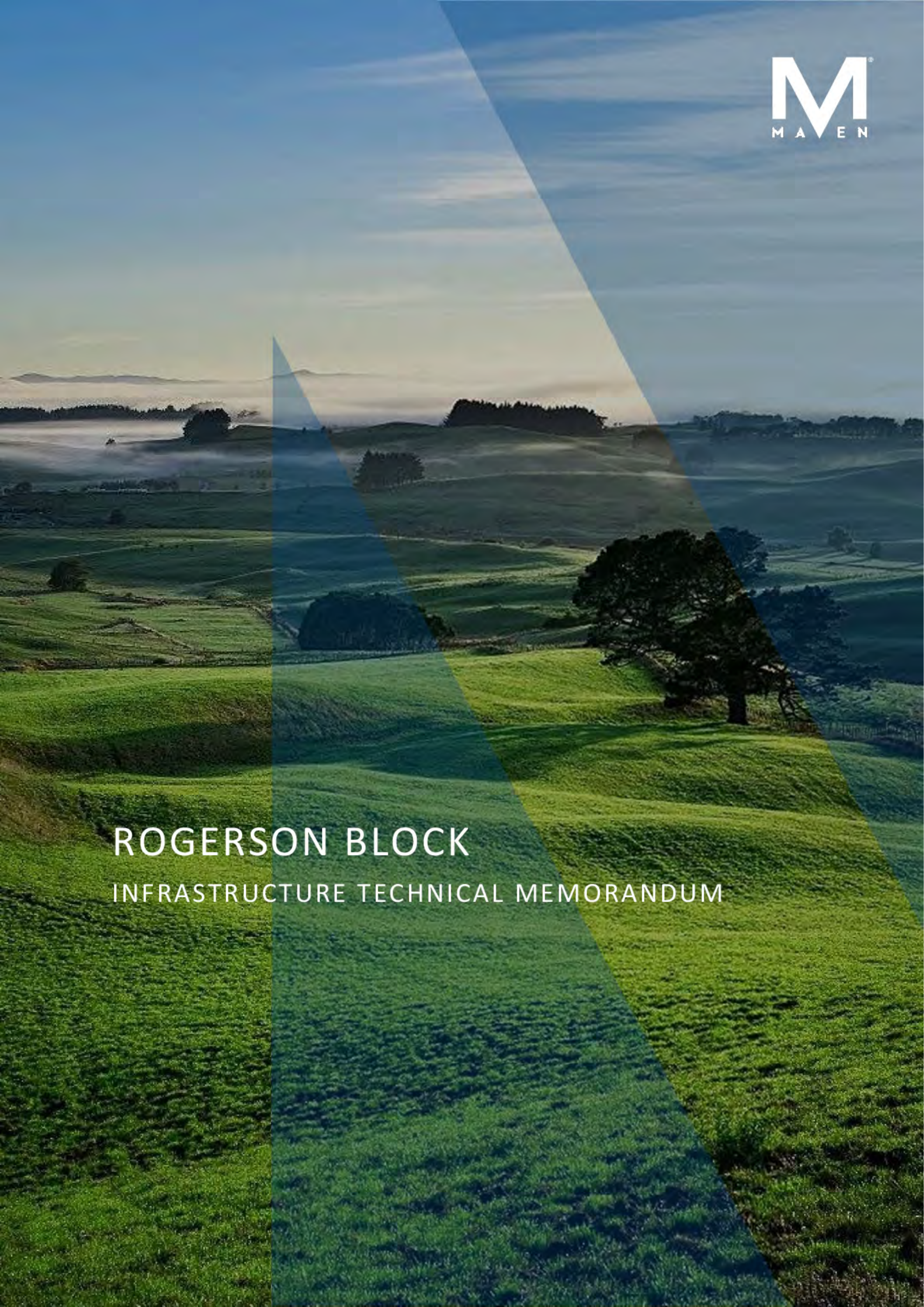

ROGERSON BLOCK

INFRASTRUCTURE TECHNICAL MEMORANDUM

PROJECT INFORMATION

CLIENT	Graeme Rogerson and Dave MacPherson
PROJECT	403001

DOCUMENT CONTROL

DATE OF ISSUE	18/06/2025
REVISION	D
AUTHOR	Tim Hawke Senior Engineer
REVIEWED BY	Min Shon Engineer
APPROVED BY	Dean Morris Regional Director

Level 1, 286 Victoria Street, Hamilton Central, New Zealand
Phone 07 242 0601
www.maven.co.nz

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1. Introduction

1.1. Background

Maven Waikato Ltd have been engaged by a Graeme Rogerson and Dave MacPherson to explore the preliminary high-level earthworks, roading and three waters strategy of land development for a proposed residential and industrial use within the Rogerson Block.

1.2. Proposal Summary

Rogerson Block Development is a combined residential and industrial development within the wider Southern Links 1 ('SL1') area.

Graeme Rogerson is part of a well-established group of developers involved in a consortium that has been established for some time that represent the bulk of the SL1 growth cell, recognised by Future Proof and the development community in the Waikato. Strong synergies with the listed (Southern Links 1 Stage 1 Industrial and Stage 1 Residential), Fast-Track project exist.

The Rogerson Block comprises circa 43 hectares, which will be split into approximately 13 hectares of medium density residential development and 28 hectares of industrial development. The residential component of the proposal will comprise circa 200 residential units, primarily medium-density (300m2 allotments), of varying typologies such as terraced, duplex and detached dwellings. The industrial component of the proposal will comprise circa 35 industrial allotments of varying size, including less than 5,000m2 (small lots), 5,000m2 to 10,000m2 (medium lots), and over 10,000m2 (large lots), to provide for a range of uses from small-scale manufacturing or workshops to light industrial workshops and warehouses. The Rogerson Block masterplan is shown in Figure 1 and contained within the Urban Design Memorandum.

The residential development is underpinned by a series of design principles, which focus on creating a well-connected, legible and integrated community on Hamilton City's urban fringe. The proposed transport network utilises the existing connection points, specifically on Tuhikaramea Road and Karen Crescent, to ensure the community is supported by local roads, cycle connections and pedestrian pathways to create an accessible and legible development. As aforementioned, a range of housing typologies and densities are proposed to meet the growing and changing needs of the housing market to ensure there are options for future residents. Each typology has been thoughtfully located, based on opportunities and constraints, with density ranging from terraced, duplex and detached dwellings to ensure integration with the adjoining urban footprint.

A thoughtful open space network will buffer the residential component of this proposal from the industrial component, with a proposed 20 metre wide green buffer and artificial wetlands, to provide amenity for local residents and create a functional development. A series of four artificial wetlands will provide both a stormwater function and amenity function.

The larger east-to-west spine road, of approximately 27.8 metres in width, will provide for the movement of people and vehicles through the site. Two additional transport corridors will be provided from this spine road to provide logical access for the industrial allotments. The industrial allotments have been thoughtfully located, with the small lots adjoining the proposed residential development and the larger lots integrating with the neighbouring proposed industrial development of the wider SL1 development and adjoining rural land.

The development will be appropriately serviced via a robust infrastructure strategy, which includes utilisation of existing services, stormwater artificial wetlands, and if required new water bores.

The high-level masterplan is shown in Figure 1 below. Refer to Appendix A for Barkers and Associates Urban Design Package for further details, and it is also contained within the Urban Design Memorandum.

Figure 1: Barkers and Associates High-level Masterplan

1.3. Site Description

The development area is a 43-hectare block of land located within the Waipa District, south of the Hamilton City boundary.

Most of the site is low lying flat farmland and the Waitawhiriwhiri Stream passes through the site. From the CMW report it has indicated that the site has predominantly peat soils up to 2m in depth.

1.1. Legal Description

The development site is split across multiple parcels of land, and the legal descriptions for these parcels of land are listed in table 1 below:

Lot Description	Area (m^2)
Lot 2 DPS 86155	209,328
Lot 3 DP 415839	290
Lot 4 DP 415839	4,477
Part Lot 1 DPS 10838	38,084
Part Lot 1 DP 13477	184,111

Table 1: Lot Descriptions

2. Earthworks & Geotechnical

A geotechnical desktop review for the overall SL1 development area was undertaken by CMW in June 2021, refer to Appendix F for the CMW report.

The report identifies the approximate distribution of prevailing landforms and geologies for the local area (Figure 2), typical geotechnical challenges associated with subdivision development on those landforms and presents strategies to mitigate hazards by further geotechnical investigation and design.

Based on the results of previous geotechnical investigations at SL1 and surrounding sites, the Rogerson Block should be suitable for the intended development. The area will however present challenges, therefore development should be supported by detailed geotechnical investigation and earthworks management.

2.1. Low Lying Peatland

Future land suitable for development consists of low-lying peat. The peat is a characteristic deposit of the Waikato Basin and is described as normally to near normally consolidated and therefore is susceptible to significant settlement when subjected to loading or drainage. As peat areas are low-lying, they can be susceptible to flooding as well.

Please see in Appendix F – CMW - "Peat Contour Plan" for underground mapping that was created to show depths of indicative Peat soils using surrounding ground investigation results.

2.1.1. Development in Peatland

Where development has underlying peat present, the developers will need to comply with the requirements of the draft ICMP for the Mangakotukutuku catchment (consultation revision November 2020):

- Identify if the peat is to be removed and advise if it is to be replaced.
- Confirm that this does not change groundwater flows sufficiently to cause any adverse effects.

The ICMP for Mangakotukutuku catchment is currently being revised and it is currently not available on the Waikato Regional Council (WRC) website.

2.1.2. Earthworks

Where the peat is present, drainage of the peat which could lead to shrinkage shall be carefully considered and mitigated against (see 4.3 Groundwater Recharge).

Peat and any existing over-lying fill material may require undercut and replacement with engineered fill where peat depths are up to 2m (above the water table) to minimise differential settlement issues.

Preload fill material may be suitable in areas where depths of peat are greater than 2m. Specific, underfill drainage, temporary pre-loading, and settlement monitoring, under the direction of a Geotechnical Engineer, will be required to limit post construction ground settlements.

2.1.3. Building Foundations

Where development in peat is proposed, pile foundations beyond base of peat or preload to induce ground settlements may be practical. Preload depths of approximately 2m with settlement hold periods of 3 to 6 months are expected based on historical works.

Lightweight buildings may require raft foundations that are designed to accommodate ground settlements. Where development in peat results in high foundation loads (i.e., heavy industrial buildings exceeding preloading weight), piled foundations beyond the base of the peat will likely be required. Foundations for larger structures resulting in high foundation loads typical to the zone, it would require specific design from a Geotechnical Engineer. Specific design (often requiring piling) is typically required in any case even if building foundations were in clay.

Figure 3 – CMW soils map

2.2. Roading Construction

For construction of any new roads, HCC will not accept new roads being built directly over existing peat soils. Where the peat is less than 2m the peat will likely be undercut and removed, and approved engineered fill placed. For peat soils greater than 2m in depth, the peat will likely be preloaded to induce ground settlement and the settlement monitored. The expected settlement time is 3 to 6 months based on historical results for surrounding areas.

2.3. Sediment and Erosion Control

Sediment and erosion control measures are to be established in accordance with Waikato Regional Council's (WRC) erosion and sediment control guidelines for soil disturbing activities. Erosion and sediment controls should be in place before earthworks commences and checked onsite by the Engineer. Sediment and erosion control drawings will be provided prior to construction.

2.4. Preliminary Earthworks

A preliminary earthworks assessment has been undertaken for the Rogerson Block. The design terrain was developed based on the master plan layout. The earthworks volumes generated are based on the proposed finished ground level vs existing finished ground level. We have not allowed for undercutting the areas of peat with this assessment, we anticipate this will further increase the overall cut volume. The preliminary earthworks volumes are summarised in table 1 below.

Earthworks Volumes	
Total Cut =	53,884m^3
Total Fill =	73,656m^3
Total Fill with Compaction bulking Factor (1.2)	64,661m^3
Balance (Fill)	19,772m^3

Table 1: Summary of Earthworks

Topsoil striping has not been included with the earthwork's volumes.

3. Roading

BBO have been engaged as the transport design leads for this Rogerson development. BBO are working with the local stakeholders to determine the proposed roading network for this development. Refer to the BBO transport memo for further details. The design criteria considered for the local residential and industrial roads are shown in Figure 4 below.

							Berm requirements[5]				
Transport corridor type[1]	Land use environment[2]	Design speed environment (max desirable)	Legal width (min desirable)[4, 5, 14]	Carriageway width[3]	Movement lane width[15]	Berm requirements[5]	On street parking requirements (min desirable)	Passenger transport requirements (min desirable)[11]	Footpath requirements (min desirable)[12]	Cyclepath requirements (min desirable)	Service corridor (min desirable)[6]
Residential Land Use Environment											
Local (low volume)	Residential (serving 10-20 units via fee simple tenure)	40km/h	16m	6m	2 way flow, not marked	5m both sides	Recessed parallel parking bays (2m) on both sides	None	1.5m wide footpath, both sides	Cycling on road shared in movement lane	1.5m both sides
Local	Residential	40km/h	20m	6m	2 way flow, not marked	7m both sides	Recessed parallel parking bays (2m) on both sides	None	1.5m wide footpath, both sides	Cycling on road shared in movement lane	1.5m both sides
Collector	Residential	40 to 50km/h	23m	9m	2 @ 3m, marked	7m both sides	Recessed parallel parking bays (2m) on both sides	All bus stops to be kerbside[11]	2m wide footpath, both sides	1.5m on road marked cycle lane, both sides	2m both sides
Minor Arterial	Residential (Managed or limited direct access)[10]	60km/h	Specific design[8]	Specific design[8]	2 @ 3.5m, marked, plus 3m flush median	Specific design[8]	Recessed parallel parking bays (2m) on both sides	All bus stops to be kerbside. Potential for bus priority at intersections	3m shared off road footpath and cyclepath on both sides		2.5m both sides
Major Arterial	Residential (Limited or no direct access)[10]	80km/h	Specific design[8]	Specific design[8]	4 @ 3.5m, marked, plus 3m solid median	Specific design[8]	None	All bus stops to be recessed. Potential for bus priority at intersections	3m shared off road footpath and cyclepath on one side		Specific design[8]
Industrial Land Use Environment											
Local	Industrial	40km/h	20m	9m	2 @ 4.5m, not marked	5.5m both sides	Recessed parallel parking bays (2m) on both sides	None	1.5m wide footpath, both sides	Cycling on road shared in movement lane	1.5m both sides
Collector	Industrial	40km/h	23m	11m	2 @ 4.5m, marked, plus 2m flush median	6m both sides	Recessed parallel parking bays (2m) on both sides	All bus stops to be kerbside	1.5m wide footpath, both sides	Cycling on road shared in movement lane	2m both sides

Figure 4 –HCC Road hierarchy

The preliminary roading layout for the Rogerson Block includes constructing 1.4km of new local residential roads with a 16.8m wide road corridor and 1.25km industrial central spine road with a 27.8m road corridor. The roading layouts will be further developed during the detailed design stages. The preliminary road corridors are shown below.

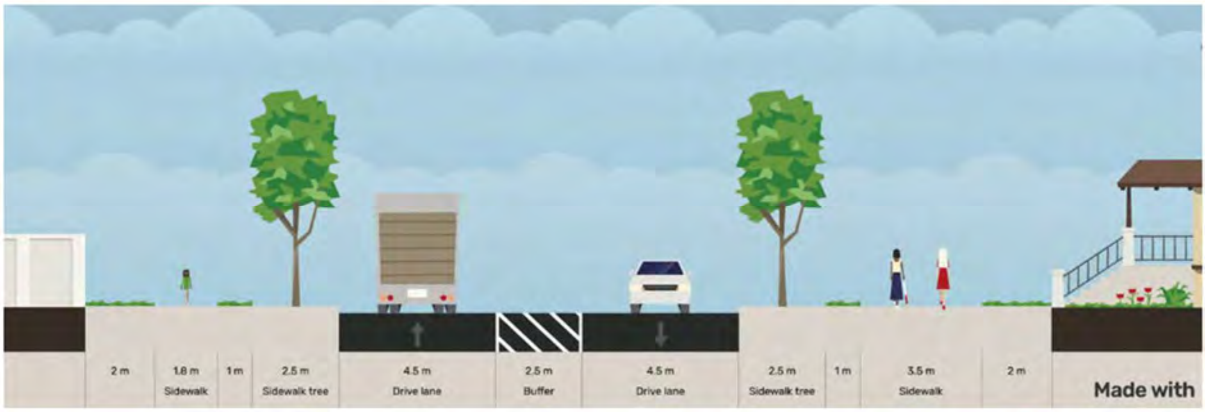


Figure 5 –27.8m wide Industrial spine road corridor typical cross section

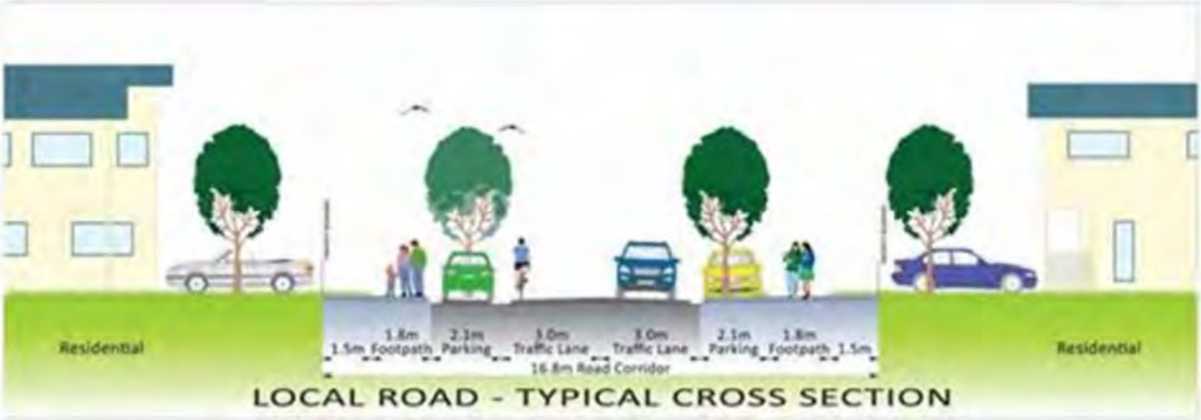


Figure 6 –16.8m wide Industrial spine road corridor typical cross section

4. Three Waters Strategy

4.1. Water Sensitive Urban Design (WSUD)

WSUD is a land planning and engineering design approach which integrates the urban water cycle, including stormwater, groundwater and wastewater management and water supply, to minimise environmental degradation and improve aesthetic and recreational outcomes.

The overarching objectives of WSUD are:

- Protect or enhance the environmental, social, and economic values of downstream environments.
- Reduce the frequency, duration, and volume of stormwater runoff to mitigate the risks of nuisance flooding and moderate post-development flows to waterways.
- Reduce demand on potable water supply.
- Improve amenity in the urban environment.

4.2. Three Waters Strategy

The Three Waters strategy incorporates WSUD engineering design principles to create a low impact, sustainable development which minimises stormwater and wastewater discharge from site.

The Brymer Farms Three Waters Strategy implements several key WSUD techniques, including:

- Restrict/ control the quantity of storm water and wastewater discharge.
- Reduce the frequency and severity of flooding in urban areas.
- Improve amenity in the urban environment by introducing waterways and green strips.

5. Stormwater

A preliminary Stormwater Management Plan (SMP) has been developed for Rogerson Block to set out the best practice framework for stormwater management. The stormwater is currently managed by the existing wetlands, farm drains and culverts to convey the surface runoff through the site. The draft consultation document for stormwater treatment for the Mangakotukutuku Integrated Catchment Management Plan (ICMP) provides draft stormwater treatment guidelines refer to SMP for further details. Refer to Appendix C for the Stormwater Management Plan (SMP) and Appendix B for the stormwater layout drawing. A high-level summary of the SMP is provided below.

5.1. Suggested Outcomes

Proposed objectives of the stormwater strategy are:

- Consideration of future public networks required in support of the study areas.
- Identify existing overland flowpaths.
- Identify existing flood hazards.
- Provide an option-based assessment for water quality treatment in support of the future development of the study areas.
- Consideration and requirement for extended detention in support of the future development of the study areas to avoid any downstream flooding, erosion, and scouring.
- Confirming the need for attenuation of peak flow during storm events up to the 100-year events.
- On-site retention (volume reduction) to ensure pre-development runoff rates and volumes are maintained within catchments and streams.

- Recommendations to guide future plan change application(s) to ensure positive environmental outcomes are achieved.

5.2. Reticulation

Existing stormwater infrastructure within Rogerson Block is limited to farm/roadside drains and streams. Development of the Rogerson Block will be supported by new public stormwater networks that will discharge into groundwater recharge pits and into the existing and proposed wetlands for primary and secondary water quality treatment. The future public networks would be developed by the developer. The stormwater infrastructure will need to comply with the conditions for resource consent and engineering approval before being vested with HCC. Where possible, the stormwater network will be designed and constructed within the roads.

5.3. Stormwater Quality and Quantity

An assessment has been undertaken to establish the best practical design options for the stormwater quality and quantity design in support of Rogerson block. These options include at source stormwater quality control through the following controls:

- Inert roofing materials for all future buildings.
- Reduction of impervious areas using permeable paving (where possible).
- Lot development supported by approved propriety devices such as raingardens, treepits, stormwater filters, etc.
- Treatment of public roads and right of ways via approved propriety devices (raingardens, swales, stormwater filters etc) as per GD01 design guidelines.
- Sub-catchment wide stormwater quality provision through detention basins and wetlands.
- Planting of riparian areas and protection of any existing bush features within SL1.
- Use of the treatment train devices (swales and/or amalgamated raingardens and artificial wetlands) to provide storage and attenuation for the required storm events from WQV, ED, 2-year, 10-year and 100-year ARI.
- Second option is to provide storage and attenuation within the existing (rehabilitated) streams in addition to wetlands. This is detailed further in the SMP.

