The report provides an assessment regarding the Māori cultural values associated with the overall Ruakura land area, any impact the development might have on these values, and possible mitigations to alleviate any such impacts.

The report also identifies the history of the land, concerns, and issues that manawhenua might hold regarding the development of the land, and proposed mitigations to address these concerns.

3.12 Existing Three-Waters Infrastructure

The existing site is a rural environment and as such there is very limited existing three-water infrastructure within Ruakura Tuumata development, other than specific onsite devices associated with the rural lifestyle land use.

In terms of stormwater, the site includes the Reeves Close drain in the north-eastern corner, a 1050mm pipeline along the northern boundary that conveys the stormwater from the Reeves Close drain to the main stormwater pipeline underneath Wairere Dr and the field sumps located in the depressions in the terrain along the northern boundary of the site. The Tramway Road drain discharges into a scruffy dome manhole. The manhole is located within the road reserve of Wairere Dr. Finally, there is a 300mm pipeline along the southern boundary towards the east. This pipeline conveys the runoff from the site that contains the HCC Ruakura Reservoir to the current discharge point in a field at the bottom of the terrace.

There are no existing water supply connections present within the site. The Ruakura Water Supply Reservoir is located south of the site and is connected to the water supply mains along Wairere Dr via two 640mm water supply mains located along the southern boundary of the site, immediately south of the site. After the connection to the reservoir, a single 640mm water supply main continues to the east. The main turns south at the location where the stormwater pipe from the Ruakura reservoir currently ends. The Wairere Dr road reserve along the western boundary of the site contains a 600mm water supply main.

There is no existing wastewater infrastructure present within the site and neither have there been wastewater manholes installed for future upstream tie-in.

4. Key Stakeholders in the Catchment

The key stakeholders for this SC-ICMP are:

- Tainui Group Holdings (TGH)
- Hamilton City Council (HCC)
- Waikato Regional Council (WRC)
- Waikato-Tainui

All the land that is part of the proposed Ruakura Tuumata development is owned by TGH (Figure 4-1). In addition, TGH owns all the land upstream of the Ruakura Tuumata development some of which has been earmarked for future industrial development.