A treatment train solution is proposed solution which would be in the form of an integrated forebay, amalgamated raingarden and wetland for each catchment. This provides two-step treatment and reduces the amount of maintenance required by creating one location per catchment to attend to.

HCC have noted their current preference is for the consolidated/amalgamated raingarden approach above. However, roadside raingardens or swales could be used in place of amalgamated raingardens before discharging into wetlands if required.

Proposed wetlands would be sized at 4% of their respective catchments, and discharge into the existing/enhanced streams. Refer to Appendix B for the concept stormwater plan, which provides preliminary catchments and wetland locations.

5.4. Groundwater Recharge

Soakage and recharge of stormwater into peat will be required to maintain hydrology to prevent dewatering of downstream wetland and streams and to mitigate ground shrinkage. For areas of deep peat, the preference would be to construct wetlands through these areas. Recharge pits should be designed at regular intervals throughout the development to encourage even distribution of groundwater recharge.

Detailed investigations by a suitable qualified Geotechnical Engineer, to determine the suitable recharge treatment measure to be implemented for each area. Recharge treatment measures will need to consider the future infrastructure and buildings in the decision-making process.

5.5. Rainwater Harvesting/Reuse

Reusing rainwater can significantly reduce the amount of water supply demand by household units by up to 50%. Decreasing demand on water supply has multiple benefits including meeting Water-Sensitive Urban Design (WSUD) criteria and decreasing household water use. Allowance for water metering is suggested for any future changes to Hamilton water supply requiring a meter box at the boundary.

Rainwater can be harvested and used for a range of different applications; for watering the garden or washing the car, for use in the laundry and toilet. Rainwater is harvested directly off the roof and travels through down pipes to a water tank, which sits either above ground or below.

Rainwater harvesting requires a building consent and would be enforced by a condition of resource consent and consent notice on each title. The use of rainwater reuse and their effects on water supply demand will need to be investigated and confirmed with council. Rainwater reuse options will be further investigated as part of future resource consent applications.

Rainwater harvesting can significantly reduce the amount of water supply demand from household units. Rainwater harvesting will be incorporated where possible into the proposed development during house construction.

5.6. Existing Stream Enhancement

The proposed wetlands are located adjacent and upstream of a few key existing conveyance channels/streams within the development. This will allow conveyance of flow from the development area into the existing environment. We have investigated the existing stream depths and levels based on available survey data and it appears most existing streams are very shallow. In their current state, this will restrict attenuation and flood storage ability for the adjacent catchment.

Based on the above, an option to address this would be enhancement of existing streams which would include deepening and possibly widening to accommodate conveyance and possibly storage and attenuation for the Rogerson Block development. Altering the streams provides the opportunity to rehabilitate the streams enhancing ecological habitat by providing a more natural meander, wetland areas and planting. This will require further inputs from an Ecologist during future design. Proposed enhanced stream locations can be found on the stormwater plan in Appendix B. Alternatively lands adjacent the existing streams could be infilled to achieve the level difference required to allow more efficient use of space to attenuate and provide flood storage.

5.7. Flooding

HEC HMS was used for hydrology analysis and HEC RAS was used to model flooding within the Rogerson Block. The modelling confirms the extent, location, flow, and depth of flood waters. The existing flood assessment was modelled by Golovan in 2021. Maven has updated the HEC RAS model using more recent survey data.

Existing modelling confirms that flooding within Rogerson Block occurs during the 100-year flood event. The flood result below (figure 5) indicates flooding throughout the proposed Rogerson block area, particularly around the low-lying areas, specifically within the existing horse racecourse area. The two main conveyance channels in the area, are the Waitawhiriwhiri stream and the existing stream that runs through the site both play a critical role in directing the flood waters downstream, north of the site through the main Waitawhiriwhiri stream.

Depths vary and are concentrated within the existing watercourses. Outside of the watercourses the bulk of the lower lying areas are subject to sheet flows only, show the overland flowpaths over 150mm in depm. This is illustrated in Figure 7 below.

Figure 7 – Existing site flood map

As mentioned in section 4.3, flood volumes and flows are proposed to be stored and attenuated within wetlands for each catchment. The wetlands would provide attenuation by means of a discharge control device installed within the wetland high-flow bypass. Alternatively, the enhanced existing streams could also be used to provide attenuation and storage. The discharge from the Rogerson Block into the downstream watercourse will need to be controlled, to ensure attenuation targets can be met. This is discussed in further detail in the SMP - Appendix C.

Subject to the future development complying with the above, there will be no adverse downstream effects from the development of the Rogerson Block. Additional investigation and detailed design are required to refine the preferred solution as part of any future resource consent or plan change approval.

5.8. Feedback from Hamilton City Council

In principle HCC agree with the general stormwater design approach. To maintain the existing primary natural overland flow paths through the Rogerson Block. We propose to create new consolidated wetlands for primary or secondary treatment. HCC will need to come to an agreement with WRC for this proposal. Roadside raingardens or swales may be proposed as an alternative option.

6. Wastewater

Maven have undertaken a desktop study to identify the most suitable option for wastewater disposal for the Rogerson Block. Reticulated, decentralised, and at source solutions have been considered. The site is in a rural location and there is no existing gravity reticulation within the site to service the proposed development. A staged approach in developing the proposed infrastructure will likely be adopted, with a preference to connect into the existing wastewater infrastructure where possible. Refer to Appendix B for the concept wastewater layout option drawings.

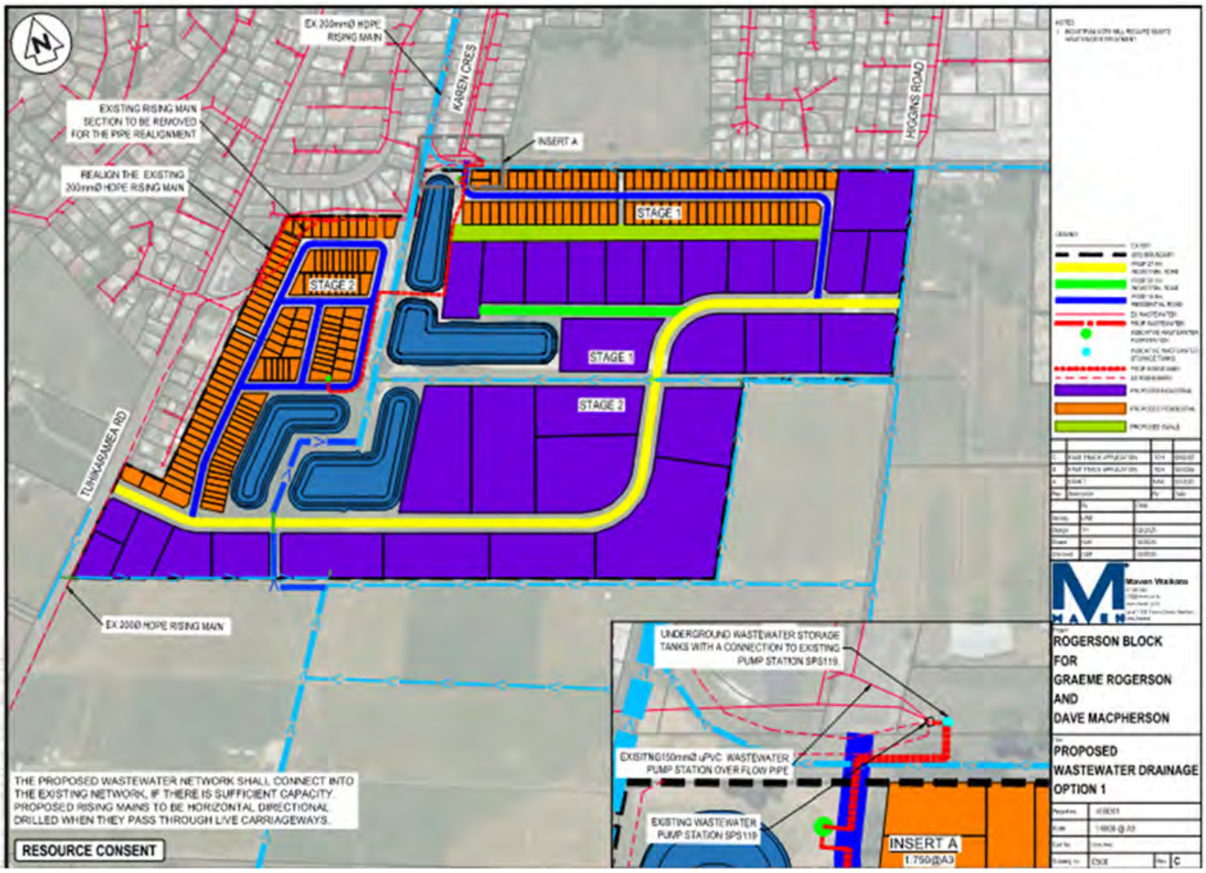


Figure 8 – Concept wastewater Plan

6.1. Existing Public Infrastructure

Hamilton has one centralised wastewater treatment plant in Pukete, that currently treats the wastewater for the entire city. HCC will be spending $56 million to upgrade the existing plant to provide additional capacity and to upgrade the secondary treatment process at the plant. The upgrade works to the existing plant started in 2018 and are due to be completed by the end of 2024. The upgraded plant will provide for the quality, capacity, and security of Hamilton's wastewater treatment plant for the next 30 years.

Figure 9 - Pukete Wastewater Treatment Plant (Google Map)

The existing wastewater pumpstation SPS119 is the nearest wastewater pumpstation to the Rogerson Block site and it is located within Kahikatea Park. The existing wastewater pumpstation pumps the existing wastewater to the north via a 200mm HDPE rising main, before it terminates into the existing gravity manhole WWS15127 in Rifle Range Road. The wastewater then passes through a 200mm HDPE line into the existing manhole WWS15122, before it enters the existing 825mm RCSRL western interceptor trunk line. The wastewater overflows from the existing wastewater pumpstation discharge out through a 150mm uPVC overflow line, into the existing wastewater manhole WWU15002.

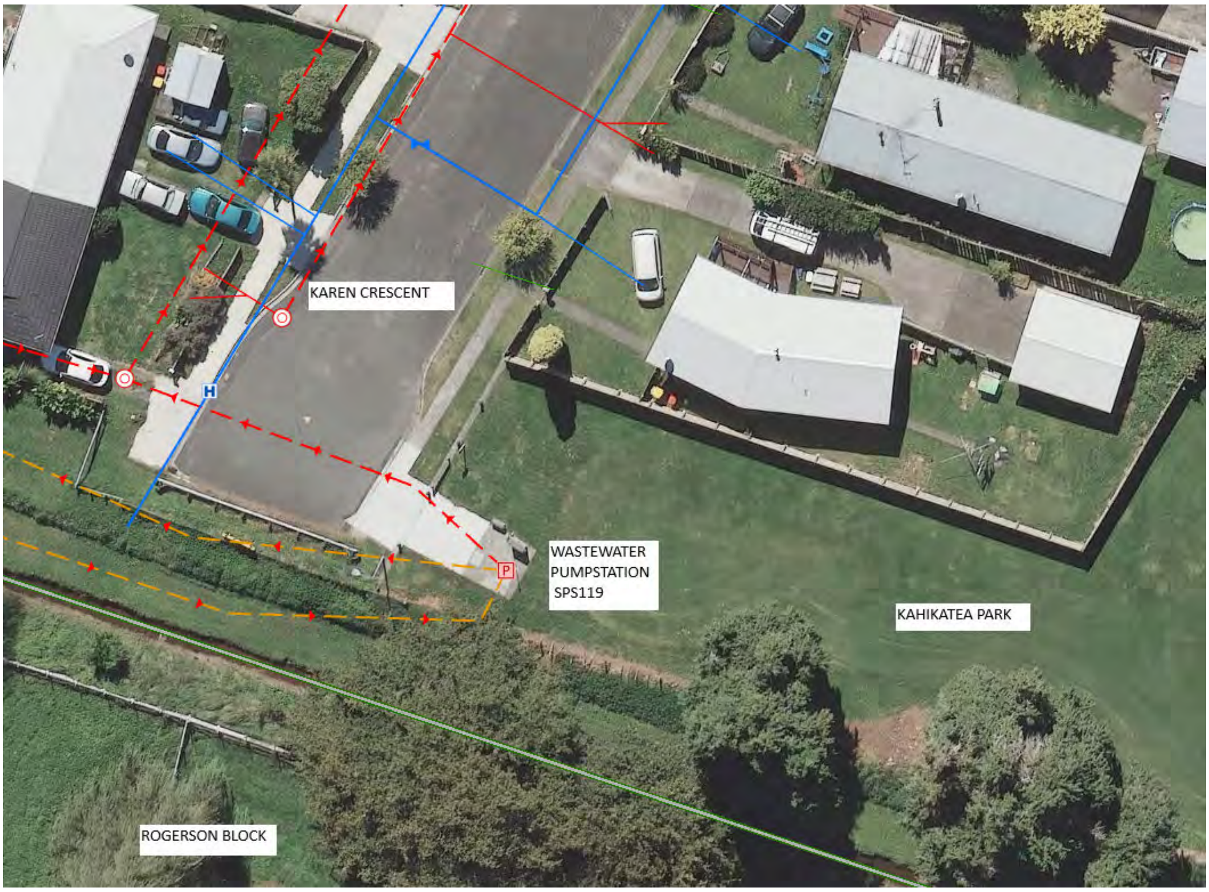


Figure 10 – Existing wastewater pumpstation SPS119 (HCC GIS)

An existing 200mm HDPE trunk wastewater rising main passes through the north-western corner of the Rogerson site and it currently conveys the wastewater from Temple View area up to the existing wastewater pumpstation SPS119. There are some existing public wastewater lines that pass through the existing residential stage 1 area.

6.2. Reticulation

The site topography is generally flat. The Rogerson Block would be predominantly serviced by gravity mains that would drain to intermediary pump stations located in the low points throughout the development. The intermediary pump stations will transfer wastewater through the site for discharge to the existing HCC wastewater network.

We have not undertaken an in-depth review of the existing network capacity, however connection into the existing reticulation will be challenging, as the network bordering the Rogerson Block has capacity issues identified by previous analysis undertaken by HCC.

To address these issues HCC have been upgrading the existing wastewater treatment plant in Pukete to provide more treatment capacity and they are, also introducing new large underground wastewater storage tanks in 8 new locations around the city. The underground tanks will provide additional wastewater holding capacity for the wet weather flows and the tanks that will release the wastewater back to the treatment plant at off peak times.

6.3. Strategic Wastewater Connections

HCC has prepared a draft ICMP for the Mangakotukutuku Catchment (consultation revision November 2020). The ICMP summarises infrastructure planned for zoned growth and options for hypothetical growth. Rogerson Block falls within the Hahawaru sub-catchment of this ICMP, and as such will need to comply with the requirements of the ICMP (if adopted) and RITS unless agreed otherwise by Council. The ICMP has identified options for wastewater infrastructure needed to service the Hahawaru sub-catchment.

6.4. Discharge to a New Southern Wastewater Treatment Plant

The Mangakotukutuku ICMP references The Metro Spatial Plan investigations into strategies for wastewater servicing for Hamilton and the surrounding settlements. As Hamilton city grows, the Pukete wastewater treatment plant will be limited by the population equivalent that it can realistically treat, so resilience will be required within the network to support growth.

HCC have included constructing a new southern wastewater treatment plant in their long-term plan with an estimated start date of 2030. The exact timing is still to be confirmed by HCC, however some funding towards the treatment plant may shift the start date. This option should be further investigated and discussed with the council.

HCC have suggested providing funding towards the wastewater treatment and they also said they would not provide for conveyance to the plant. There may be an opportunity to negotiate with HCC to construct the pipeline to the wastewater treatment plant, which would provide for SL1 development and for the surrounding areas, as a contribution towards the plant infrastructure.

6.5. Alternative Treatment Options

Recognising the issues and constraints around traditional centralised solutions identified above, Maven have considered “at source” and “decentralised” wastewater treatment solutions.

6.6. At Source Treatment

At source wastewater treatment solutions were considered, but discounted, as treatment devices will significantly reduce the available yield that can be achieved due to the need for large lot sizes to provide for sufficient secondary treatment area rendering development in the area unfeasible.

6.7. Decentralised Treatment

Centralised approaches identified in the Mangakotukutuku ICMP will offer long term viability for development of the Rogerson Block, however, prohibitive costs and programme to implement capital infrastructure for surrounding areas and downstream capacity upgrades could unnecessarily delay or prolong initial development of the Rogerson Block area. If early release of initial stages is desired, then onsite wastewater treatment options could be investigated which may include onsite septic tanks or MBR/Aeration plants. Refer to Appendix H for the MBR wastewater case study.

6.8. Feedback from Hamilton City Council

HCC said they would not support decentralised wastewater treatment and therefore the MBR/Aeration plants would need to remain under private ownership. HCC had concerns with discharging the treated wastewater from the MBR/Aeration plants, directly to the wetlands and Maven clarified this would be to offline artificial stormwater wetlands, discharge from MBR/Aeration plants would only be proposed at acceptable water quality levels, alternatively there is the option to discharge to land instead. HCC said they currently have no existing capacity for the overall SL1 area to connect to the existing wastewater network. Further consultation with HCC will be required to consider options.

HCC have advised that their preference would be to invest in the Southern WWTP for the SL1 development instead of implementing decentralised wastewater treatment. HCC said they would not provide any funding towards the conveyance to the Southern WWTP for SL1.

6.9. Proposed Wastewater

There is an existing trunk rising main that currently passes through the north-western corner of the site. It would be partially re-aligned to closely follow the existing boundary, which will increase the potential development area for residential housing. There are also some existing public wastewater lines that pass through the existing residential stage 1 area, they may also be realigned to increase the development area for residential housing.

The industrial areas will be dry industrial, and each lot will be required to provide for onsite wastewater treatment to manage their wastewater. For the residential areas gravity reticulation networks will be constructed through the site to convey the wastewater to new wastewater pumpstations located in the low areas of the site. Where there is an existing wastewater network nearby the preference is to connect to the existing wastewater infrastructure where possible. Further discussions will be held with HCC to see if there would be any provision to make a wastewater connection to the existing network to manage all or a portion of this development site. Please refer to Appendix B for the wastewater drainage option drawings. For the wastewater calculations for the residential area refer to Appendix D.

6.9.1. Wastewater options:

- Option 1 - The Rogerson residential wastewater would be directed to newly constructed underground wastewater storage tanks, that would be located near the existing wastewater pumpstation SPS119. These underground wastewater storage tanks would provide wastewater attenuation storage and emergency storage for up to nine hours. The wastewater from within the new wastewater storage tanks would be pumped out during the off-peak times. The emergency option would involve utilising sucker trucks to remove the stored wastewater from the wastewater storage tanks.
- Option 2 - The Rogerson residential wastewater would be directed to the downstream underground wastewater storage tanks and the wastewater pumpstation would then pump out the wastewater during the off-peak times. The wastewater would be pumped up to connect into the existing 225mm AC trunk main, located within the stormwater reserve area.
- Option 1A – Similar to Option 1 except a wastewater low-pressure system would be used instead of public wastewater pumpstations and gravity networks. Each residential lot would have a low-pressure pump system contained within their property and a connection provided to the proposed rising main in the road. The rising mains would convey all the wastewater to the newly constructed wastewater storage tanks. The existing wastewater pumpstation SPS119 would then pump out the wastewater from the tanks during the off-peak times.
- Option 2A – Similar to Option 2 except a wastewater low-pressure system would be used instead of public wastewater pumpstations and gravity networks. The wastewater would then be pumped up to the newly constructed wastewater storage tanks. A gravity feed wastewater line from the wastewater storage tanks would discharge the wastewater into the existing 225mm AC wastewater trunkmain.

6.9.2. Recommendations:

Option 1 or Option 1A would be our two recommended options, both options would allow the storage tanks to be constructed within the Kahikatea Park, and this could reserve more developable land. Option 1A would cost less to construct than Option 1, however the operation costs would then be transferred over to the new lot owners after they purchase the new residential lots. If it is determined that there is insufficient capacity in the wastewater network to support all or a part of the development, then onsite treatment options should be further investigated.

7. Water

Maven have undertaken a desktop study to identify the most suitable option for potable water for the Rogerson Block area. Reticulated and decentralised solutions have been considered. Refer to Appendix B for the proposed water layout drawing.

7.1. Existing Public Infrastructure

Hamilton has one centralised water treatment plant located at 1A Waiora Terrace, Fitzroy, Hamilton, that currently treats the water from the Waikato River that provides water supply for Hamilton city.

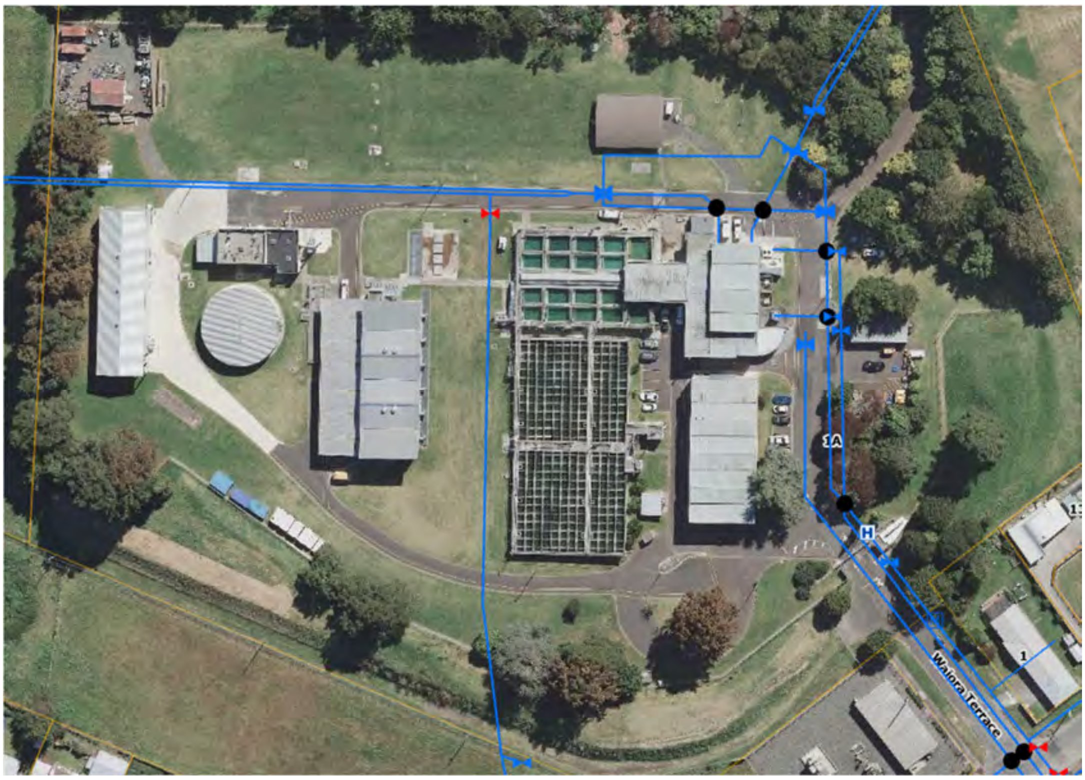


Figure 11 - HCC Water Treatment Plant

The nearest water reservoirs to the Rogerson Block are the Dinsdale and Newcastle water reservoirs. They are both located between the 29 and 49 Newcastle Road properties along Newcastle Road in Dinsdale.

Figure 12 – Dinsdale and Newcastle Water Reservoirs

7.2. Reticulation and Capacity

Reticulation will be designed to provide the Rogerson Block with a suitable means of potable and firefighting supply for the residential areas and only firefighting supply for industrial areas.

We have not undertaken an in-depth review of the existing network, however HCC advised that there is limited capacity in the existing water network, and it could not support the entire SL1 development.

7.3. Strategic Upgrades

HCC has prepared a draft ICMP for the Mangakotukutuku catchment (Consultation revision November 2020). The ICMP summarises infrastructure planned for zoned growth and options for hypothetical growth. The Rogerson Block falls within the Hahawaru sub-catchment of this ICMP and as such will need to comply with the requirements of the ICMP (if adopted) and RITS unless agreed otherwise by the council. The ICMP has identified options for water infrastructure needed to service the Hahawaru sub-catchment.

7.4. Alternative Supply Options

In addition to the centralised solutions identified above, a hydrogeological desktop review of SL1 was undertaken by WGA (May 2021) to consider groundwater as a potable water solution. Refer to Appendix G for the WGA report for further details.

Whilst centralised approaches offer long term viability for development of SL1, prohibitive costs and programme to implement capital infrastructure for surrounding areas could delay initial development. If early release of initial stages is desired, then using ground water could provide a transition period for development to occur. In addition to a transition period, groundwater could also provide increased security for water supply to the HCC water supply network water supply.

7.5. Feedback from Hamilton City Council

HCC said there are potential licensing issues and supply issues for using water bores within, however this is managed by WRC, and they would need to confirm the suitability to use water bores for the Rogerson Block.

7.5.1. Proposed Water

The proposed watermains through the industrial areas will only provide water supply for firefighting purposes. The industrial lots will require roof water collection tanks for non-potable water supply, and they will have the option to treat the non-potable water onsite for potable water supply.

The residential lots will be provided with individual lot connections for potable water supply. For the existing residential stage 1 area, these residential lots will be provided with individual lot connections off the existing 250mm AC trunk watermain in Tuhikaramea Road.

Further discussions will be held with HCC to see if there would be any provision to make a minor water supply connection to the existing network to provide water supply water for a portion or all this development stage. Refer to Appendix E for the water demand calculations for the proposed residential areas.

7.5.2. Water Supply options:

- Option 1 – For servicing the industrial area, a new 250OD HDPE trunkmain would be constructed from the existing 250mm AC trunkmain near the entrance of the development in Tuhikaramea Road and it would follow the industrial road to the east. The trunk watermain would then follow the residential access road to the north and then continuing through to the stormwater reserve area. It would then follow the stormwater reserve east, before heading north into Higgins Road where it would tie into the existing 200mm OPVC watermain within Higgins Road.

  A new 180OD HDPE watermain would be constructed from the end of the existing 150mm AC watermain in Karen Crescent and then it would follow the residential road, before connecting into the proposed 250OD HDPE trunkmain. For the western residential area, a new 125OD HDPE branch watermain would tee off the proposed 250OD HDPE trunkmain and it would follow the residential road, and it would loop around.

- Option 2 – Similar to Option 1 except another 250OD HDPE trunkmain would be constructed off the 250mm AC trunkmain. It would pass through the existing residential stage 1 area, and then it would continue down the residential road to the south before connecting into the other proposed 250OD HDPE trunk main.

7.5.3. Recommendations

Option 1 would be the preferred option if there is sufficient water supply capacity to support the overall development. If it is determined that all or a portion of the site could not be serviced, then alternative water supply options could be investigated further.

8. Services

8.1. Power

Wel Networks are the power service providers within this area. We have received service provision confirmation from them that they can service this development. Refer to Appendix I for the Wel Power service provision letter.

8.2. Communications

Tuatahi First Fibre are the fibre service providers within this area. We have received service provision confirmation from them that they can service this development. Refer to Appendix I for the Tuatahi First Fibre service provision letter.

8.3. Gas

First Gas are the gas service providers within this area. We have received service provision confirmation from them that they can service this development. Refer to Appendix I for the First Gas service provision letter.

9. Conclusions

Stormwater drainage can be provided for the Rogerson Block through wetlands, ground water recharge and piped stormwater networks. Overland flow paths will be managed through the development, and it will reduce any potential flooding risks. An overarching stormwater strategy has been developed, and this sets out the high-level, best practice approach for stormwater management within the catchment.

Wastewater drainage can be provided for the Rogerson Block though piped networks to intermediary pump stations or alternatively use a low-pressure wastewater system that would transfer the wastewater through the site for discharge into the existing HCC wastewater network. If the existing network cannot provide sufficient capacity for stages of the development decentralised portable onsite wastewater treatment will be implemented, until the downstream public network can support them.

Water supply can be provided for the Rogerson Block though water supply networks through the development site and by connecting into the existing water supply network. If the existing network cannot provide sufficient capacity for stages of the development, new water bores will be established a strategic locations and onsite portable water treatment devices will treat the water before entering the public water supply network.

Additional investigation work and detailed reporting for three waters and earthworks will be required to support future structure plans.

10. Limitations

The calculations and assessments included in this report are a ‘desktop’ analysis and are preliminary in nature based on information available at time of issue. To the best of our knowledge, it represents a reasonable interpretation of available information including the outcomes of the Mangakotukutuku ICMP which status is draft for consultation at the time of this issue.

Depending on the outcome of the high-level structure plan, further community; stakeholder engagement; and feasibility investigations, including engineering design and calculations, will be required to determine the suitability of the areas proposed for industrial and residential development.

This report is solely for our clients use for the purpose for which it is intended in accordance with the agreed scope of work. It may not be disclosed to any person other than the client and any use or reliance by any person contrary to the above, to which Maven has not given its prior written consent, is prohibited.

This report must be read in its entirety and no portion of it should be relied on without regard to the limitations and disclaimers set out.

Maven makes no assurances with respect to the accuracy of assumptions and exclusions listed within this report and some may vary significantly due to ongoing stakeholder engagement.

Appendix A – B & A Urban Design Package

APPENDIX 1 - Urban Design Package

Fast Track Application Referral | May 2025

B&A

Urban & Environmental

B&A
Urban & Environmental

Project:
Rogerson Block Development - Fast Track Referral (JN #25679)

Prepared for:
Graeme Rogerson

Prepared by:
Barker and Associates, Hamilton

Document date:
14 May 2025 - For Review - Rev A

Contents

Barker & Associates

Contacts
admin@barker.co.nz | barker.co.nz | 298 Victoria Street, Hamilton 3204
Kerikeri | Whangārei | Warkworth | Auckland | **Hamilton** | Cambridge | Tauranga | Havelock North | Wellington | Christchurch | Wānaka & Queenstown

1.0 Introduction

1.1 Introduction

This drawing pack has been prepared to support the application for a referral project under the Fast Track Approvals Act (2024) at 183 and 293 Tuhikaramea Road, Hamilton, to accomodate future urban growth. This drawing pack should be read in conjuction with the associated urban design memo prepared by Baker & Associates (**B&A**).

Specifically this drawing pack seeks to provide the following:

- An understanding and high-level analysis of the site in context to the Hamilton City area, in particular to the existing and planned for movement and landuse patterns of Hamilton City;
- An analysis of constraints that impact the urban development of the site, including overlaying the specialists' reports and the issues they have identified that impact spatial outcomes within the site;
- An analysis of the spatial opportunities the site presents in terms of urban development including recommendations from the specialists' reports;
- A recommendation for a high level masterplan that illustrates the spatial form outcomes for urban development of the site that reflects the above analysis of the sites' context, its constraints and its potential opportunities.

1.2 City-wide and Wider SL1 Context

Rogerson Block Development ('**The Site**') is a combined residential and industrial development within the wider Southern Links 1 ('**SL1**') area. It is located at the most northwestern portion of the SL1 area, and it has been strategically planned to serve as a transitional area that integrates residential growth with adjacent industrial and existing urban areas.

The SL1 area is situated within the Waipa District, and contiguous with Hamilton City Council's southern boundary to the south-west. Located approximately 3 - 4 km south west of Hamilton City Centre, the site stretches from south Frankton to the south western edge of the Peacockes Structure Plan area. SL1 is partially bound by State Highway 3 (**SH3**) to the south east the North Island Main Trunk Rail to the north east and the Hamilton Southern Links designation to the west. As of August 2022, was identified by Hamilton City Council (**HCC**) as one of the 'Emerging Areas'. In addition, as of October 2024, Residential Stage 1 and Industrial Stage 1 of the SL1 development has been listed as one of the 149 projects in the Fast-track Approvals Bill Schedule (Application FTA352).

In the context of the wider SL1 project area, the Site represents a critical component in achieving a comprehensive urban expansion strategy. It aligns with the broader vision of creating cohesive, sustainable urban environments that balance housing, employment opportunities, and community amenities.

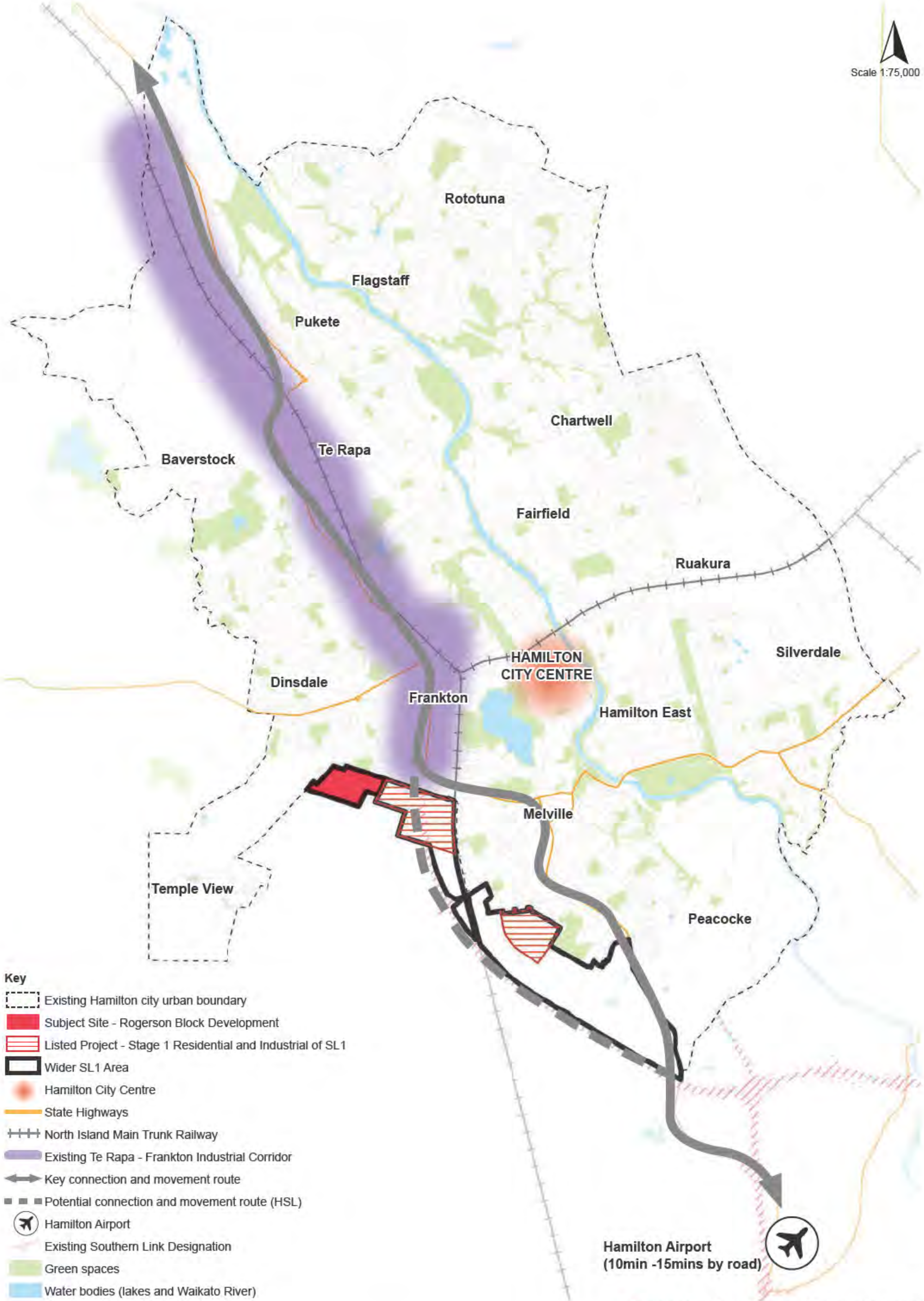


Figure 1: City wide and SL1 context map

1.3 Local Site Context

The Rogerson Block Development site covers approximately 43 hectares and is strategically located at the southwestern urban edge of Hamilton City, immediately adjacent to the residential communities of Dinsdale. It lies at the interface between Hamilton City's urban boundary and rural landscapes administered by the Waipa District Council.

The site is largely flat to gently undulating, with several prominent hydrological features, including Waitawhiriwhiri Stream and some existing drains. Accessibility to the site is currently through Tihikaramea Road and Karen Crescent. A potential extension of Huggins Road to the east of the site would provide further vehicular access points into the site.


VP 1: Looking south from Karen Cres


VP 2: Looking into the Site from Tuhikaramea Rd


VP 3: Looking south from Higgins Rd

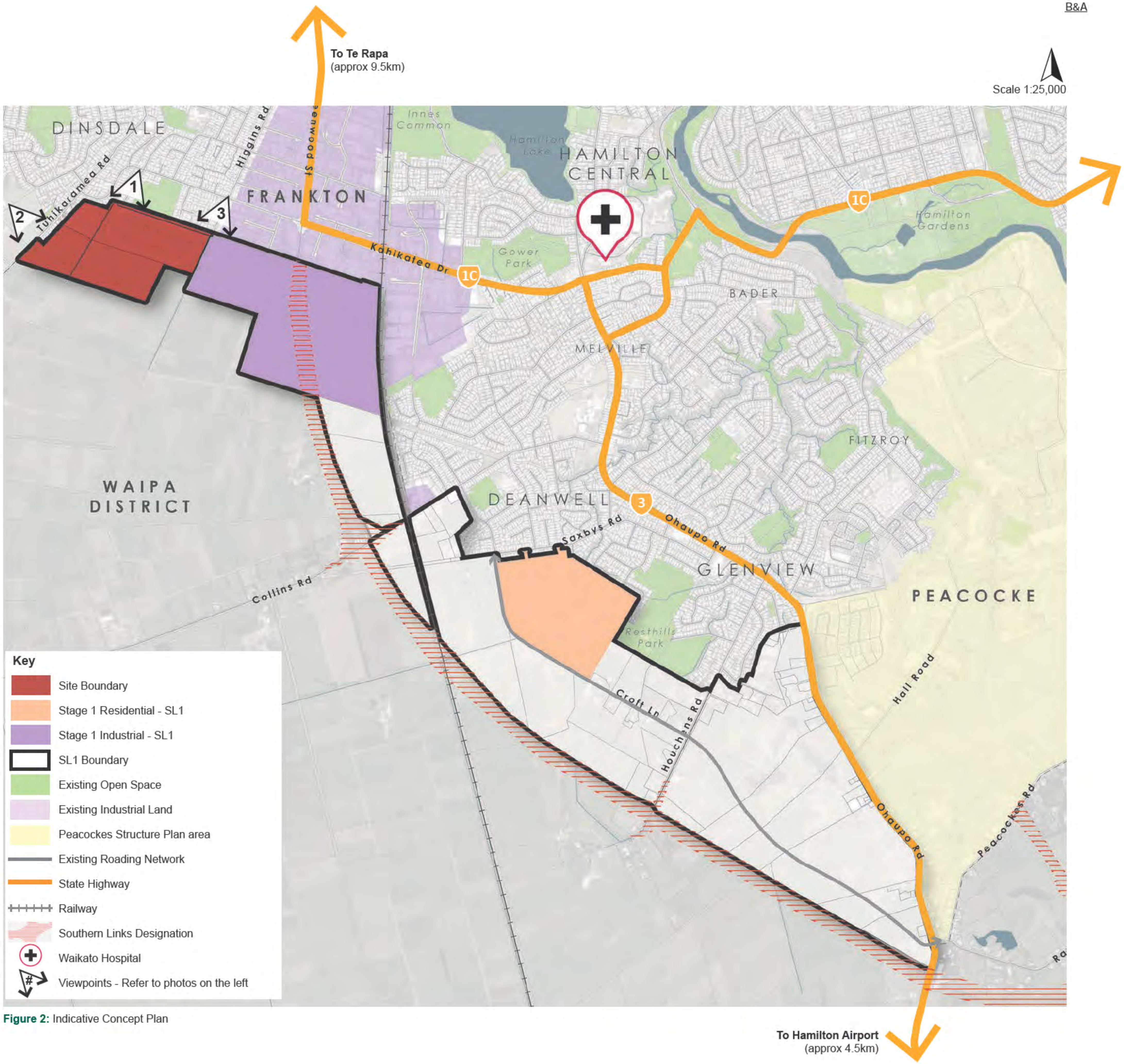
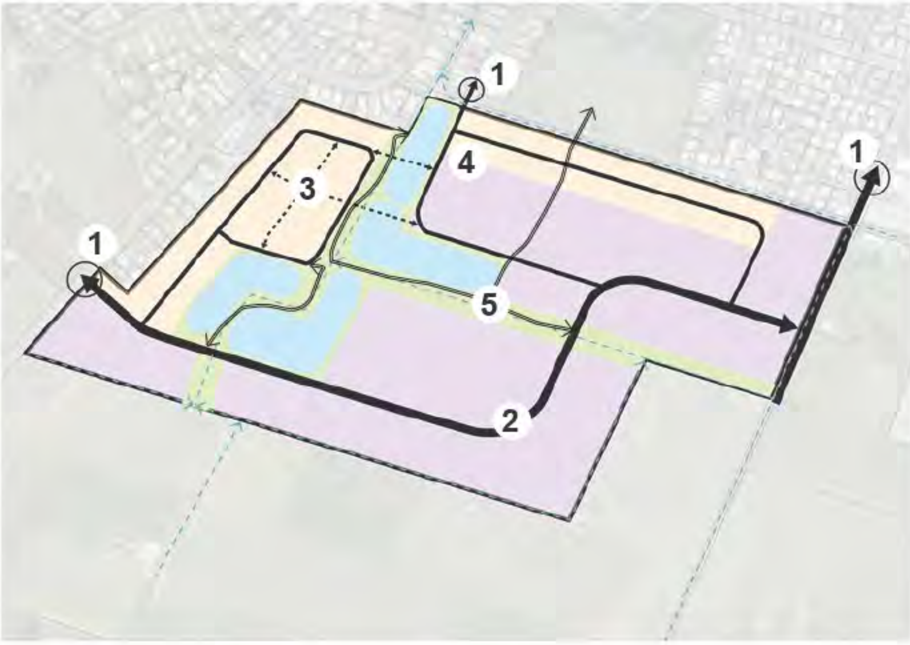
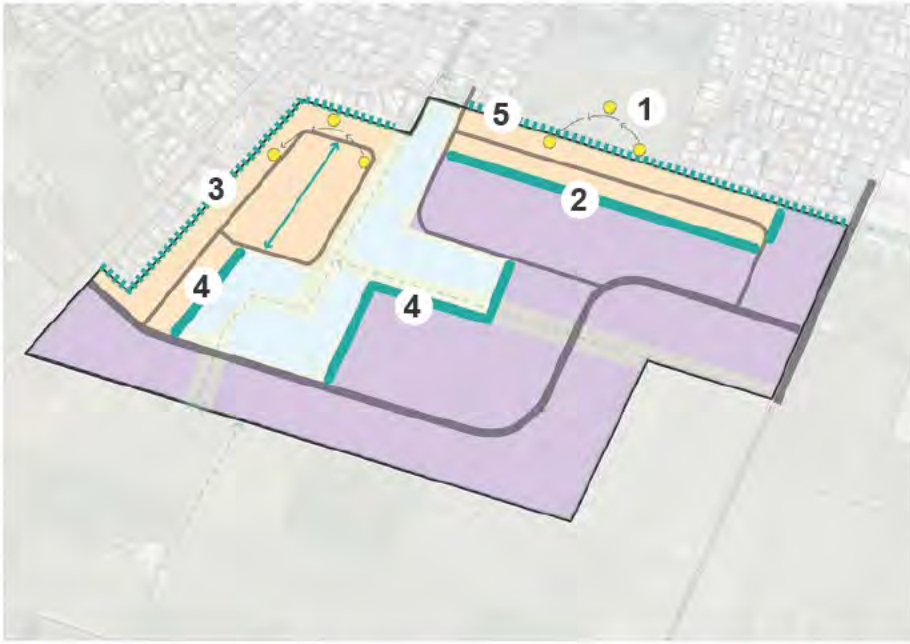