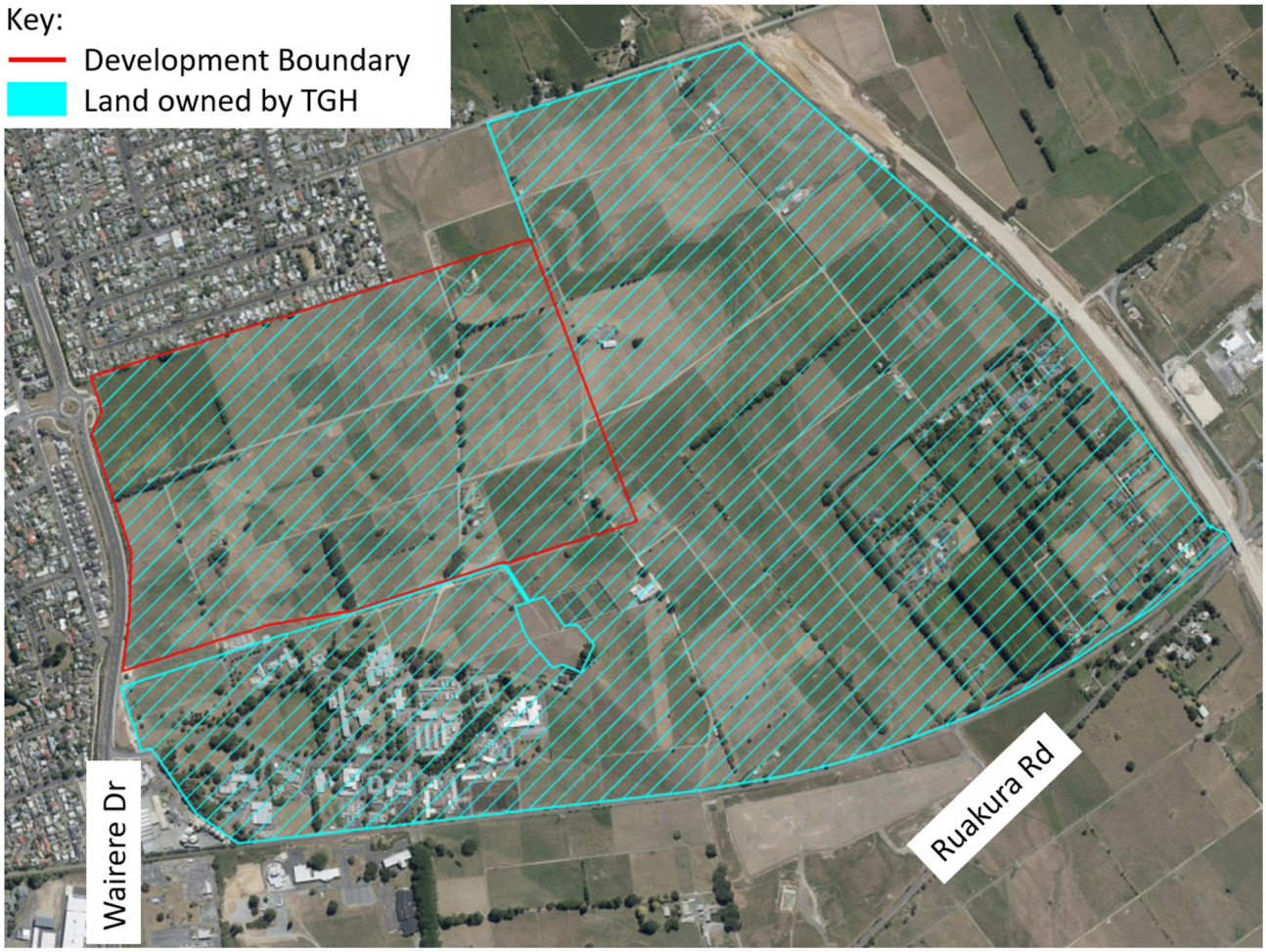


Figure 4-1 – Property owner of land within development and upstream of development

5. Development Concept

5.1 Overview of Proposed Development

As outlined in the Private Plan Change application, the Private Plan Change seeks to rezone 68Ha within the identified sub-catchment from Industrial to Medium Density Residential (Figure 5-1). The development will include dwellings up to three stories high, open spaces, shared paths and a suburban commercial centre.

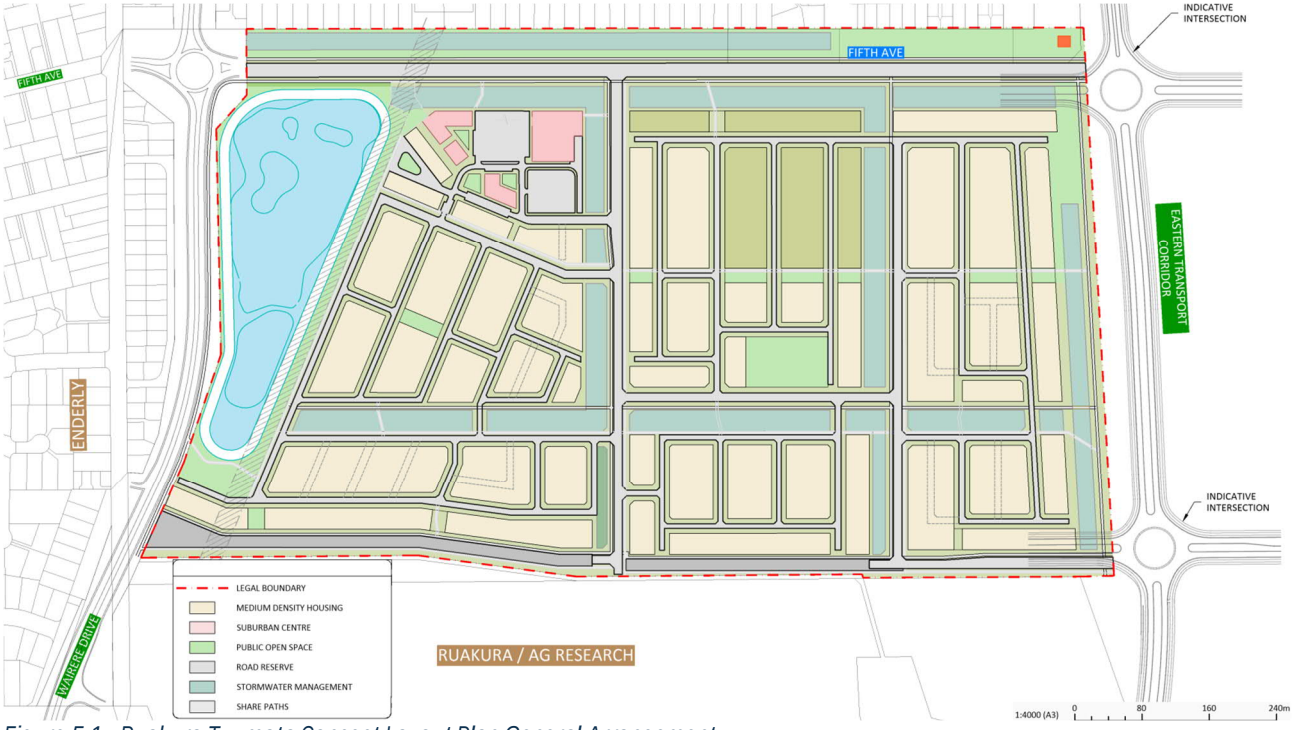


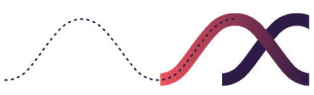
Figure 5-1 - Ruakura Tuumata Concept Layout Plan General Arrangement

5.2 Key Issues, Opportunities and Constraints

Considering key site constraints identified above, Table 5-1 outlines any issues and constraints for the management of three water and identifies any key opportunities that could be addressed.

Table 5-1 - Issues, opportunities and options

Broad Area	Issues/Potential Effects	Opportunities	Options for Three Water Management
Topography	Majority of the site is flat, creating potential issues for conveyance of stormwater and wastewater.	Minimal requirements for zone management across the site. Potential to use engineered wetlands for treatment which require flat land.	Water: As per RITS
			Wastewater: Utilize gradients carefully to manage flows
			Stormwater: Engineered wetlands for treatment and detention. Stormwater: Conveyance via swales with shallow grades.
Soils/ Permeability	Soil profile creates risk of liquefaction. Low permeability soils cause low infiltration and hence high runoff which affects flow rates and storage volumes for stormwater devices.		Water: -
			Wastewater: Leak tight standard for any gravity system
			Stormwater: Stabilise areas prone to liquefaction Stormwater: No onsite soakage Stormwater: Sufficient attenuation volume available to reduce peak flow rates at discharge locations from site to below existing values.
Groundwater	High groundwater table – potential for underground structures to rise (need to be weighted) and high potential for groundwater to enter stormwater devices and gravity wastewater network. Installation of gravity piped networks would require dewatering operations for trench excavations. Gravity wastewater network would expose risk of infiltration occurring over asset design life, leading to reduced future capacity, increased treatment costs at Pukete Wastewater Treatment Plant.	Utilise above ground technologies for stormwater attenuation. Utilise swales for stormwater conveyance.	Water: -
			Wastewater: Leak tight standard for any gravity system. Wastewater: confirm safety factor against buoyancy for underground structures.
			Stormwater: Groundwater monitoring for depth of groundwater table prior to design of wetland, etc. Stormwater: Provide impermeable lining for stormwater devices as identified by monitoring. Stormwater: Limit underground structures.



Existing stream network	Farm drains (artificial watercourses) with limited hydraulic capacity transverse the site. Stability of existing farm drains uncertain due to liquefaction potential. Currently water quality is degraded. Gravity wastewater network will require emergency overflow structure(s) to manage abnormal flow conditions, specifically at pumping stations.	Potential for conveyance of stormwater – widen swale margins, which also reduces liquefaction potential. Margins of swales could be enhanced with riparian planting Existing performance of septic tanks and disposal fields for existing properties unknown. Removal of these has potential to improve stream water quality.	Water: - Wastewater: Removal of poorly performing septic tanks and disposal fields. Wastewater: Careful design of gravity system. Stormwater: Utilize swale network for conveyance of stormwater runoff, including flood flow. Stormwater: Treatment prior to discharge into HCC reticulation network. Stormwater: Riparian planting of swales above permanently wet flow level.
Overland Flow Paths	Potential flood risks should be accounted for in the design of flow path corridors Gravity wastewater network manholes within road reserve that would be within overland flow path.	Intercept upstream overland flows and attenuate before discharge into downstream network. Consider type of wastewater manhole lids within road reserve to reduce potential for inflow from overland flow paths	Water: - Wastewater: Leak tight standard for any gravity system Stormwater: Utilise road network for overland flow. Stormwater: Overland flow network within site to drain into attenuation facility, reducing overland flow rates downstream of site.
Change in land-use	Increased impervious surface results in greater peak runoff rate and runoff volumes. Increased temperature/heat. Increased water supply demand will increase demands on water supply infrastructure upstream of site. Increased wastewater loading will increase demands on wastewater infrastructure downstream of site.	Utilise water quality management and water quantity design principles to mitigate impacts of additional impervious surface. Increase native flora and fauna, through riparian planting in margins of swales.	Water: - Wastewater: - Stormwater: Improve water quality through new treatment devices. Stormwater: Reduce existing discharge flow rates from site through attenuation devices.

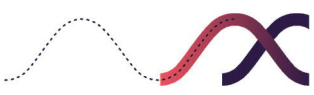
Road/Car parking	Generates key stormwater contaminants, including heavy metals and sediments. Road runoff potentially increases surface water temperatures. High groundwater is risk to road pavement where subsoil drainage is not possible due to invert levels of stormwater devices. Water supply and wastewater networks to be located within road reserve.	Utilise water quality management to mitigate impacts of roading on stormwater quality. Pavement sub-soil drainage to be integrated with stormwater conveyance system.	Water: Locate water supply network in berm as per RITS Wastewater: Locate water supply network in berm as per RITS Stormwater: Use treatment train of swales and wetlands to remove road contaminants. Stormwater: Reduce existing discharge flow rates from site through attenuation devices.

5.3 Operational Objectives

Considering the key issues, opportunities and constraints identified above, the following operational objectives have been derived to the address the issues and to align with the strategic objectives as set out in Chapter 2.

Table 5-2 – Operational Objectives

Operational Objective	Description
1. Stormwater discharge quality	Treatment device design will be according to WLASS RITS. Primary stormwater discharges shall be treated to a high level prior to discharge using a treatment train of swales and wetland. The system as a whole is to achieve at least 75% sediment removal from the site. Devices serving roading areas should be suitable for the removal of hydrocarbons and heavy metals. Swales will be lined with appropriate plants as an erosion measure. Construction generated sediment shall be controlled to meet Waikato Regional Council standards and shall comply with relevant city bylaws and District Plan requirements.
2. Ecological Enhancements	Enhance indigenous biodiversity across the site by utilising native species wherever possible for swale plantings, wetland margins, amenity tree species, road verges and traffic island/roundabouts. Where possible, create connections or corridors to existing ecological sites associated with the Waikato River corridor. Stabilise erosion prone areas, trees and other vegetation, along with discharge point. Where native tree plantings are proposed, encourage cluster plantings to create potential habitat for birds and bats.