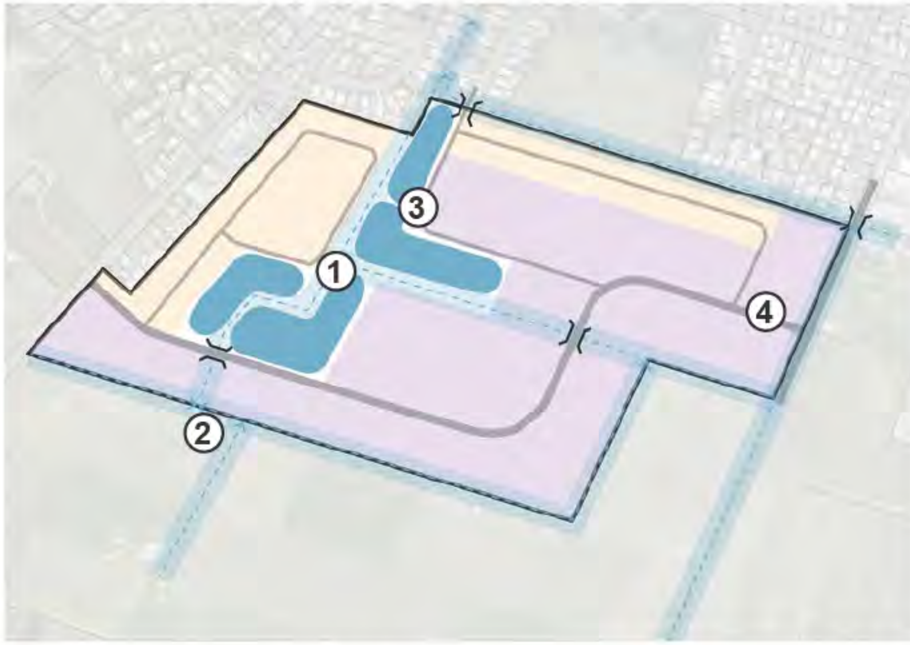
Figure 2: Indicative Concept Plan

2.0 Design Responses

2.1 Key Design Opportunities







Site Access and Connectivity

1. Existing access points available from Tuhikaramea Road and Karen Crescent, as well as potential future links to adjacent Higgins Road to enable a well-connected internal movement network.
2. Opportunity to establish a clear collector road spine through the site to serve the majority of industrial movements and is able to link to the wider SL1 Stage 1 Industrial (located to the east) transport framework.
3. Opportunity to create a legible and grid-like movement network for the proposed residential areas and open spaces.
4. Minimise potential land use conflicts between industrial and residential areas by limiting the number of shared access roads and establishing separated road hierarchies tailored to each use.
5. Potential to create defined pedestrian and cycle links that connect to existing and proposed greenways, open spaces, and adjacent urban neighbourhoods.

Orientation and Interface

1. Opportunity to orient residential lots to optimise solar access whenever it is practical, and enhance passive design outcomes while responding to site existing waterways and open space networks.
2. Ability to manage sensitive interfaces between industrial and residential land uses through planting buffer, landscape screening, and graduated density transitions.
3. Opportunity to use of stepped setbacks and height transitions to reduce visual dominance to the existing lower density urban areas and create defined residential edges for the development.
4. Potential to activate street frontages and public spaces through careful building orientation, ensuring good surveillance, walkability, and amenity.
5. Interfaces with existing residential areas and parks present opportunities to strengthen local character and reinforce urban continuity.

Infrastructure and Enhanced Waterways

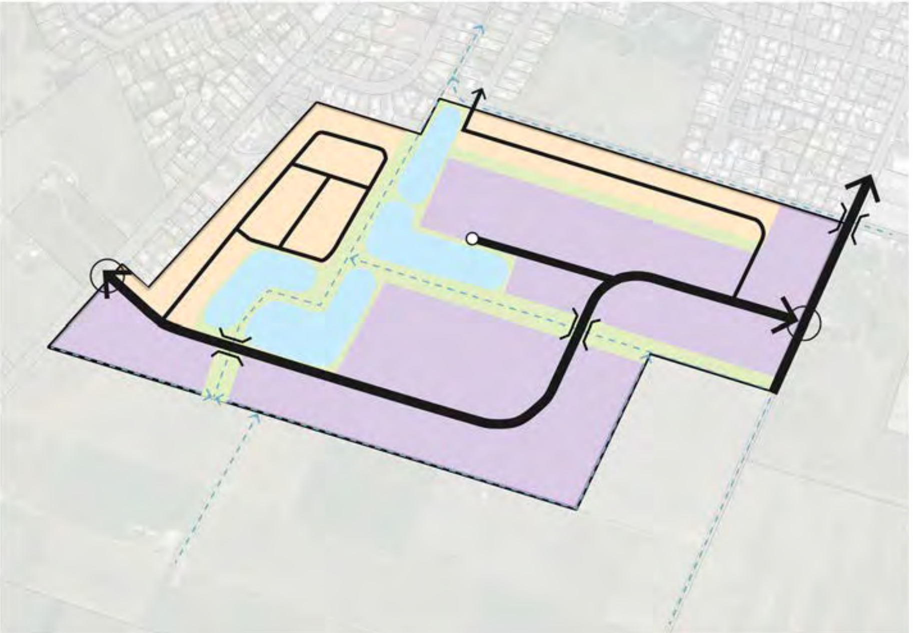
1. Proposed stormwater wetlands can serve dual functions: infrastructure and ecological/recreational assets that enhance the site's environmental quality.
2. Opportunity to realign or naturalise existing rural drains into green corridors that support biodiversity, public access, and visual amenity.
3. Integration of stormwater management with open space planning allows the creation of attractive public spaces while improving catchment performance.
4. Infrastructure upgrades (e.g., roads, three waters) can be coordinated with wider SL1 development to ensure efficient and future-proofed service delivery.

2.2 Preliminary Design Options

Three initial design options have been developed in response to the site's context and identified opportunities. One of these options has been progressed and refined into a high-level masterplan, providing a strategic layout that will align with current assumptions, design priorities and developer's preference.

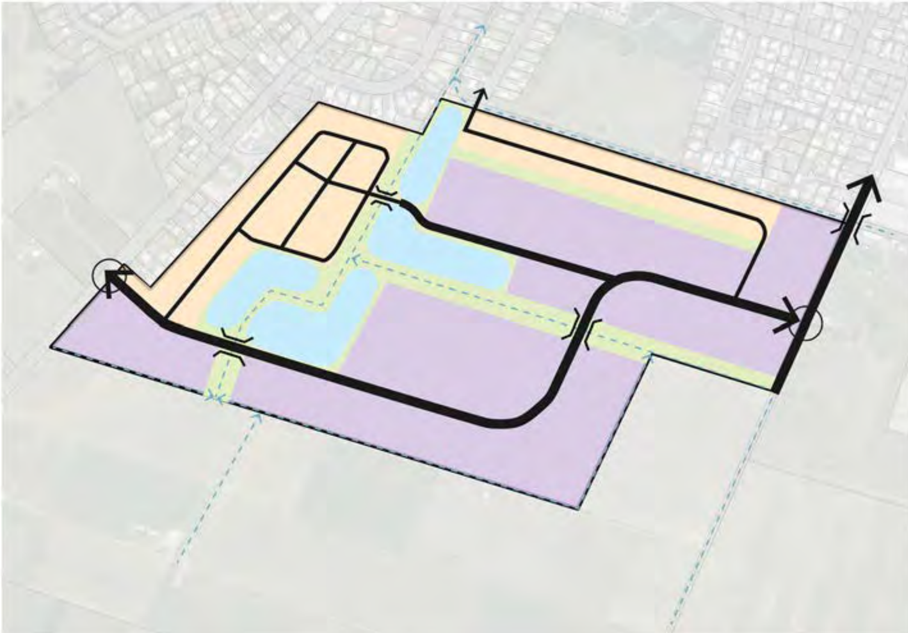
However, the alternative design options remain relevant and offer viable responses to site-specific constraints and opportunities.

These options will continue to be considered as part of the substantive application process, with the final form and configuration of development to be determined following further technical investigations, including infrastructure servicing, transport modelling, stormwater management, and geotechnical inputs.



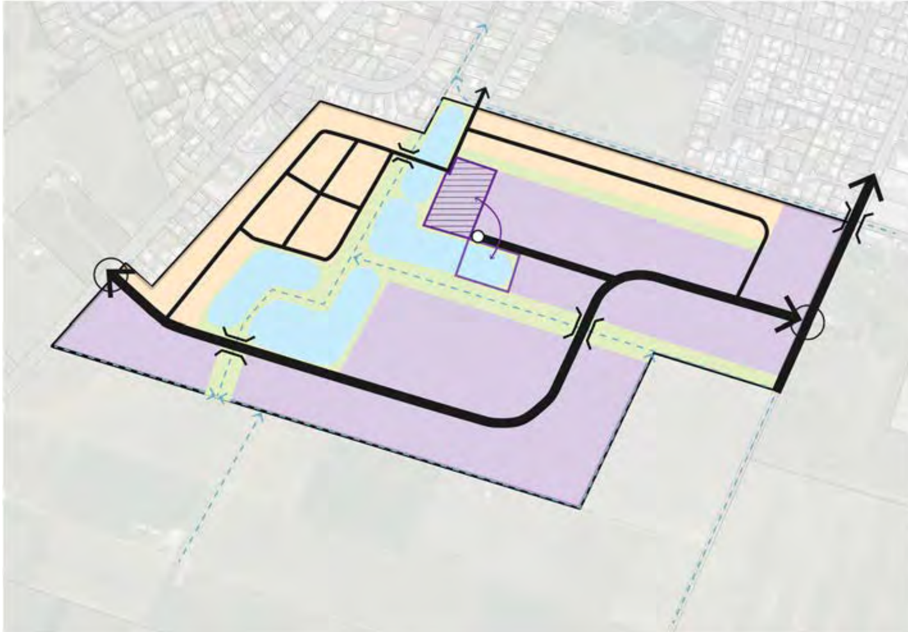
Commentary and Notes

- Minimum number of shared access roads which enables residential and industrial movements to be separated.
- Minimum number of culverts and/or bridges required.
- Pedestrian and cycle links can be established within the open space areas and be connected to the proposed roading network.
- Optimise residential local roads being adjacent to open spaces and benefit for activating street frontages and passive surveillance.
- The east-west orientated block which would result in residential lots potentially with south facing outdoor living areas. However, a different block orientation could potentially create variety and diversity for the development.



Commentary and Notes

- The shared access road that would serve both residential and industrial movements would require careful design to establish clear hierarchies between uses.
- Improved vehicular connectivity between two residential areas within the area. Although more culverts and/or bridges might be required.
- Pedestrian and cycle links can be established within the open space areas and be connected to the proposed roading network.
- Optimise residential local roads being adjacent to open spaces and benefit for activating street frontages and passive surveillance.
- The north-south orientated blocks with residential lots to optimise solar access whenever it is practical.



Commentary and Notes

- Minimum number of shared access roads which enables residential and industrial movements to be separated.
- Improved vehicular connectivity between two residential areas within the area. Although more culverts and/or bridges might be required.
- Relocation, reshaping and/or resizing the proposed stormwater ponds would be required. This might result in undesired outcome for a combined stormwater pond serving both industrial and residential uses
- Pedestrian and cycle links can be established within the open space areas and be connected to the proposed roading network.
- Optimise residential local roads being adjacent to open spaces and benefit for activating street frontages and passive surveillance.
- The north-south orientated blocks with residential lots to optimise solar access whenever it is practical.

3.0 Masterplan

3.1 High-level Masterplan

* This masterplan document represents a high-level conceptual layout only. The proposed site layout, estimated yield, typologies, and land uses illustrated herein are based on the preferred development approaches and the existing industrially zoned areas within Hamilton. The exact residential typology, industrial activities, and lot sizes are subject to further adjustments upon comprehensive technical investigations and detailed design processes, including but not limited to engineering, ecological assessment, geotechnical analysis, and hydrological studies.

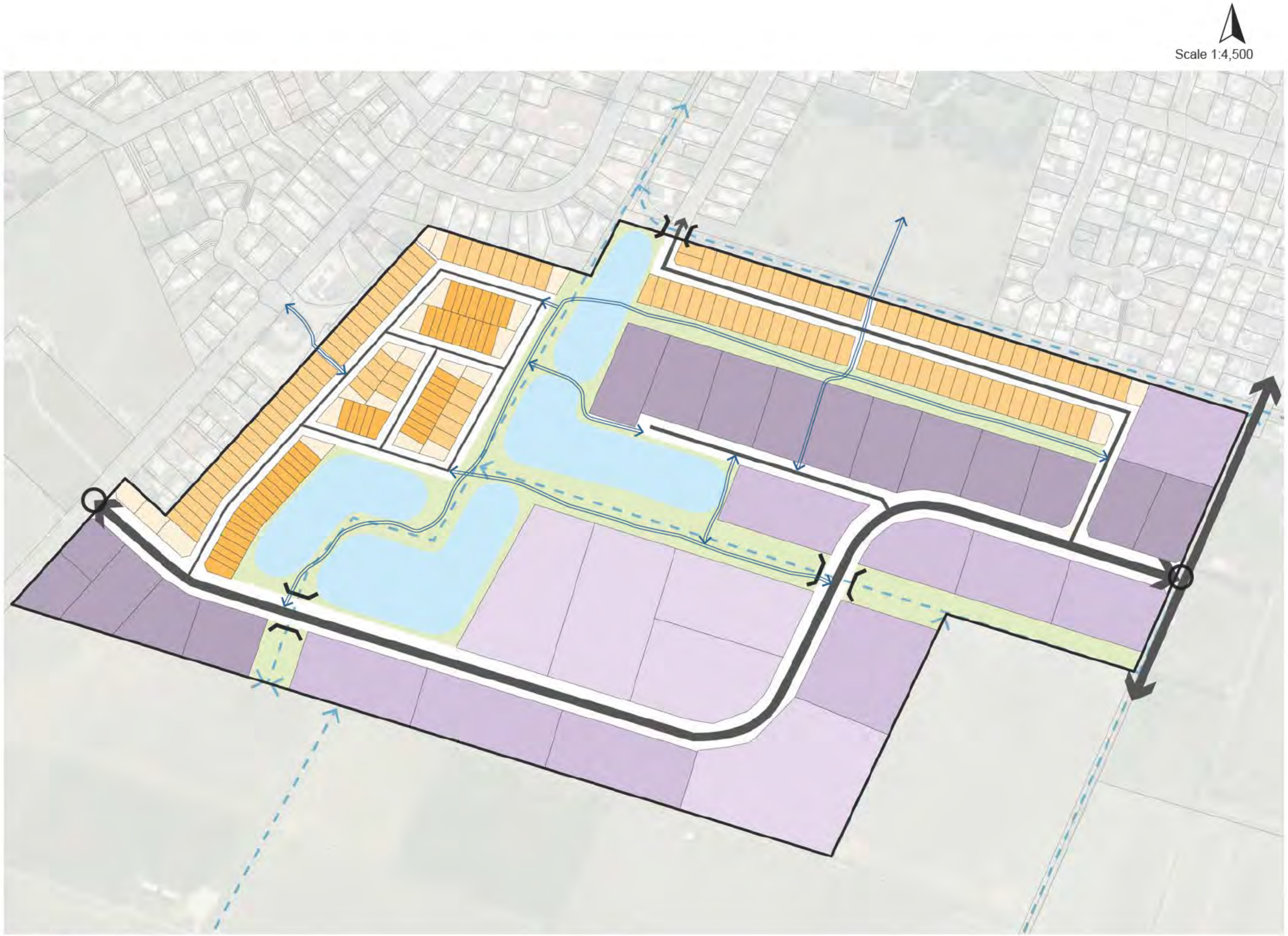


Figure 3: High-level Masterplan

Key

- **Rogerson** Site Boundary
- Higher Density Residential (7.5m - 9m lots)
- Lower Density Residential (10m - 12m lots)
- Larger and/or Irregular Shaped Residential Lots
- Smaller Industrial Lots (less than 5,000m²)
- Medium Industrial Lots (5,000m² - 10,000m²)
- Larger Industrial Lots (more than 10,000m²)
- Indicative Stormwater Treatment (sizes & locations to be refined and confirmed at future design stages)
- Proposed Open Spaces/Riparian/Native Revegetation Areas
- Proposed Key Collector Connection (27.8m)
- Proposed Key Local Connections/Road Network
- Proposed Bridge or Culvert
- Proposed Roundabouts (size and location to be confirmed)
- Indicative Pedestrian Connections
- Existing Drains/Stream
- State Highway
- Railway

Residential Metric	Typical Lot Size	Estimated Yield	Potential Typologies/Uses
Higher density (7.5m - 9m lot)	200m² - 250m²	50	Terraced dwellings, duplexes
Lower density (10m - 12m lot)	300m² and above	133	Duplexes, detached dwellings
Larger lot and/or irregular shaped	400m² and above	22	Detached dwellings
Total		205	

Industiral Metric	Typical Lot Size	Estimated Yield	Potential Uses
Smaller lots	Less than 5,000m²	16	Small-scale manufacturing, repair workshops, and wholesale businesses
Medium lots	5,000m² - 10,000m²	9	Light industrial workshops, warehouse, and commercial showrooms
Larger lots	10,000m² and above	5	Light industrial workshops, warehouse, and commercial showrooms
Total		30	

3.2 Staging and Infrastructure Sequence

Proposed Stages	Catchment Areas (approx.)	Wetland Required	Approx. Yield
Residential Stage 1	5.7 ha	Wetland 1A	78
Residential Stage 2	7.4 ha	Wetland 1B	127
Industrial Stage 1	15.1 ha	Wetland 2A	16
Industrial Stage 2	13.3 ha	Wetland 2B	14

Key

- **Rogerson** Site Boundary
- Residential Stage 1
- Residential Stage 2
- Industrial Stage 1
- Industrial Stage 2
- Higher Density Residential (7.5m - 9m lots)
- Lower Density Residential (10m - 12m lots)
- Larger and/or Irregular Shaped Residential Lots
- Smaller Industrial Lots (less than 5,000m^2)
- Medium Industrial Lots (5,000m^2 - 10,000m^2)
- Larger Industrial Lots (more than 10,000m^2)
- Indicative Stormwater Treatment (sizes & locations to be refined and confirmed at future design stages)
- Proposed Open Spaces/Riparian/Native Revegetation Areas
- Proposed Key Collector Connection (27.8m)
- Proposed Key Local Connections/Road Network
- Proposed Bridge or Culvert
- Proposed Roundabouts (size and location to be confirmed)
- Indicative Pedestrian Connections
- Existing Drains/Stream
- State Highway
- Railway

Figure 4: High-level Staging Plan

Residential Metric	Typical Lot Size	Estimated Yield	Potential Typologies/Uses
Higher density (7.5m - 9m lot)	200m^2 - 250m^2	50	Terraced dwellings, duplexes
Lower density (10m - 12m lot)	300m^2 and above	133	Duplexes, detached dwellings
Larger lot and/or irregular shaped	400m^2 and above	22	Detached dwellings
Total		205	

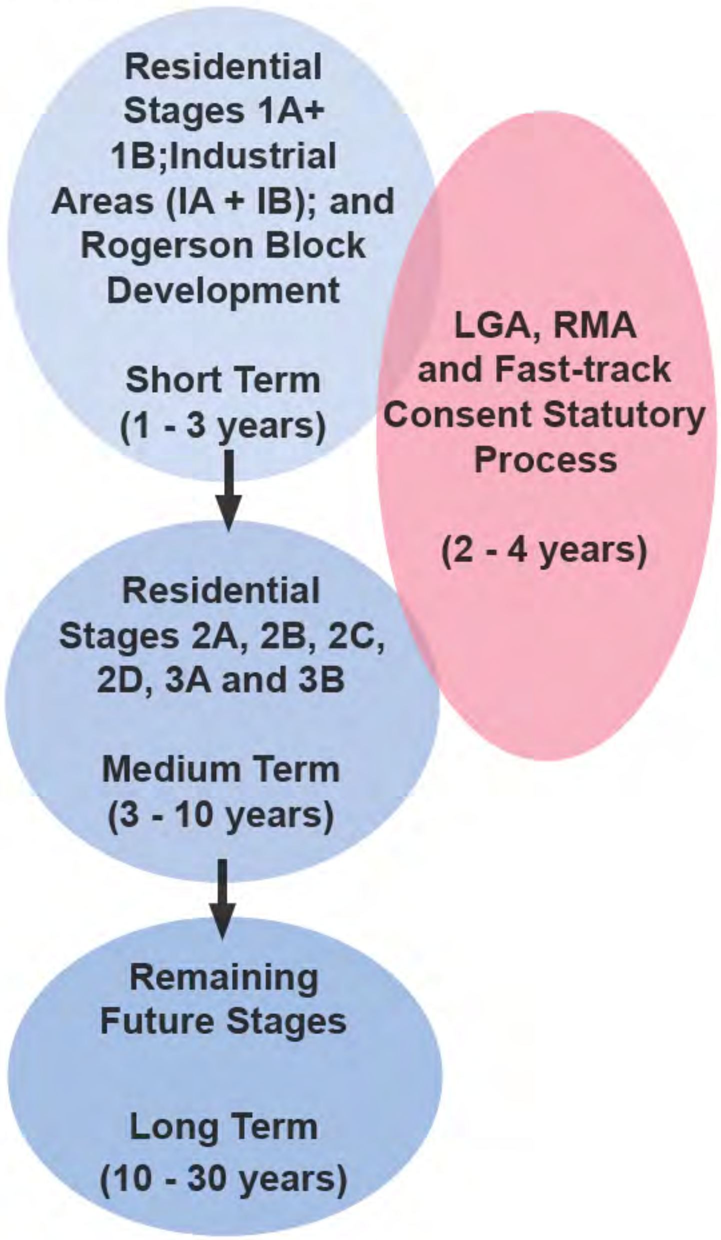
Industrial Metric	Typical Lot Size	Estimated Yield	Potential Uses
Smaller lots	Less than 5,000m^2	16	Small-scale manufacturing, repair workshops, and wholesale businesses
Medium lots	5,000m^2 - 10,000m^2	9	Light industrial workshops, warehouse, and commercial showrooms
Larger lots	10,000m^2 and above	5	Light industrial workshops, warehouse, and commercial showrooms
Total		30	

3.3 Overall Concept Plan with SL1 Stage 1

SL1 listed residential and industrial stages 1 have been divided into several key sub-stages. The map on the right demonstrates the relationship between Rogerson Block Development and the SL1 stage 1 development areas, as well as the identified proposed future stages.