3. Flooding	Runoff from upstream catchments will be intercepted and conveyed via swales to the attenuation device. Where existing downstream flooding is known, or potential flooding is predicted, peak flow management is required for small events and reduction to 80% of pre-development peak flow rate is required for the 100yr ARI storm including climate change. Overland flowpaths shall be provided for all stormwater discharges in accordance with HCC standards. Wherever possible, the use of private property for overland flow paths shall be avoided. Sufficient freeboard protection, in accordance with HCC standards shall be provided to building floor levels.
4. Protect Cultural Values	Engage with iwi in accordance with the Waikato-Tanui Environmental Plan. Riparian planting will be encouraged throughout the site. Planting shall include an appropriate mix of native plant species.
5. Demand Management	The use of water sensitive practices shall be incorporated into the stormwater management approach for the site. Grey water recycling technologies will be considered at detailed design stage of the development. The design will be to reduce pressure on the wastewater system and treatment plant through water conservation. Rainwater harvesting will be considered at detailed design stage of the development. The design will be to reduce pressure on the wastewater system and treatment plant through water conservation. Low flow plumbing fittings where practicable are expected to be standard throughout the site. A leak tight standard wastewater system that will provide reduced flows of stormwater and groundwater to the treatment plant.
6. Public Safety	Stormwater management systems are to be designed for public safety. The wastewater system to be implemented must be designed and constructed according to the RITS.
7. Economic Affordability	Proposed stormwater management systems are to be cost-efficient during long term operation and maintenance. The creation of three-waters infrastructure assets that maximise opportunities for reduction, re-use and recycling of potable water and stormwater where appropriate. Integrating three-waters infrastructure systems with amenity and open space areas wherever possible.

6. Three-Waters Management and Capacity - Water

A concept level design has been carried out for the water supply management of the sub-catchment ICMP. A summary of the concept design is given below. Details can be found in Appendix A.

6.1 Existing Network

There are currently no water supply connections within the site. Water mains are present along the southern boundary of the site, going to and from the Ruakura reservoir, and along Wairere Dr (Figure 6-1). A new bulk main is also programmed to be installed in the first half of 2023 along the eastern boundary of the site from the Revisor to the Chedworth properties development in the north.

6.2 Constraints and Design Parameters

The concept design of the proposed water supply network that services the Ruakura Tuumata development complies with RITS. The key water supply design parameters are shown in Table 6-1.

Table 6-1 – Water Supply Network Design Parameters

Design Parameter	Value
Domestic Demand per Person per Day	260 litres
Peak Flow Rate Factor	5
Minimum Residual Pressure	200 kPa
Minimum Flow Rate at Point of Supply	25 litres/min

Key design assumptions and considerations were as follows:

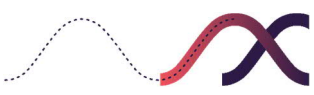
- Tie into the existing water supply network at a minimum of two suitable locations.
- Existing upstream water supply network has sufficient capacity to service the area covered by the sub-catchment ICMP, based on implementing network upgrades as per the HCC Water Supply Master Plan.
- Design to include linked or looped mains to avoid dead end water mains.
- Design to meet the FW2 firefighting requirements at the street boundary for residential areas and FW3 requirements for other zones.

6.3 Required Water Upgrades and Water Supply Networks

The Ruakura Tuumata development is located immediately north of the Ruakura Water Supply Reservoir that feeds the Ruakura DMA (Direct Metered Area) Water Supply Zone. For additional resilience within the overall Ruakura DMA, two new water supply trunk mains are proposed to be installed that cross the development (Figure 6-1). The first new trunk mains will connect the existing trunk main along Wairere Dr with proposed new trunk main along Spine Road, the second new trunk main connects the existing trunk main along the southern boundary with the first new trunk main.

The proposed water supply network within the development is dependent on new water distribution mains (Figure 6-1). A connection between the new water distribution network and the trunk network will be at the southern boundary of the development and a connection with the existing water distribution network will be at the Wairere Dr roundabout. Additional connections with the distribution network will be created with the proposed water distribution main along the Eastern Transport Corridor.

Within the Ruakura Tramway development, there are proposed to be two main water networks (Figure 6-1):



- West Zone has an area of 19.9 Ha and will require an estimated flow of 13 l/s.
- East Zone has an area of 33.9 Ha and will require an estimated flow of 23 l/s.