This has been informed by records of title, lot parcels development potential, high level transport and infrastructure analysis.

Estimated Timeline



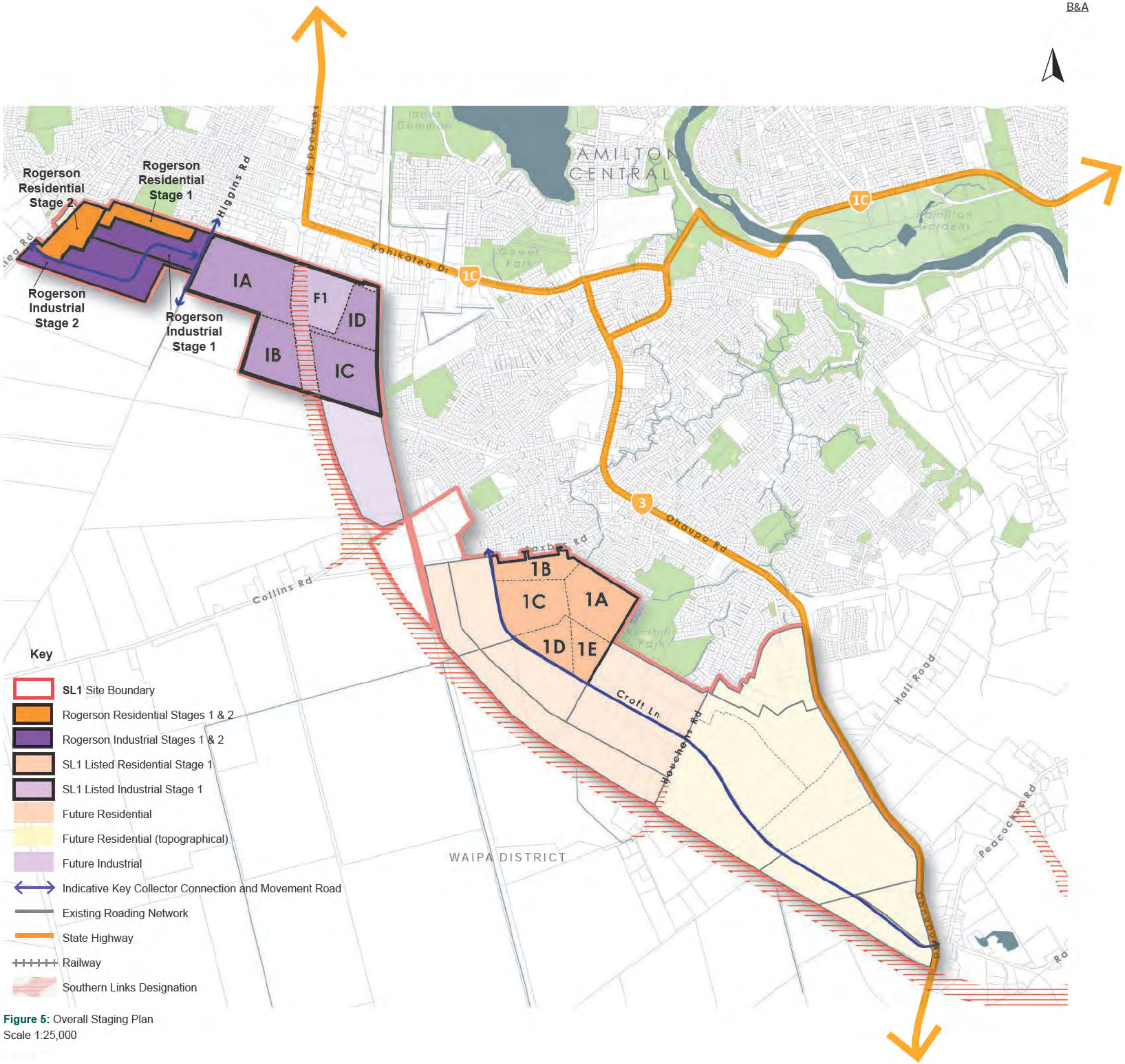


Figure 5: Overall Staging Plan
Scale 1:25,000

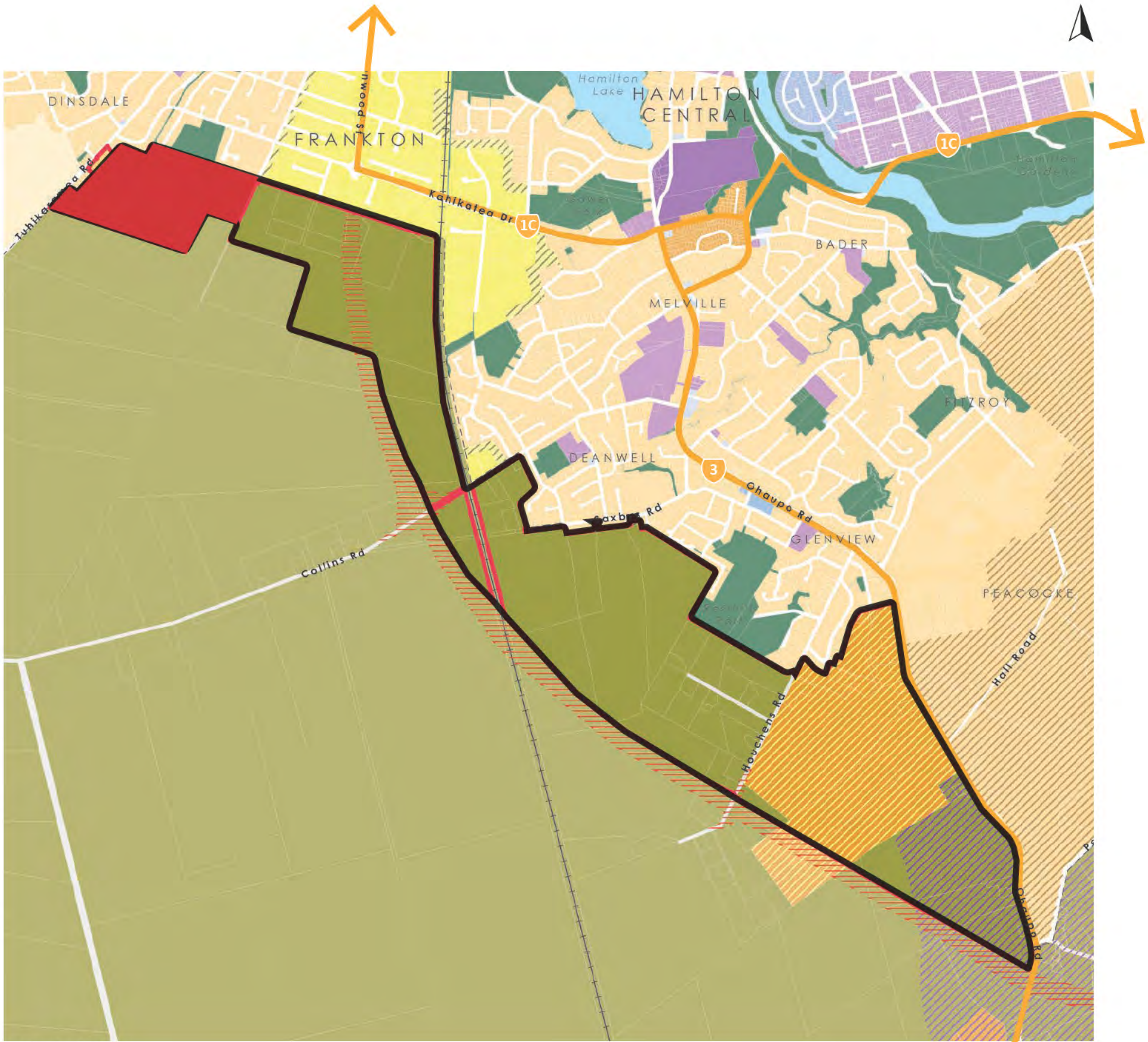
4.0 Context and Spatial Analysis (SL1)

The context and spatial analysis provided in the following section covers the entire SL1 development area. Given the integral relationship and strategic positioning of the Rogerson Block within the broader SL1 area, undertaking the analysis at this wider scale ensures a more comprehensive understanding of contextual influences, development opportunities, and constraints.

This holistic approach allows for informed urban design responses, facilitates better integration across land uses, infrastructure, and connectivity networks, and ultimately supports cohesive planning outcomes for both the Rogerson Block specifically and the broader SL1 area collectively.

4.1 Planning Context

The Rogerson Block Site is currently zoned as Rural Zone under the Waipa District Plan. Future development of the SL1 area, specifically for the industrial areas, should carefully consider the planning context under the Hamilton City Operative District Plan, in order to create a cohesive and comprehensive transition from the existing rural / semi-rural environment context into urban environment context.



Existing Zoning Map
Scale 1:25,000

KEY

- Rogerson Block Development Area
- SL1 Area Site Boundary
- Railway Line
- State Highway
- Designation

Waipa District Policy Areas and Zoning

- Viewshaft and SH3 Scenic Corridor
- Waipa Structure Plan (Houchens Plan)
- Rural Zone
- Large lot Residential

Hamilton City Council Zoning

- General Residential
- Medium Density Residential
- Future Urban Zone
- Business - Suburban Centre
- Business - Neighbourhood Centre
- Industrial Zone
- Industrial Amenity Protection Area
- Community Facilities Zone
- Major Facilities Zone
- Open Space Zone
- Peacocke Special Character Zone
- Special Residential Zone,
- Special Heritage Zone
- Waikato River & Lakes

4.2 Infrastructure

KEY

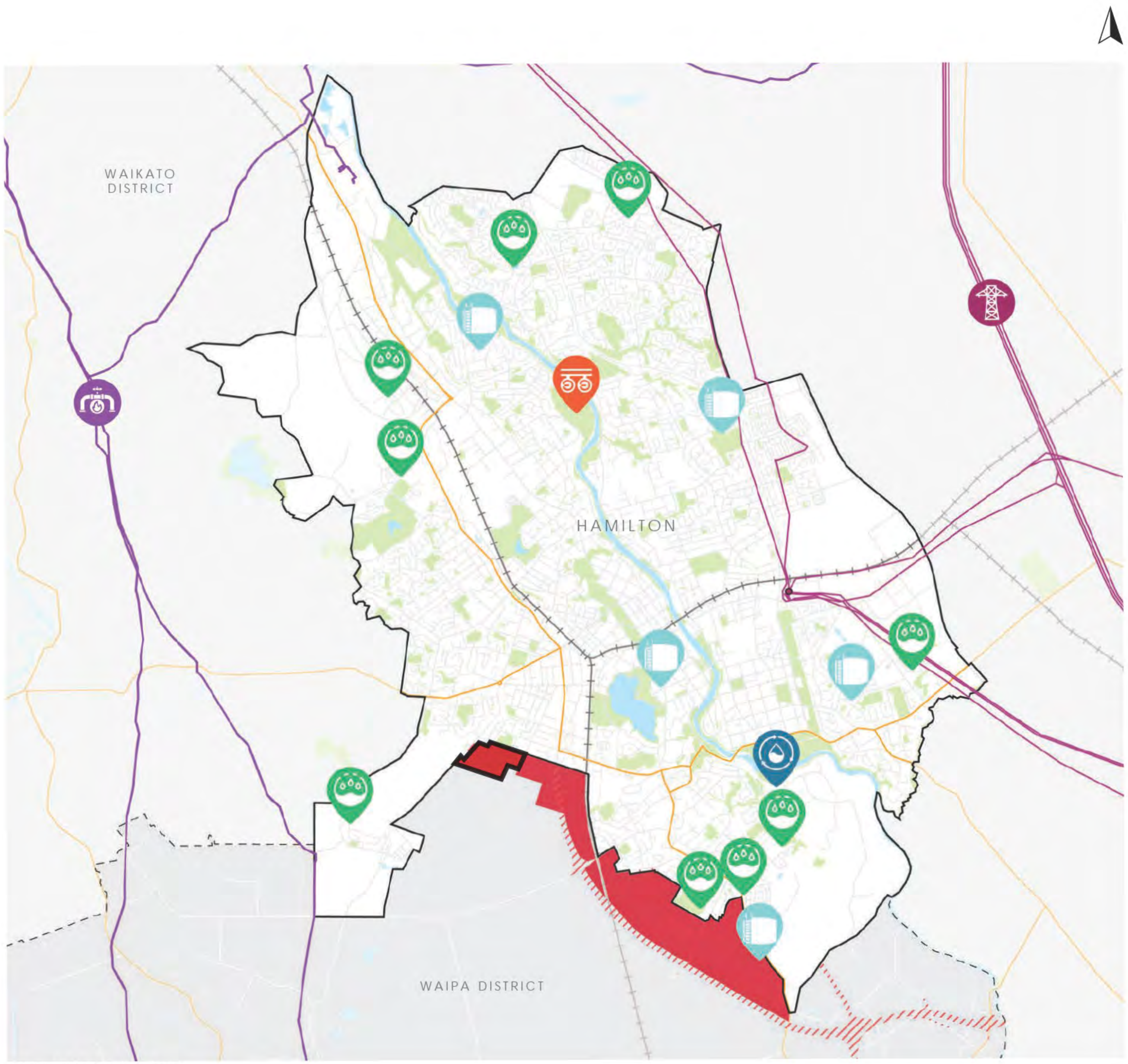
- Rogerson Block Site Boundary
- SL1 Area
- Reserves
- Railway Line
- State Highway
- Designation

National Infrastructure

- First Gas Lines
- Transmission Lines

Hamilton Infrastructure

- Water Treatment Plant
- Water Reservoir
- Wastewater Treatment Plant
- Stormwater Attenuation & Treatment



Existing Infrastructure Map
Scale 1:75,000

4.3 Land Transport and Existing Public Transport

Both the Rogerson Site and the SL1 area have access to both the arterial and local road network of Hamilton. The local road network, including primary and secondary collector roads, provide opportunities to link the site to proximate social amenities including schools and parks.

Key opportunities to connect for the SL1 area include:

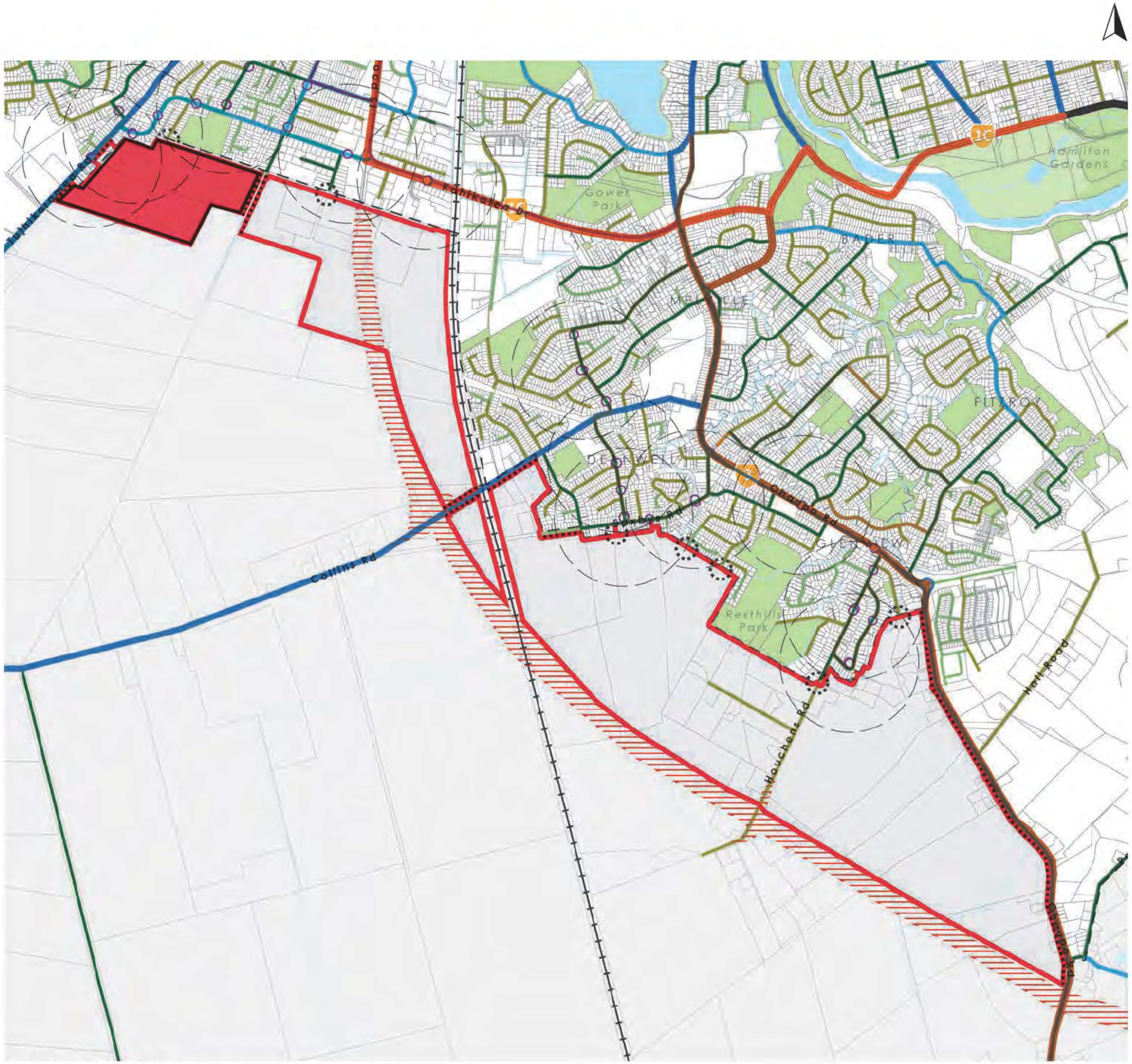
- Macmurdo Avenue
- Fourth Crescent
- Saxbys Road
- Houchens Road
- Latham Court
- Wickham Street
- Collins Road
- Higgins Road
- Tuhikaramea Road
- Ohaupo Road

KEY

- Rogerson Site Boundary
- SL1 Site Boundary
- Reserves
- Railway Line
- Designation
- Site Access Opportunities
- 400m walkable catchment (5min walk)
- Existing bus stops (within prixmity of site)

One Network Road Classification (ONRC)

- High Volume
- Regional
- Arterial
- Primary Collector
- Secondary Collector
- Access
- Low Volume
- Unknown



Existing Land Transport Map
Scale 1:25,000

4.4 Social Amenities

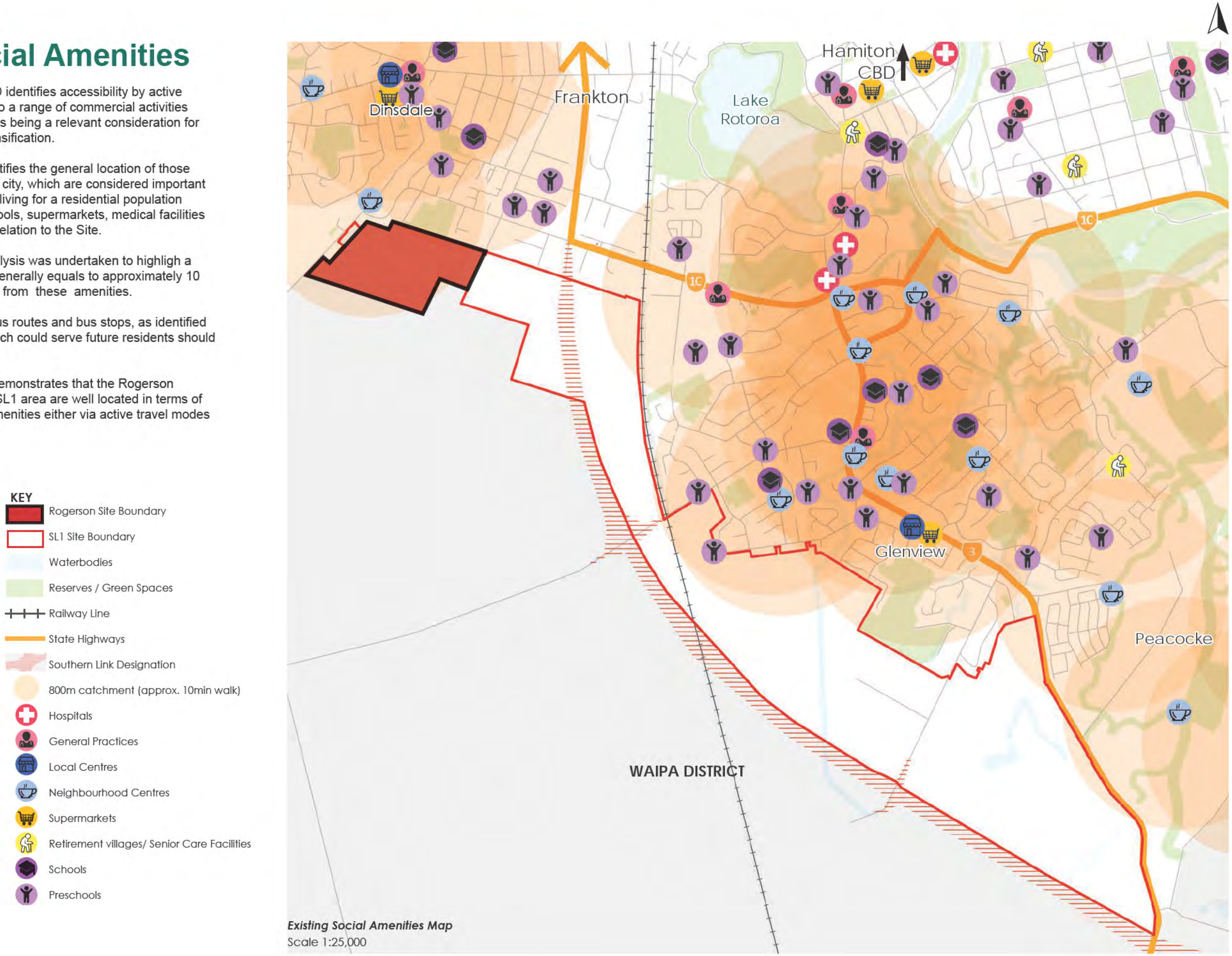
Policy 3(d) of the NPS-UD identifies accessibility by active travel or public transport to a range of commercial activities and community facilities as being a relevant consideration for supporting growth or intensification.

The map on the right identifies the general location of those amenities within Hamilton city, which are considered important for supporting day-to-day living for a residential population including schools, preschools, supermarkets, medical facilities and retail destinations in relation to the Site.

In addition, a network analysis was undertaken to highligh a 800m catchment, which generally equals to approximately 10 minutes walking proximity from these amenities.

It is noted that existing bus routes and bus stops, as identified in the sections above, which could serve future residents should development be enabled.

In general, this analysis demonstrates that the Rogerson Block Site and the wider SL1 area are well located in terms of proximity to supporting amenities either via active travel modes or public transport.



Existing Social Amenities Map
Scale 1:25,000

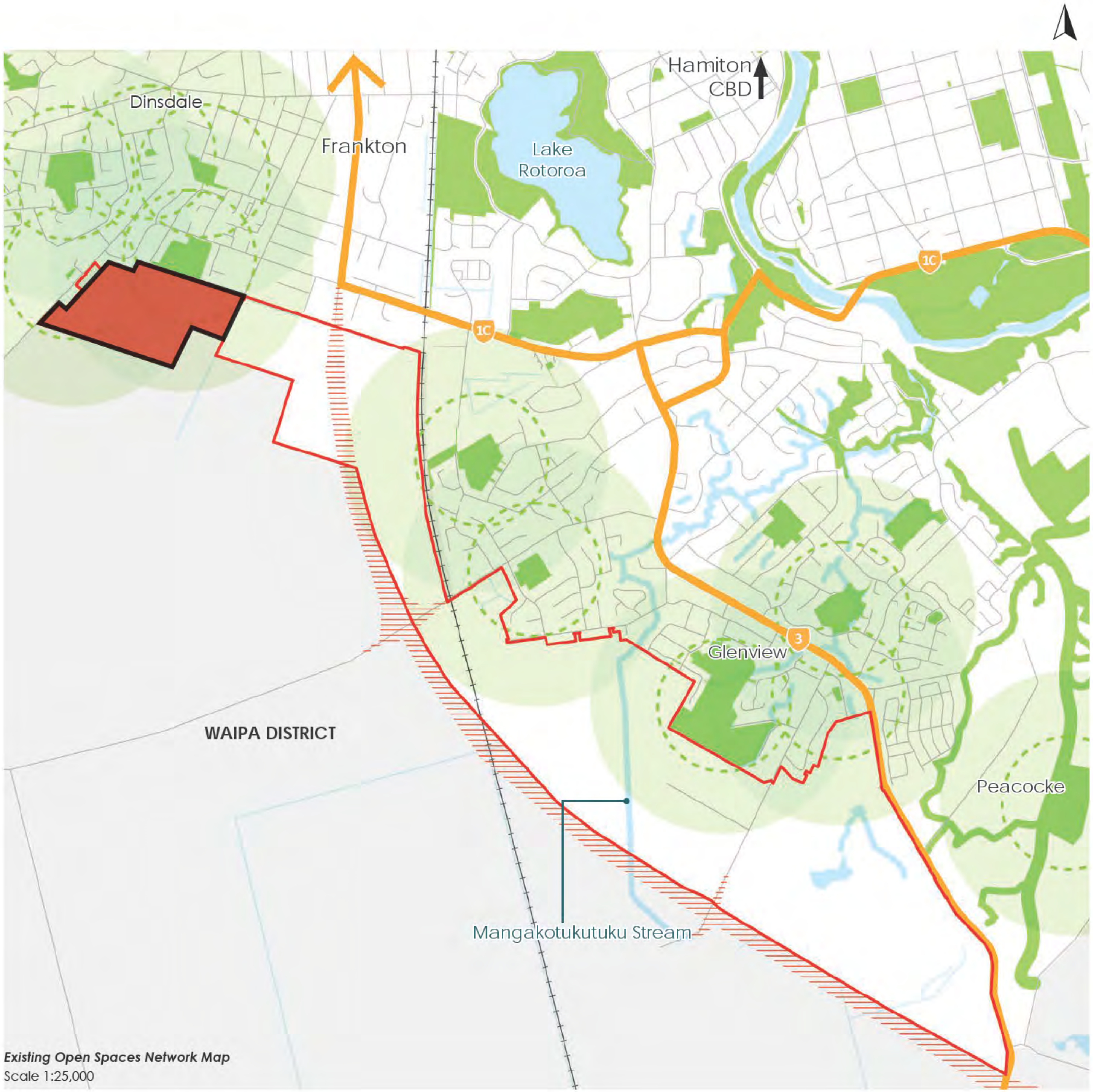
4.5 Open Spaces

Hamilton City Council holds about 1160 ha of green spaces which equals approximately 10% of the city's area. The map on the right shows the Rogerson Block site is located well within 400m catchment (approx. 5 minutes walking distance) to 800m catchment (approx. 10 minutes walking distance) of a park. The key parks that within the proximity to the wider SL1 area include:

- Resthills Park
- Deanwell Park
- Mahoe Park
- Kahikatea Park
- Pygmalion Park
- Rhode St Park
- Bremworth Park

The Mangakotukutuku Stream, other watercourse and wetland areas provide blue spaces for the site.

This analysis demonstrates that the Site is generally well located in terms of proximity to several key open spaces, in particular within its north-west part and mid-north part of the site.



KEY
- Rogerson Site Boundary
- SL1 Site Boundary
- Waterbodies
- Reserves / Green Spaces
- Railway Line
- State Highways
- Southern Link Designation
- 400m catchment (approx. 5min walk)
- 800m catchment (approx. 10min walk)

Existing Open Spaces Network Map
Scale 1:25,000

4.6 Accessibility Analysis - Access to Employment

Further to an assessment of the SL1 area's proximity to social amenities, of particular relevance to strategic assessment of potential growth areas is proximity to employment opportunities.

This links back to Objective 3 which of the NPS-UD **enables more people to live in, and more businesses and community services to be located in,** areas are in or near a centre zone or other area with many employment opportunities.

The map on the right identifies the site in relation to estimated 2020 job numbers per the 2018 Census SA2 unit boundaries.

The Rogerson Block Site sits immediately adjacent to the existing Frankton industrial area and further connect to Te Rapa industrial area. This Frankton - Te Rapa area comprises the largest area of employment in the region.

The Waikato Hospital and Hamilton Airport are also a major employment generators located in close proximity to the SL1 area.

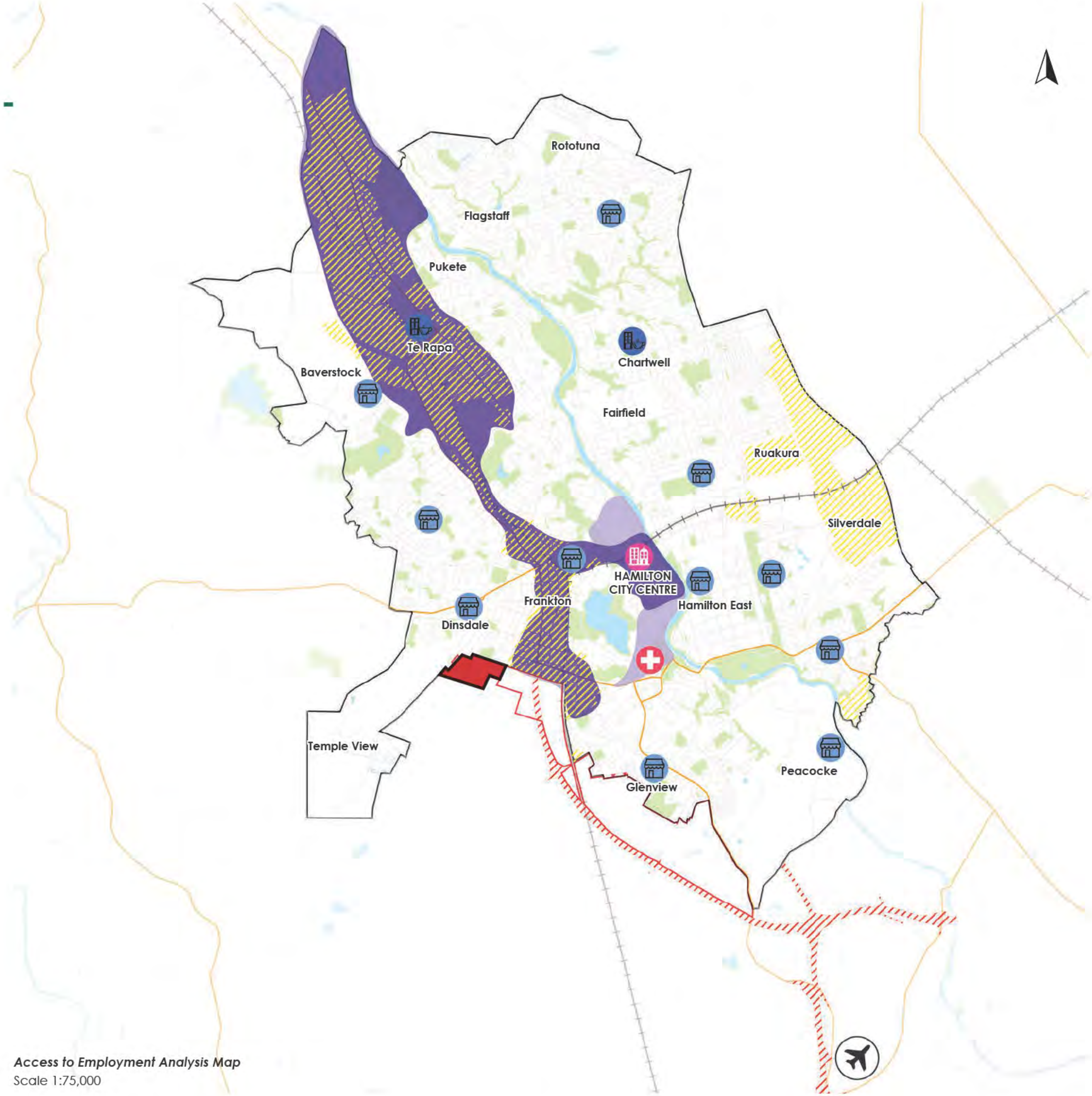
In addition, the site is in proximity to the Hamilton city centre and several suburban centres, including Glenview suburban centre and Dinsdale suburban centre.

KEY

- Rogerson Site Boundary
- SL1 Site Boundary
- Waterbodies
- Reserves / Green Spaces
- Railway Line
- State Highways
- Southern Link Designation
- Hamilton City Centre
- Sub-regional Cenetre (Te Rapa and Chartwell)
- Suburban Centres
- Hospital
- Hamilton Airport
- Industrial Zoned Areas

Estimated 2020 job numbers (per 2018 census)

- Greatest number of jobs
- Second greatest number of jobs



Access to Employment Analysis Map
Scale 1:75,000

4.7 Overall Accessibility Analysis

A high-level desktop study looking at overall accessibility across Hamilton has been undertaken.

This study has taken into consideration access to job numbers via walking, cycling and public transport, as well as walking catchments for key social amenities including primary, intermediate and secondary schools, supermarkets, general practices, town centres, and Waikato Hospital.

These layers were then layered on top of each other, and those areas that have the most layers that reach / cover over them are then defined as high accessibility and those areas that have the least are defined as low accessibility.

This coarse analysis unsurprisingly indicates that Hamilton City Centre and its fringe are the most accessible areas within Hamilton. In addition, this analysis also indicates that areas to the southeast through to south-west of the City Centre could generally be considered more accessible than Hamilton's northern suburbs.

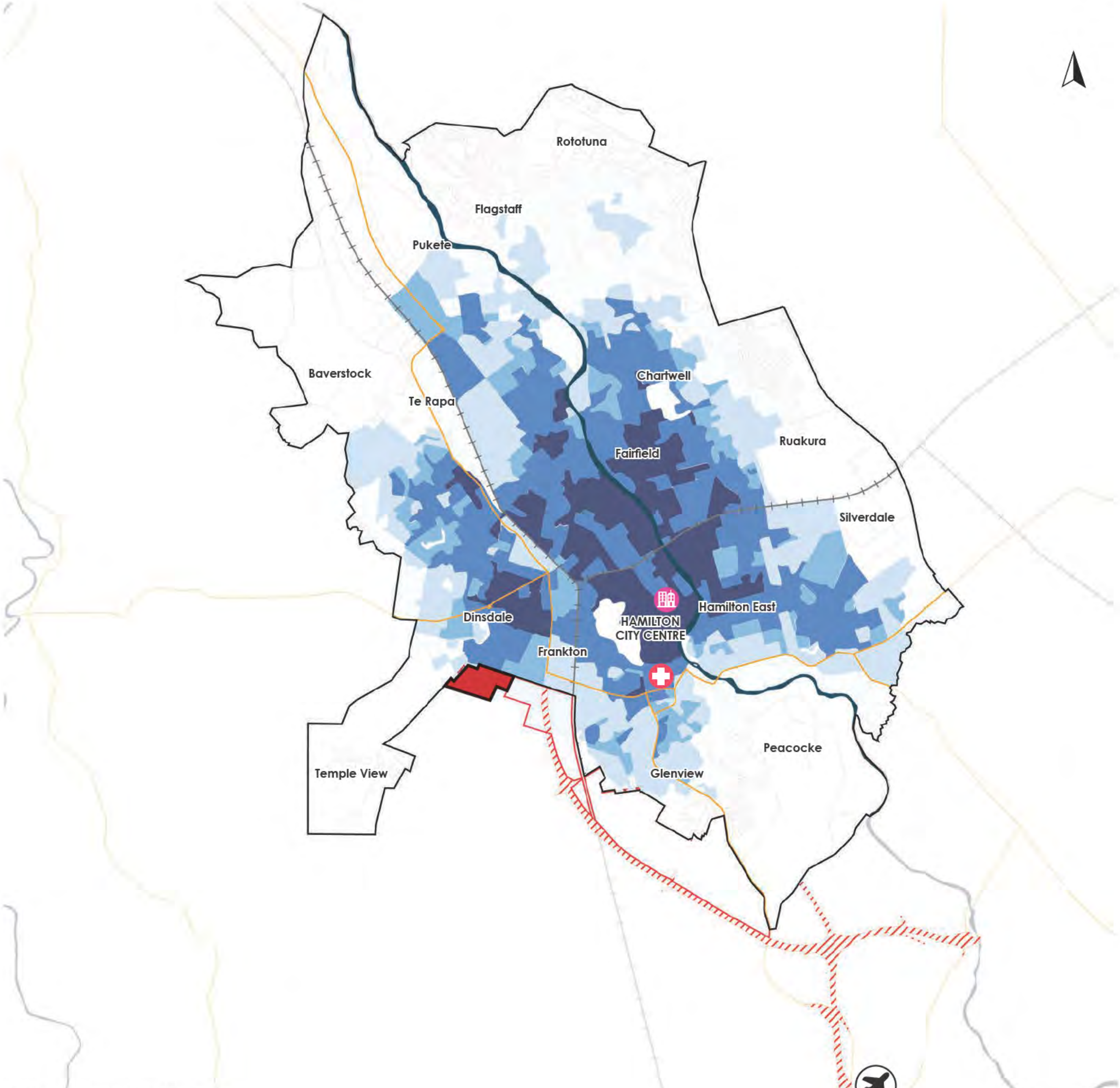
The result of the analysis is shown and it indicates an opportunity for the SL1 area, in particular for the Rogerson Block site, to leverage off this improved accessibility and this should be reflected in residential densities enabled across the site.

KEY

- Rogerson Site Boundary
- SL1 Site Boundary
- Waikato River
- Railway Line
- State Highways
- Southern Link Designation
- Hamilton City Centre
- Hospital
- Hamilton Airport

High level Urban Accessibility Analysis

- Lower Accessibility
- Moderate Accessibility
- Higher Accessibility



Overall Accessibility Analysis Map
Scale 1:75,000

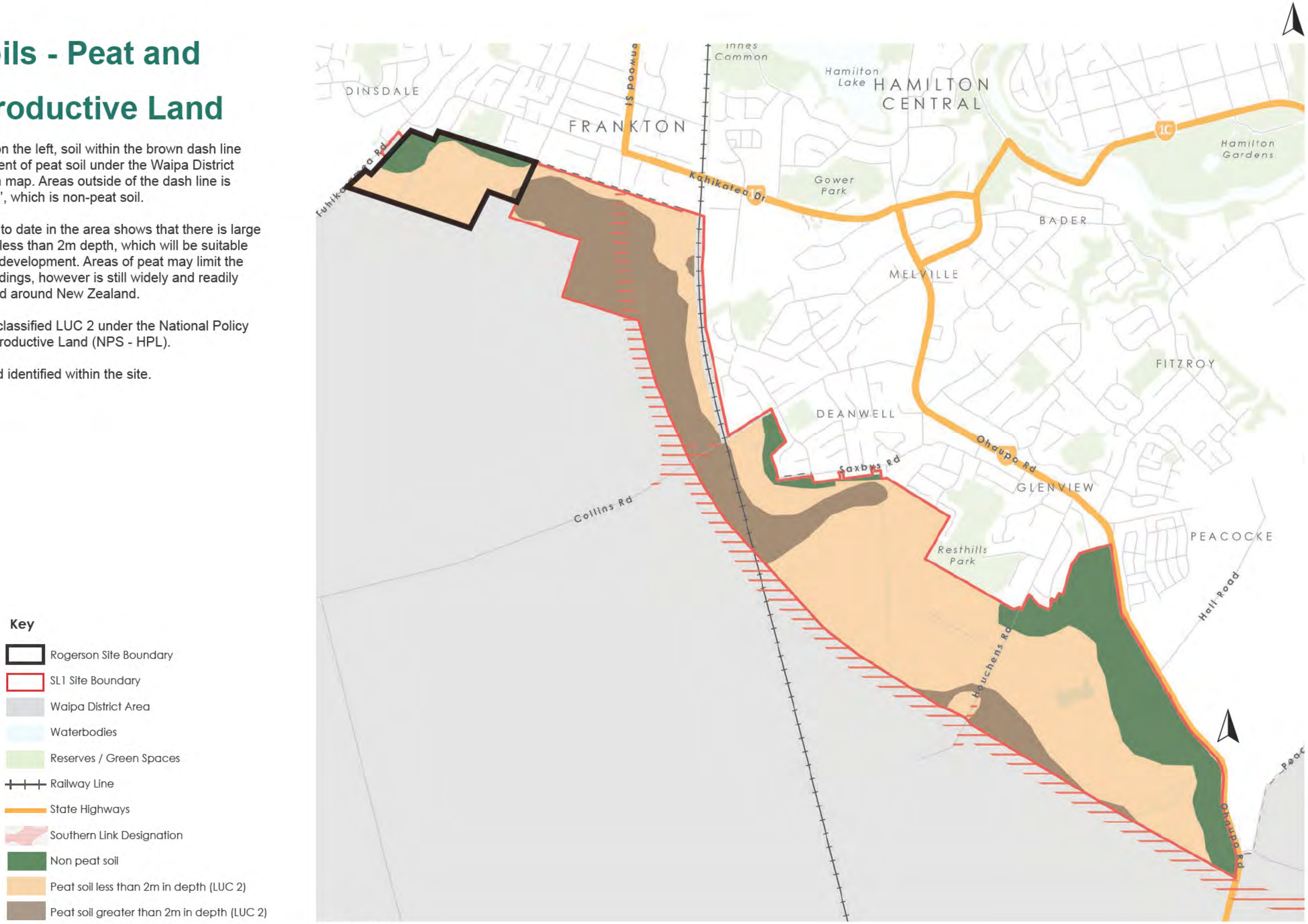
4.8 Soils - Peat and Highly Productive Land

As shown in the map on the left, soil within the brown dash line shown the existing extent of peat soil under the Waipa District Plan Soil Classification map. Areas outside of the dash line is classified as 'other soil', which is non-peat soil.