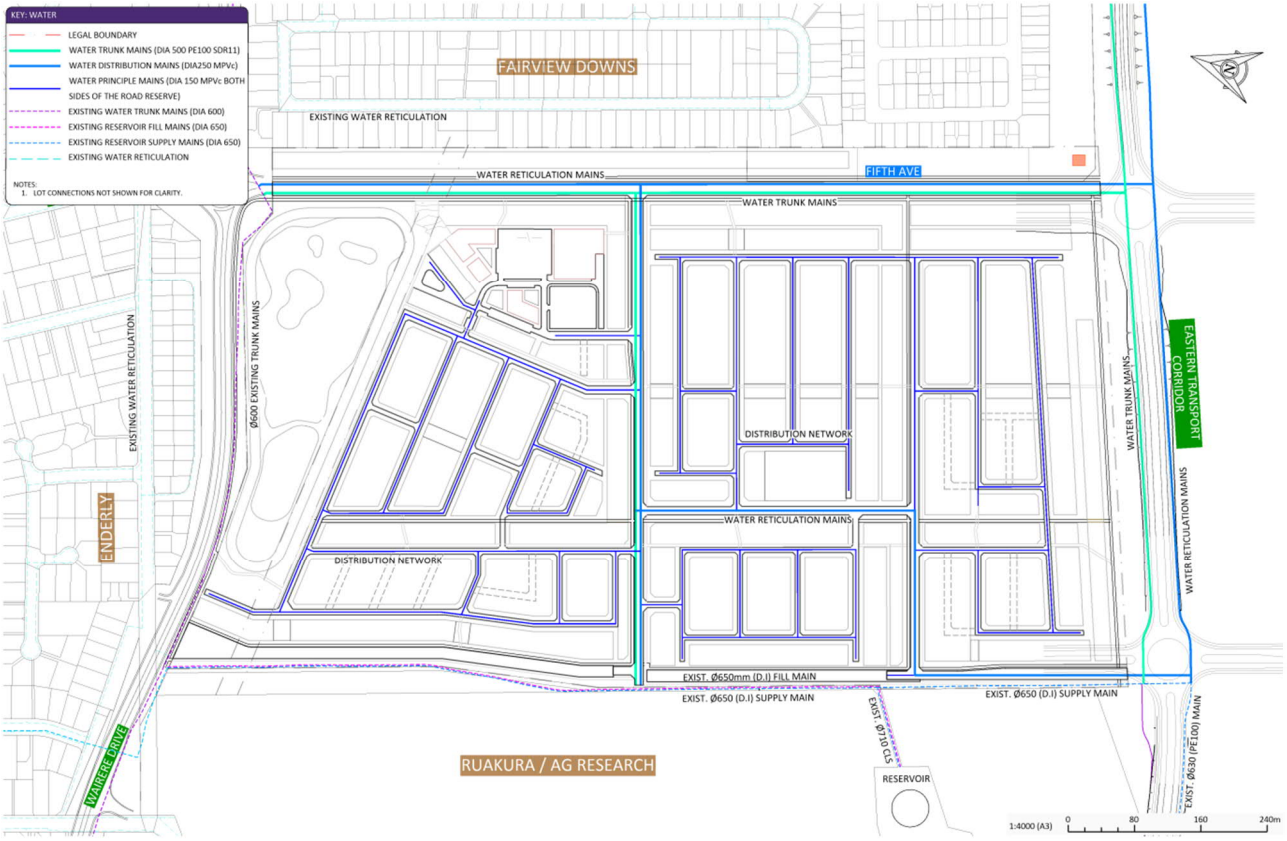


Figure 6-1 – Water Supply Network Concept Design

7. Three-Waters Management and Capacity - Wastewater

A concept level design has been carried out for the wastewater management of the sub-catchment ICMP. A summary of the concept design is given below. Details can be found in Appendix A.

7.1 Existing Network

A 1050mm wastewater interceptor is under construction along the Eastern Transport Corridor alignment. The interceptor has been constructed underneath Webb Dr as far as the farm drain that ends at Aldona Pl. The most upstream manhole is WWN26022, an 1800mm manhole with an invert elevation 34.88m RL. This manhole is located approximately 700m from the north-eastern corner of the development.

7.2 Constraints and Design Parameters

The concept design of the proposed wastewater network that services the Ruakura Tuumata development complies with RITS. The key water supply design parameters are shown in Table 7-1.

Table 7-1 - Wastewater network Design Parameters

Design Parameter	Value
Population Equivalent per Lot	2.7
Average daily flow per population equivalent per day	200 litres
Infiltration allowances per serviced hectare per day	2250 litres
Surface water ingress per serviced hectares per day	16500 litres

Key design assumptions and considerations were as follows:

- Use an existing manhole, that connect to the HCC wastewater network, as the discharge point for all wastewater from the Ruakura Tuumata ICMP.
- Existing downstream wastewater network has sufficient capacity to manage the flow generated in the Ruakura Tuumata ICMP area.
- Use gravity only to convey wastewater from the whole sub-catchment to a single pumpstation located in the centre of the development.
- Use a single rising main from the pumpstation to the proposed southern extension of the existing wastewater interceptor to be located underneath Spine Rd.