In addition, work done to date in the area shows that there is large areas of peat soil with less than 2m depth, which will be suitable for early stages of the development. Areas of peat may limit the construction of tall buildings, however is still widely and readily used as residential land around New Zealand.

All peat soils are also classified LUC 2 under the National Policy Statement on Highly Productive Land (NPS - HPL).

There is no LUC 1 land identified within the site.

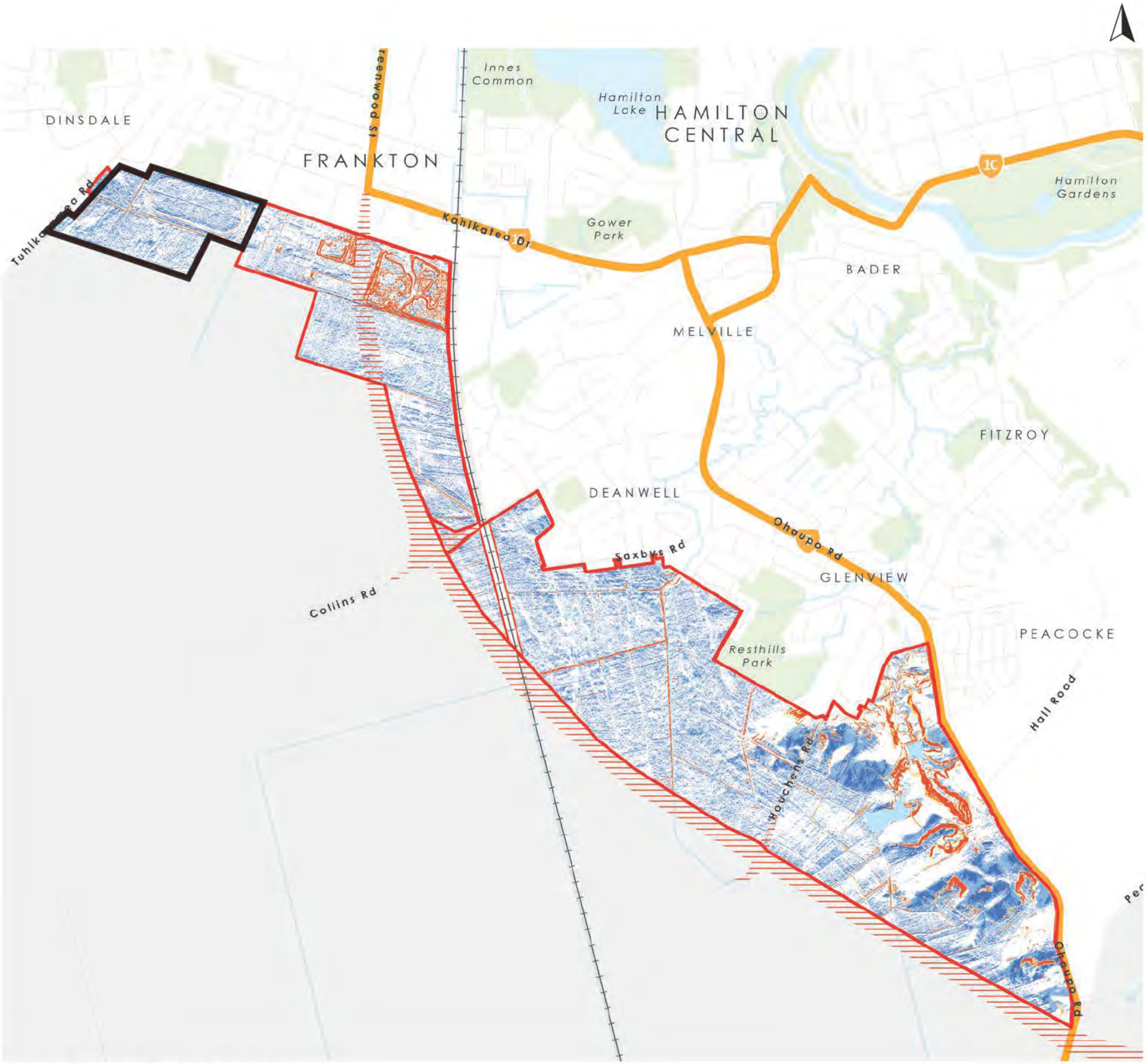


Peat Soil Map
Scale 1:25,000

4.9 Typography - Slope and Aspect Studies

The Rogerson Block Site is relatively flat and with mostly southeast, southwest and/or south aspects.

For the wider SL1 area, one of the defining characteristics of the most eastern part of the area is the steep topography. The slope gradients and aspects vary along its length but get as steep as over 25% in some places and there are some slopes with southeast, southwest and/or south aspects. Significant earthworks would likely be required to accomodate building platforms and to traverse this terrain in order to meet relevant subdivision and transport requirements of the District Plan.



Key

- Rogerson Site Boundary
- SL1 Site Boundary
- Waipa District Area
- Waterbodies
- Reserves / Green Spaces
- Railway Line
- State Highways
- Southern Link Designation

Slope Analysis in percentage (based on 1m contour)

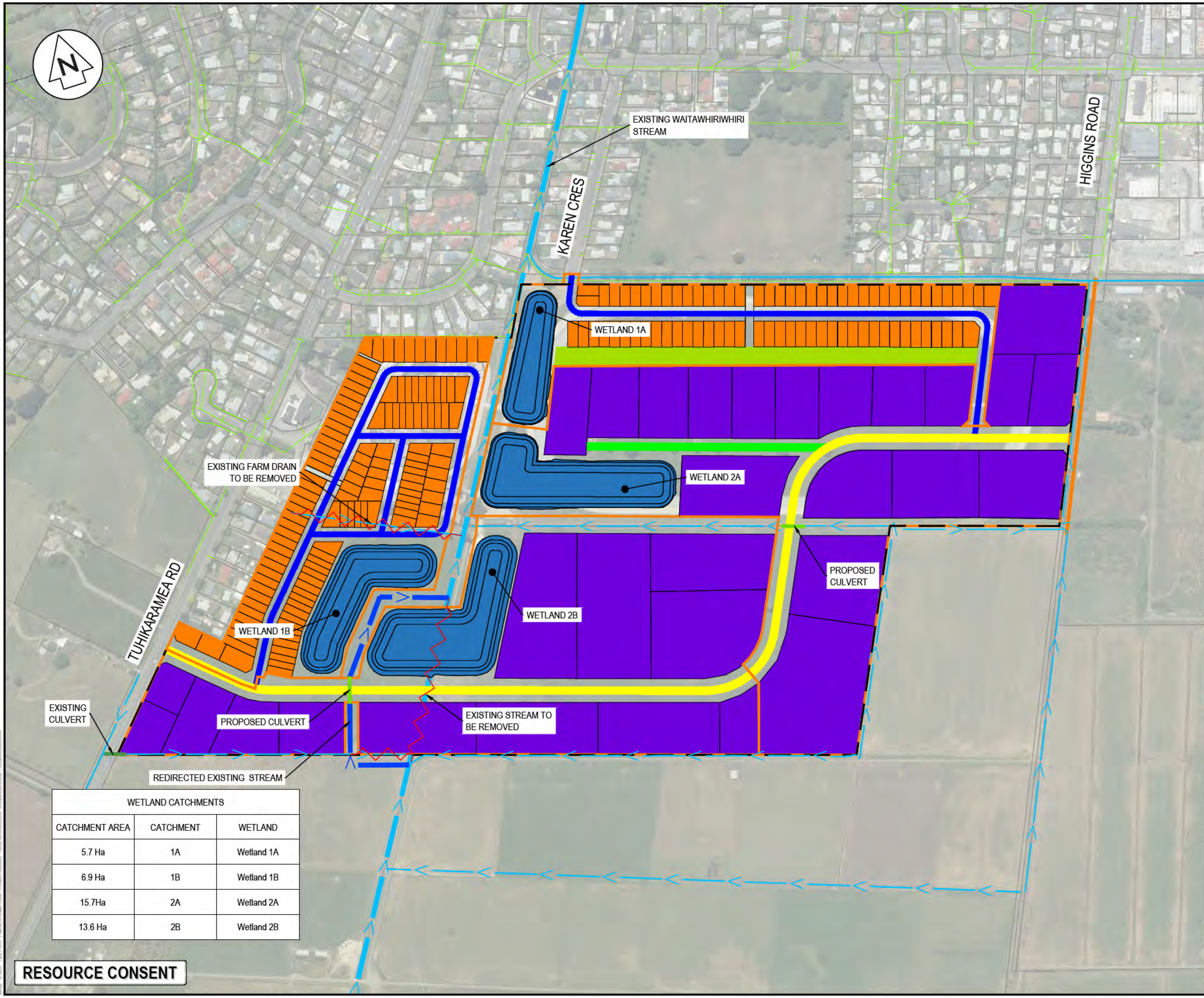
- Up to 20%
- 20% - 25%
- Over 25%

Topographic Aspect Analysis (orientation of slope)

- Southeast or southwest
- South

Topography - Slope and Aspect Studies
Scale 1:25,000

Appendix B – Drawings



WETLAND CATCHMENTS		
CATCHMENT AREA	CATCHMENT	WETLAND
5.7 Ha	1A	Wetland 1A
6.9 Ha	1B	Wetland 1B
15.7Ha	2A	Wetland 2A
13.6 Ha	2B	Wetland 2B

RESOURCE CONSENT

LEGEND

- EX BDY
- SITE BOUNDARY
- PROP 27.8m INDUSTRIAL ROAD
- PROP 20.0m INDUSTRIAL ROAD
- PROP 16.8m RESIDENTIAL ROAD
- CATCHMENT BOUNDARY
- EX WATERCOURSE
- EX MAJOR WATERCOURSE
- PROP WATERCOURSE
- PROPOSED INDUSTRIAL
- PROPOSED RESIDENTIAL
- PROPOSED SWALE

Rev	Description	By	Date
C	FAST TRACK APPLICATION	TCH	06/2025
B	FAST TRACK APPLICATION	TCH	05/2025
A	DRAFT	NAK	02/2025

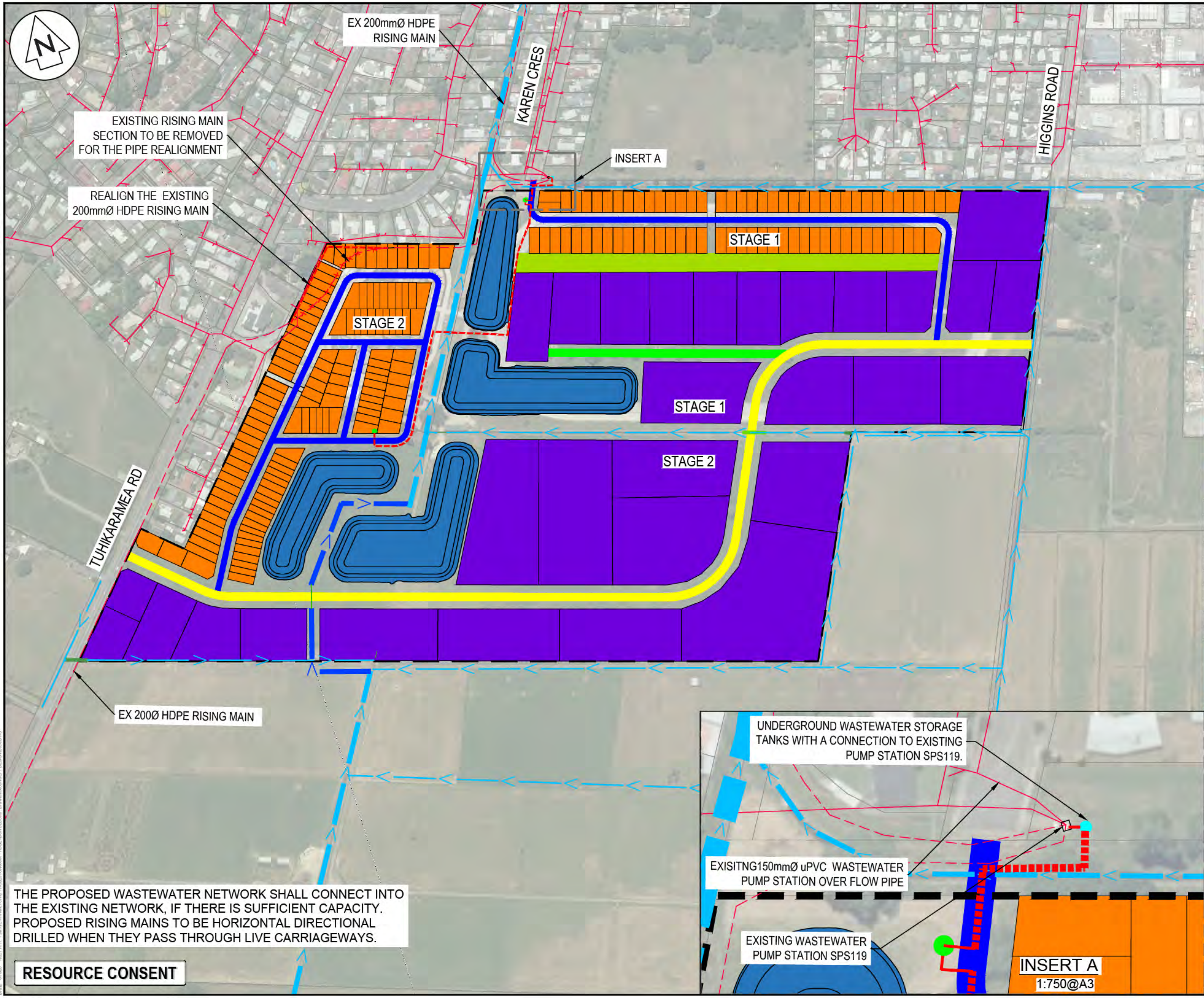
	By	Date
Survey	LINZ	
Design	TH	02/2025
Drawn	NAK	02/2025
Checked	DJM	05/2025

Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
ROGERSON BLOCK FOR GRAEME ROGERSON AND DAVE MACPHERSON

Title
PROPOSED STORMWATER DRAINAGE

Project no.	403001		
Scale	1:4000 @ A3		
Cad file	C400.DWG		
Drawing no.	C400	Rev	C



THE PROPOSED WASTEWATER NETWORK SHALL CONNECT INTO THE EXISTING NETWORK, IF THERE IS SUFFICIENT CAPACITY. PROPOSED RISING MAINS TO BE HORIZONTAL DIRECTIONAL DRILLED WHEN THEY PASS THROUGH LIVE CARRIAGEWAYS.

RESOURCE CONSENT

NOTES
1. INDUSTRIAL LOTS WILL REQUIRE ONSITE WASTEWATER TREATMENT.

LEGEND

- EX BDY
- SITE BOUNDARY
- PROP 27.8m INDUSTRIAL ROAD
- PROP 20.0m INDUSTRIAL ROAD
- PROP 16.8m RESIDENTIAL ROAD
- EX WASTEWATER
- PROP WASTEWATER
- INDICATIVE WASTEWATER PUMPSTATION
- INDICATIVE WASTEWATER STORAGE TANKS
- PROP RISING MAIN
- EX RISING MAIN
- PROPOSED INDUSTRIAL
- PROPOSED RESIDENTIAL
- PROPOSED SWALE

Rev	Description	By	Date
C	FAST TRACK APPLICATION	TCH	06/2025
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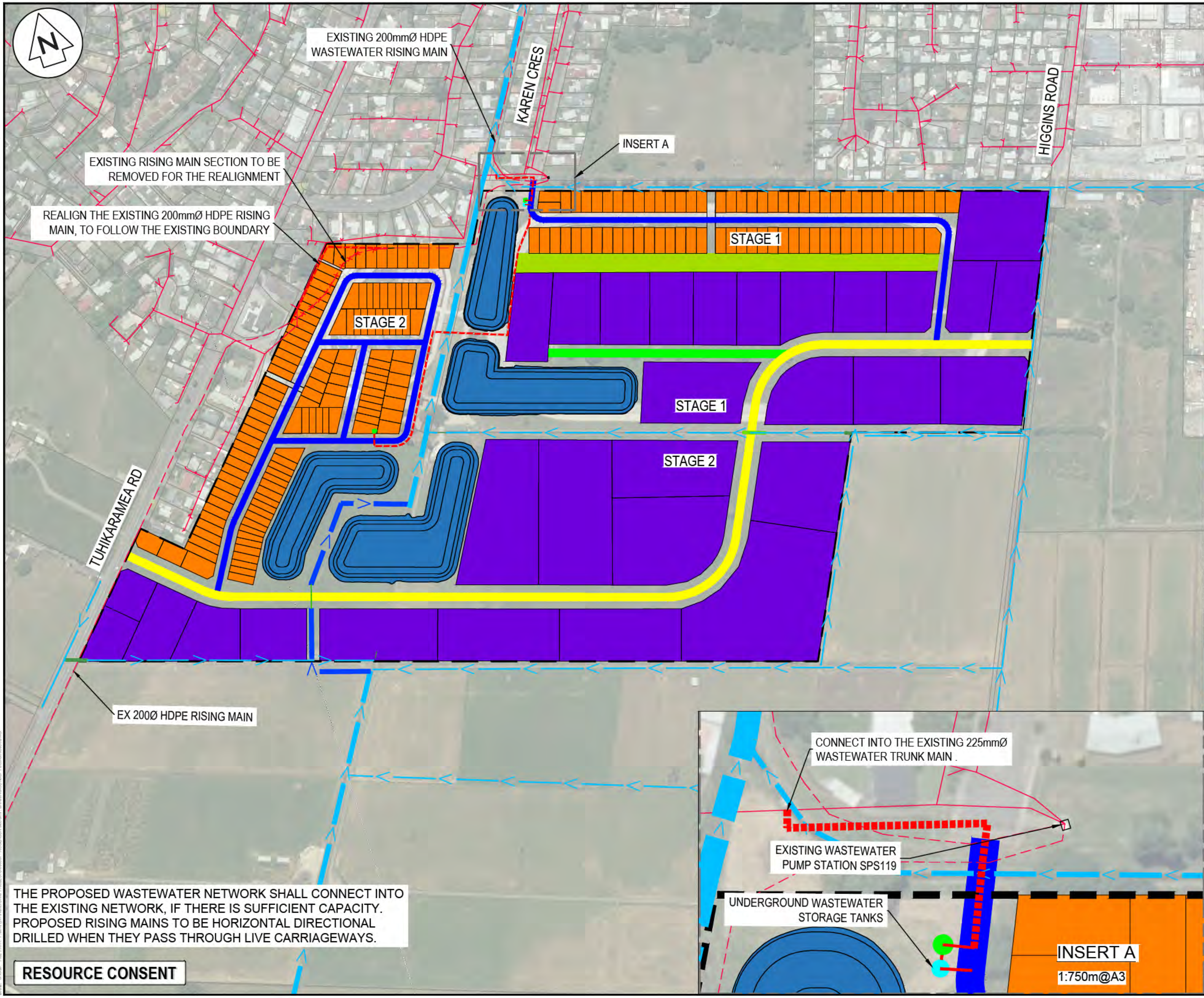
Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
ROGERSON BLOCK FOR GRAEME ROGERSON AND DAVE MACPHERSON

Title
PROPOSED WASTEWATER DRAINAGE OPTION 1

Project no.	403001		
Scale	1:4000 @ A3		
Cad file	C500.DWG		
Drawing no.	C500	Rev	C



NOTES
1. INDUSTRIAL LOTS WILL REQUIRE ONSITE WASTEWATER TREATMENT.