7.3 Required Wastewater Infrastructure and Upgrades

The Ruakura Tuumata wastewater network has an area of 52.9Ha (Figure 7-1). The proposed pumpstation is located along the road crossing the development from the northern to the southern boundary. The pumpstation will be able to service the entire sub-catchment. The combined peak wet weather flow is estimated to be 26 l/s. The pumpstation is connected via an 850m rising main with an internal diameter of 180mm to the proposed wastewater interceptor underneath Spine Rd. The discharge manhole of the rising main is SSMH-02-007.

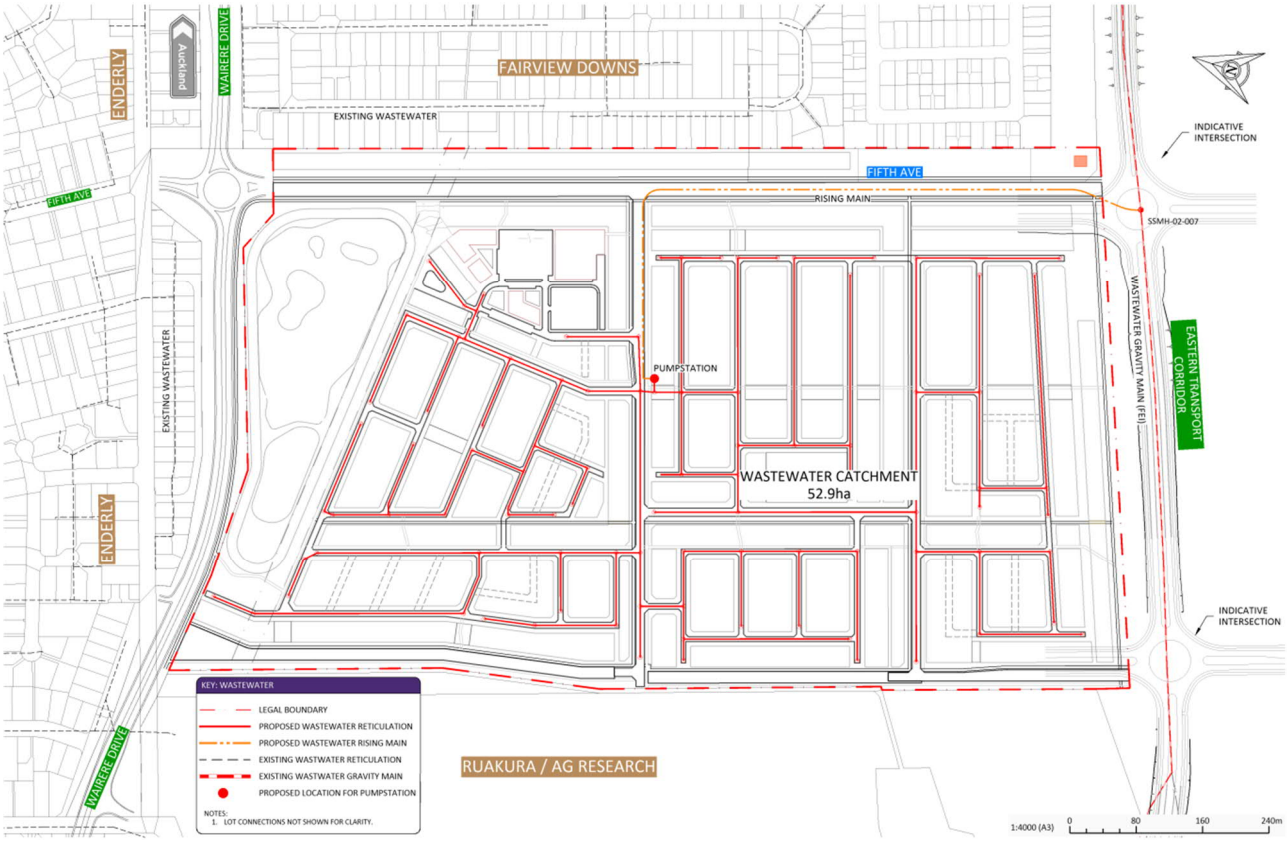


Figure 7-1 - Wastewater Network Concept Design

8. Three-Waters Management and Capacity - Stormwater

For the stormwater management of the sub-catchment ICMP, a concept level design has been carried out. A summary of the concept design is given below. Details can be found in Appendix B.

8.1 Constraints and Design Parameters

The key design parameters are:

- Water Quality Treatment compliant with RITS (Waikato Local Authority Shared Services, 2018) and WRC TR2020/07 (Waikato Regional Council, 2020) including pre-treatment for High Contaminant Load surfaces in all sub-catchments.
- Water Quantity Control for the discharge from the Ruakura Tramway development for the extended detention volume, the 2yr ARI 24 hr, the 10yr ARI 24hr and the 100yr ARI 24hr storm events.

Due to the high groundwater level throughout the Ruakura Tuumata development, the use of soakage to dispose of groundwater is not a viable option. Design of stormwater wetland and swales for quality and volume for attenuation requirements have assumed that no soakage occurs.

8.2 Stormwater Catchments

The Ruakura Tuumata area has been divided further into minor sub-catchments. Each residential minor sub-catchment discharges into a small reticulation network through private connections and each road minor sub-catchment discharges into small reticulation networks via kerb and channel and catchpits. Each of the small reticulation networks discharge into the swale network (Figure 8-1). The swale network will provide the first level of treatment and will convey the flow into the stormwater treatment wetland. The swales in combination with the wetland will form a treatment train to meet the water quality requirements.

The wetland has been adopted as the preferred main stormwater devices as a wetland generally provides the best mix of water quality, ecological, maintenance, land, and amenity outcomes. A wetland can also be designed to provide attenuation as well as treatment, with very little additional area required.

On the southern boundary of the development, where runoff from the southern off-site catchments is expected, cut-off swales have been incorporated into the design to allow for interception (Figure 8-1). The cut-off swales are discharging into the proposed swale network through culverts. The proposed layout also provides a future connection from the off-site catchment to the reticulation network downstream of the wetland. This connection will be used to divert future treated flows from the upstream catchment developments directly into the downstream reticulation network, bypassing the proposed swales and wetland of the Ruakura Tuumata development and therefore avoiding mixing treated and untreated waters.

Runoff from the eastern off-site catchments in the Reeves Close drain is intercepted before reaching the development (Figure 8-1). The existing 900mm diameter pipe along the northern boundary of the development is proposed to be extended to the east, past the future Spine Rd. The proposed extension of the stormwater line is expected to cause a rise of the flood levels at the upstream land, which also belongs to TGH Group Holdings. This increase is considered acceptable as it only affects farmland within the paleochannel and does not have any impact on the existing dwellings, including those along Percival Rd and Ryburn Rd. The future development of Ruakura Tramway East industrial development will take this layout into account, and it is expected that, with the addition of stormwater devices that will treat and attenuate the future industrial runoff, this water surface increase will be mitigated or even seize to exist.

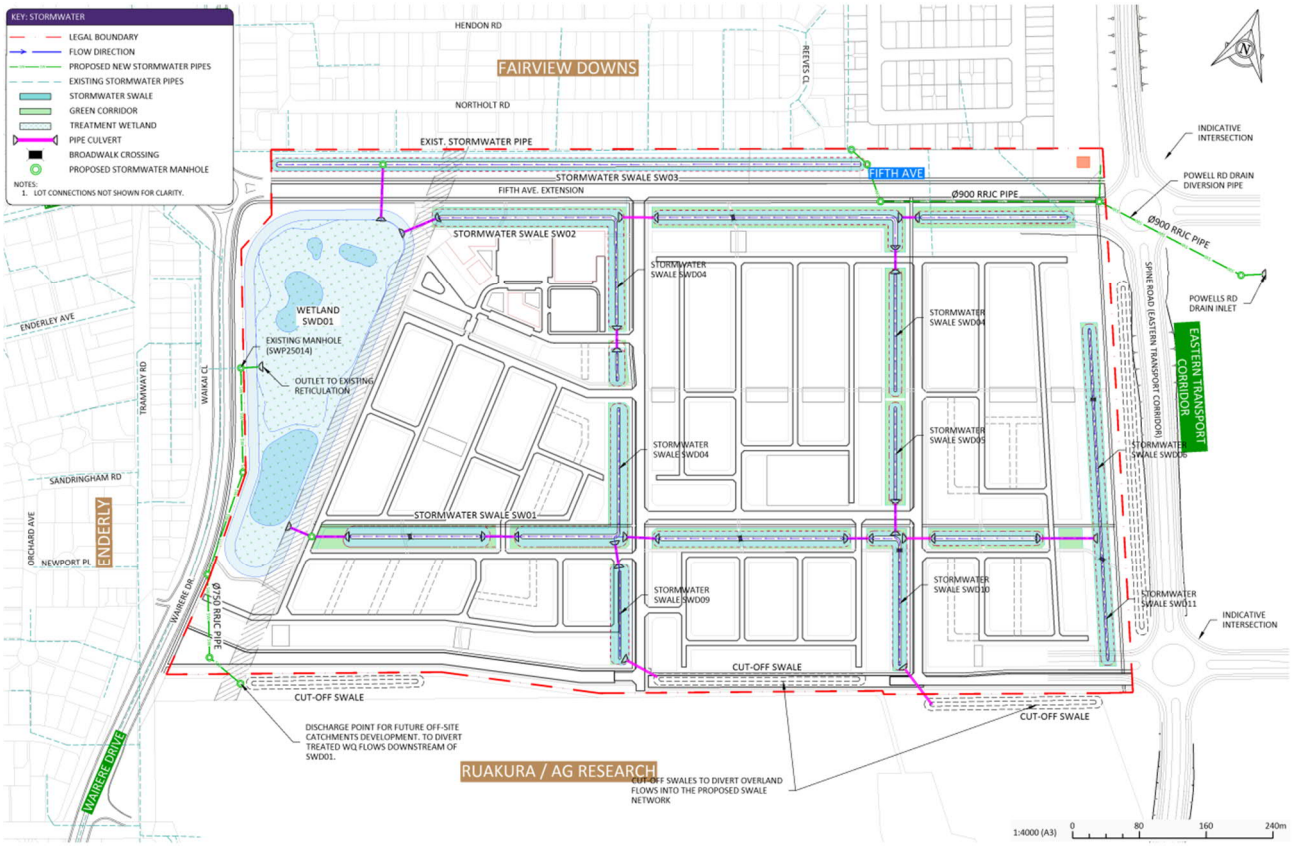


Figure 8-1 - Stormwater Management Concept Design

8.3 Stormwater Design

Stormwater hydrology and hydraulics were modelled using EPA SWMM-5. Based on current rainfall patterns, soil infiltration characteristics and soil cover complexes, the pre-development peak flow rates out of the Ruakura Tramway sub-catchment were determined for the existing discharge locations into the downstream reticulation network at Wairere Dr (the end of the Tramway Rd Drain) and at the Powells Rd development (the end of the Reeves Cl drain). The results are presented in Table 8-2.

Table 8-1 - Modelled existing peak flow rates at discharge locations

Discharge Location	2yr ARI (m^3/s)	10yr ARI (m^3/s)	100yr ARI (m^3/s)	80% of 100yr ARI (m^3/s)
Wairere Dr – Pipe	0.63	1.17	1.23	-
Overflow	-	-	1.00	-
Total	0.63	1.17	1.91	1.78
Powells Rd	1.22	1.44	1.56	1.25

To model the proposed condition, rainfall patterns were updated to include climate change, and the soil infiltration characteristics and soil cover complexes were updated to consider the change in land-use. The tailwater condition used assumed that the flow depth in the pipe immediately downstream of the discharge locations increased to the soffit of the pipe (full flow tailwater condition).

The wetland has been designed to ensure that the post-development peak flow rates will be less than the pre-development peak flow rates at the proposed discharge location out of the Ruakura Tuumata sub-catchment ICMP (Table 8-3). The results show that during the 100yr ARI storm event, the total peak flow rate has been reduced by nearly 50%, stormwater is no longer flowing across Wairere Dr, and the peak flow in

the downstream pipe has been reduced to approximately 80% of the pre-development peak flow rate in the pipe only.

Table 8-2 - Modelled proposed peak flow rates for full flow tailwater conditions at discharge locations

Discharge Location	2yr ARI (m^3/s)	10yr ARI (m^3/s)	100yr ARI (m^3/s)
Wairere Dr – Pipe	0.62	0.85	1.01
Overflow	-	-	-
Total	0.62	0.85	1.01
Powells Rd	1.21	1.41	1.52

9. Implementation Methods

Implementation methods for the SC-ICMP include but are not limited to those measures in Table 9-1.

Table 9-1 - Implementation/Means of Compliance

Area Type	Requirement		Recommended Device Option
Medium Density Residential	Detention	Detention is being achieved through the centralised device (Stormwater wetland).	Tank (above or below ground)
	Treatment	Roof material metals contaminant runoff avoidance	Inert roof materials Runoff discharge through swale and treatment wetland
Suburban Centre	Detention	Detention is being achieved through the centralised device (Stormwater wetland).	Tank (above or below ground)
	Treatment	Roof material metals contaminant runoff avoidance	Inert roof materials Runoff discharge through swale and treatment wetland
Roads	Conveyance		Kerb & Channel, Catchpits and discharge into swales
	Treatment		Treatment is provided in treatment wetland
Stormwater Management	Conveyance		Swales
		Environmental Enhancement	Riparian planting of native species
Treatment Device	Treatment	Removal of 75% TSS	Wetland
	Attenuation		Wetland

10. Further Work

Further work and actions include:

- Regional Consenting for stormwater discharge

Appendix A – Ruakura Tuumata Sub-Catchment ICMP Infrastructure Report (BBO, November 2022)

Appendix B – Ruakura Tuumata Sub-Catchment ICMP Stormwater System Report (BBO, November 2022)

Appendix C – Tuumata Plan Change – Geotechnical Investigation Report (CMW, November 2022)

Refer Tuumata Plan Change Report prepared by Peter Hall Planning Limited

Appendix D – Tramway Plan Change Area Rezoning – Private Plan Change – Ecological Impact Assessment (Boffa Miskell, August 2022)

Refer Tuumata Plan Change Report prepared by Peter Hall Planning Limited

Appendix E – Tramway Proposed Plan – Contamination Assessment (4SIGHT Consulting Ltd, April 2022)

Refer Tuumata Plan Change Report prepared by Peter Hall Planning Limited

Appendix F – Ruakura Development - Powells/Tramway Road Drains Watercourse Classification (Boffa Miskell, March 2022)

Refer Tuumata Plan Change Report prepared by Peter Hall Planning Limited

Appendix G – Cultural Assessment

Refer Tuumata Plan Change Report prepared by Peter Hall Planning Limited

Appendix H – Archaeological Assesment

Refer Tuumata Plan Change Report prepared by Peter Hall Planning Limited

Appendix I – Archaeological Authority (Pouhere Taonga Heritage New Zealand, August 2015)

Refer Tuumata Plan Change Report prepared by Peter Hall Planning Limited