LEGEND

- EX BDY
- SITE BOUNDARY
- PROP 27.8m INDUSTRIAL ROAD
- PROP 20.0m INDUSTRIAL ROAD
- PROP 16.8m RESIDENTIAL ROAD
- EX WASTEWATER
- PROP WASTEWATER
- INDICATIVE WASTEWATER PUMPSTATION
- INDICATIVE WASTEWATER STORAGE TANKS
- PROP RISING MAIN
- EX RISING MAIN
- PROPOSED INDUSTRIAL
- PROPOSED RESIDENTIAL
- PROPOSED SWALE

Rev	Description	By	Date
C	FAST TRACK APPLICATION	TCH	06/2025
B	FAST TRACK APPLICATION	TCH	05/2025
A	DRAFT	NAK	02/2025

	By	Date
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Checked	DJM	05/2025

Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
ROGERSON BLOCK FOR GRAEME ROGERSON AND DAVE MACPHERSON

Title
PROPOSED WASTEWATER DRAINAGE OPTION 2

Project no.	403001
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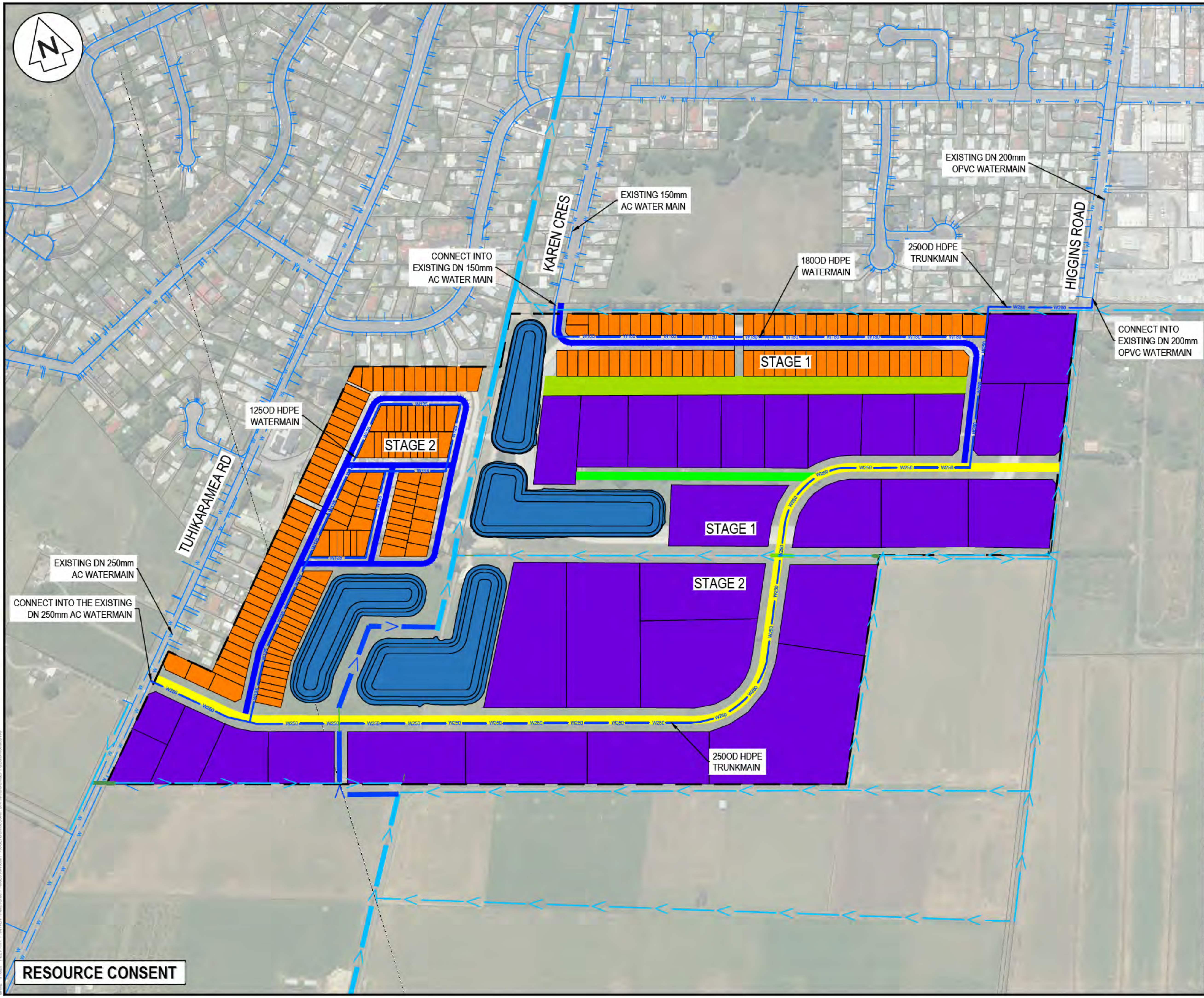
Cad file	C500.DWG
Drawing no.	C501
Rev	C



NOTES
1. PUBLIC WATER SUPPLY AND FIRE FIGHTING WILL BE PROVIDED FOR THE RESIDENTIAL AREAS.
2. THE PUBLIC WATER SUPPLY WILL ONLY BE PROVIDED FOR FIRE FIGHTING SUPPLY FOR THE INDUSTRIAL AREAS.

LEGEND
EX BDY
SITE BOUNDARY
PROP 27.8m INDUSTRIAL ROAD
PROP 20.0m INDUSTRIAL ROAD
PROP 16.8m RESIDENTIAL ROAD
EX WATERMAIN
PROP WATERMAIN
PROPOSED INDUSTRIAL
PROPOSED RESIDENTIAL
PROPOSED SWALE

Rev	Description	By	Date
C	FAST TRACK APPLICATION	TCH	06/2025
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A	DRAFT	NAK	02/2025

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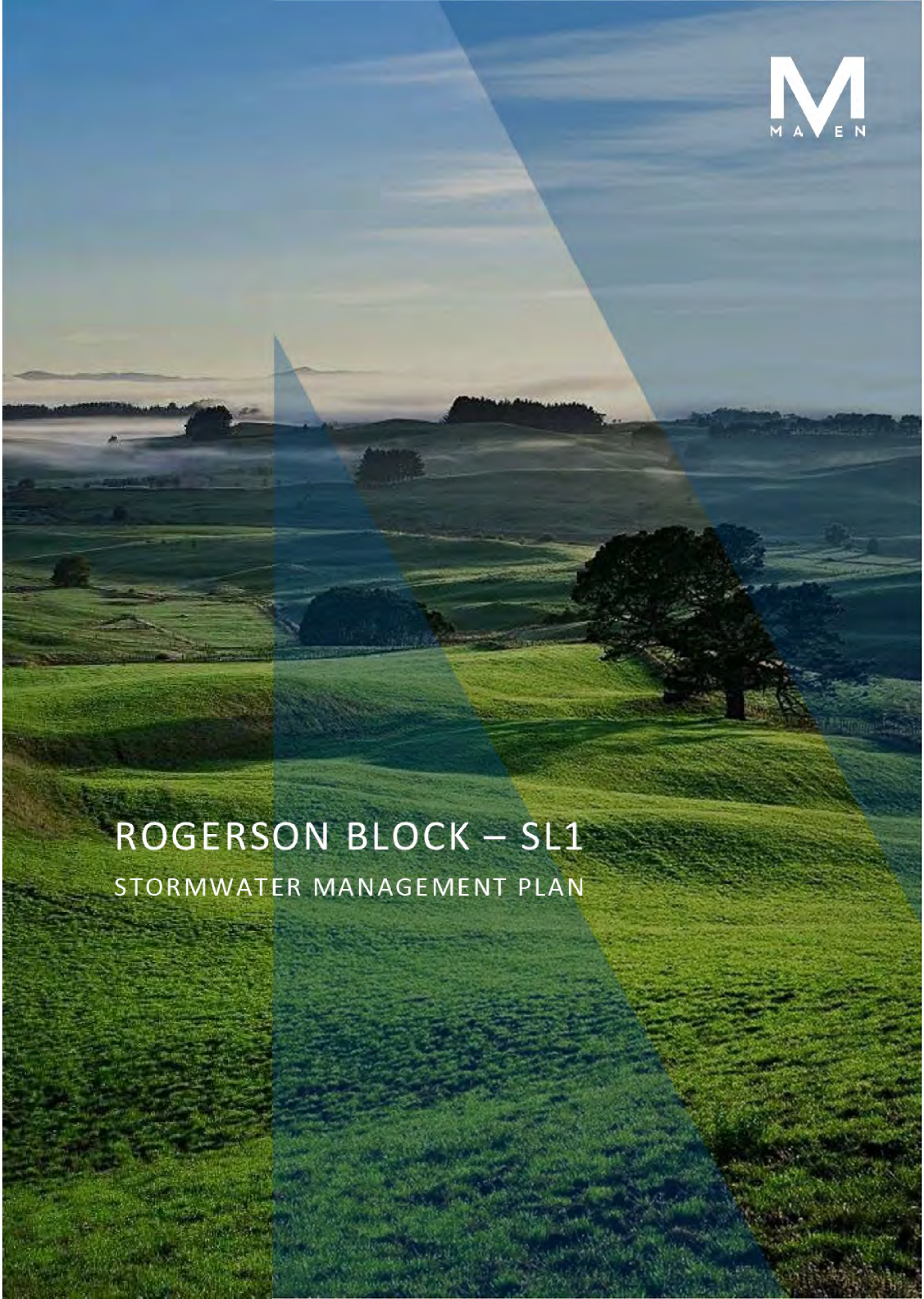
Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
ROGERSON BLOCK FOR GRAEME ROGERSON AND DAVE MACPHERSON

Title
PROPOSED WATER SUPPLY

Project no.	403001
Scale	1:4000 @ A3
Cad file	C600.DWG
Drawing no.	C600
Rev	C

Appendix C – Stormwater Management Plan (SMP)



ROGERSON BLOCK – SL1

STORMWATER MANAGEMENT PLAN

PROJECT INFORMATION

CLIENT	Graeme Rogerson & Dave MacPherson
PROJECT	403001

DOCUMENT CONTROL

DATE OF ISSUE	19/02/2025
REVISION	A

AUTHOR

Raatite Kanimako & Navdeep Kaur
Civil Engineers

REVIEWED BY

Tim Hawke
Senior Engineer

APPROVED BY

Dean Morris
Regional Director

Level 1, 286 Victoria Street
Hamilton
New Zealand
Phone 09 571 0050
www.maven.co.nz

Table of Contents

1. Introduction

1.1. Background

Maven Waikato Ltd have been engaged by a Graeme Rogerson and Dave MacPherson to explore the feasibility and concept of land development for residential and industrial use within the Rogerson Block designation. The Rogerson Block forms a part of the overall Southern Links land designation also known as SL1. SL1 is an emerging area identified by HCC for future housing and industrial.

1.2. Purpose of this Report

The purpose of this report is to provide a high-level overarching Stormwater Management Plan (SMP) that supports the intended rezoning of the Rogerson block area and to provide the framework for future stormwater management plans.

The design and layout of the Rogerson block structure plan (concept plan prepared by Barker & Associates) has been developed through on-going consultation and collaboration with developers.

The calculations and assessments included in this report are a 'desktop' analysis and are preliminary in nature based on information available at time of issue. Depending on the outcome of the high-level Structure Plan, further community; stakeholder engagement; and feasibility investigations, including engineering design and calculations, will be required to determine the suitability of the areas proposed for industrial and residential development.

1.3. Catchment

The Rogerson block area is a circa 43 ha block of land consisting Residential and Industrial areas within Waipa District. The area has a northwest to southeast orientation, bound by Tuhikaramea road on north-west side and existing open farm drains delineating the other sides.

The site is low-lying flat farmland traversed by the significant Waitawhiriwhiri Stream, which runs across the site, effectively dividing the site and eventually flowing into the Waikato River.

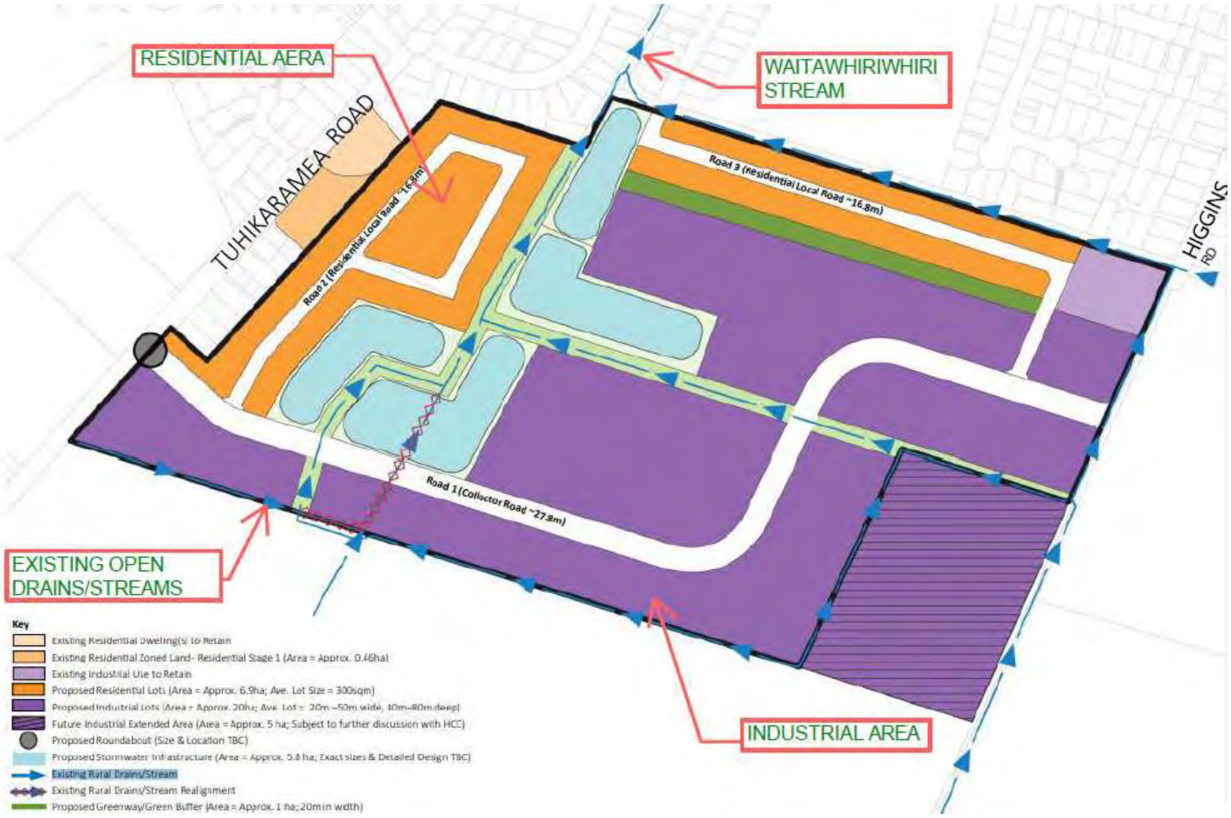


Figure 1 - Structure Plan

1.4. Objectives

As part of the structure plan process, an overarching SMP has been developed for Rogerson Block. The SMP sets out the high-level, best practice approach to stormwater management within the receiving catchment.

The strategy for future stormwater management is outcome focused. The SMP provides a solution-based approach for the receiving environment. Consideration and emphasis are given to the inclusion of Water Sensitive Urban Design principles, with the overall goal of developing environmentally conscious outcomes which help address and mitigate known and future constraints of Rogerson block.

Proposed objectives of the SMP are outlined below:

- Consideration of future public networks required in support of Rogerson block. The report confirms discharge location and provides a design methodology which will guide future development of the area.
- Existing waterways are identified and investigated. Parameters are set which will ensure protection of existing waterway environments in future development.
- Existing overland flow paths identified and investigated. Design parameters are set, which will ensure existing overland flow paths are allowed for in future development up to and for the 100-yr event.
- Existing flood hazards investigated, mapped, and summarised. Flood mitigation strategies are developed for each of the catchments. This framework will enable the development of the structure plan areas and will guide future development controls.
- The SMP provides an option-based assessment for water quality treatment in support of the future development of Rogerson block. A review of the relevant statutory framework is undertaken before a high-level strategy is provided for the catchments.
- The consideration and requirement for extended detention in support of the future development of the Rogerson block
- to avoid any downstream flooding, erosion and scouring. Indicative flood mitigation options are developed for the catchments and receiving environments.
- Confirming the need for the attenuation of peak flow, decreasing stream bed erosion during storm events up to and including the 100-yr events. Attenuation forms part of the overall stormwater management toolbox and solutions are considered (both at-source and catchment wide) for Rogerson block.
- On-site retention (volume reduction) to ensure pre-development runoff rates and volumes are maintained to provide catchments with hydraulic neutrality.
- On-site retention (volume reduction) to ensure pre-development runoff rates and volumes are maintained within catchments and streams. Existing streams are located within the Rogerson block, and it is important to maintain underlying base flows of water into the streams to avoid any effects on stream biodiversity.
- The urbanisation of the block presents an opportunity to provide significant ecological improvements through the protection and planting of riparian margins. Recommendations are made to guide future Change application(s) to ensure positive environmental outcomes are achieved.
- Groundwater recharge to areas thereby maintaining water tables and preventing dewatering.
- Information gaps which require further investigation and/or detailed design are identified.

The overall SMP creates a stormwater toolkit, which will guide future development of Rogerson block. The toolkit will promote sustainable solutions including the integration of Water Sensitive Urban Design ('WSUD') principles in future land use planning.

2. Stormwater Reticulation

Existing stormwater infrastructure within Rogerson block is limited to farm/roadside drains and streams. Development of Rogerson block will be supported by new public stormwater networks. The future public networks would be constructed by developers, which will be subject to Resource Consent and Engineering Approval before being vested to Hamilton City Council, post construction. Where possible, the network will be designed and constructed within the public roads.

2.1. Stormwater Capacity

The primary reticulated network will be sized to convey the peak discharge for rainfall events up to and including 10-year $_{(cc)}$ ARI storm events to the identified discharge points. Stormwater calculations will need to be provided to Hamilton City Council to supplement the applications for Resource Consent and Engineering Approval. The future networks will need to demonstrate compliance with the Hamilton City Council standards for Subdivision and Land Development.

There is no overland flow predicted for the 10-year $_{(cc)}$ ARI event. During the 100-year $_{(cc)}$ event the stormwater runoff will be conveyed by overland flow paths within the proposed development, which will follow the road reserves (where possible) which in turn discharge into the existing watercourses and/or catchment detention solutions contained within the Rogerson block.

3. Stormwater Quality and Quantity

3.1. Statutory Context

Future stormwater discharge from Rogerson block is required to comply with the Regional Policy Statement and the Regional Resource Management Plan both administered by Waikato Regional Council. The relevant policy criteria are summarised below:

3.1.1. Waikato Regional Policy Statement (RPS)

The Waikato Regional Policy Statement (Te Tauākī Kaupapa here ā-Rohe), or RPS, is a mandatory document that provides an overview of the resource management issues in the Waikato region, and the ways in which integrated management of the region's natural and physical resources will be achieved.

The RPS identifies the significant resource management issues of the region and sets out the objectives, policies, and methods to address these issues. The RPS informs the regional and district plans and consideration of resource consents.

Central to the outcomes sought within the RPS is the protection and enhancement of freshwater ecosystems. The following lists key Waikato RPS high-level objectives relevant to this SMP and the future management of stormwater within this development.

Relevant objectives include:

1. Integrated management of natural and physical resources;
2. Restoration and protection of the health and wellbeing of the Waikato River;
3. Avoiding the potential adverse effects of climate change;
4. The relationship of tangata whenua with the environment is recognised and provided for;
5. Sustainable and efficient use of resources;
6. Development of the built environment in an integrated, sustainable and planned manner;
7. Maintain or enhance the mauri and identified values of fresh water bodies;
8. Maintain or enhance riparian areas and wetlands;
9. Historic or cultural heritage sites, areas or landscapes are protected or maintained;
10. Healthy, functioning ecosystems and indigenous biodiversity;
11. Maintenance and enhancement of amenity;
12. Protection of the natural character of wetlands and rivers and their margins;
13. Maintenance and enhancement of public access along rivers; and
14. The effects of natural hazards are managed.

The Waikato RPS states territorial authorities should consider promoting best practice stormwater management for urban areas and preparing stormwater catchment plans for greenfield urban developments.

This SMP supports achievement of the above Waikato RPS objectives. It integrates land-use and three-waters planning within SL1, which includes this development. The SMP identifies the three-waters infrastructure necessary to accommodate urban growth, whilst giving effect to the relevant development principles, to ensure the freshwater ecosystem is protected and improved through urbanisation.

3.1.2. Waikato Regional Plan

The Waikato Regional Plan is the principal policy tool that enables Waikato Regional Council to carry out its functions to achieve the sustainable management of resources within the Region. With respect to this SMP, the following modules of the Waikato Regional Plan are relevant: matters of significance to Māori, water, river and lake beds, land and soil, and air.

Each module provides an overview of the environmental problems the Regional Council seeks to manage, the objectives to be achieved, policies (actions to be taken) to achieve them, and methods and rules to implement the objectives and policies. Each module also describes the environmental results anticipated and how they will be monitored. Resource consent will be required for any activity that will not comply with permitted activity standards listed under the plan.

Future development of this site as part of the overall SL1 will need to be supported by resource consents from Waikato Regional Council under the Waikato Regional Plan. Such activities which would trigger consents are listed below:

1. Works in a stream bed – such as for culvert, bridge, pipeline or stormwater pipeline outfall construction or any stream diversion; and
2. Vegetation clearance and earthworks – including for management of sediment-laden runoff and dust;
3. Diversion and discharge of stormwater into water or onto or into land, including management of contaminants.

3.1.3. Comprehensive City-wide Discharge Consent

Hamilton City Council holds a comprehensive city-wide stormwater consent ('CSDC') which allows for multiple discharges in multiple catchments. The CSDC authorises the diversion and discharge of stormwater from developed areas within Hamilton City existing at the commencement of the consent in 2012.This consent has stringent conditions relating to stormwater quality and quantity effects downstream of this proposal. It is anticipated that SL1 will be enveloped by the CSDC if brought into Hamilton City via Future Proof. As such, the development of a future ICMP/SMP based off this document will ensure compliance with the Council's CSDC.

The CSDC will authorise any new stormwater diversion and discharge activities established after 2012, if the Waikato Regional Council certifies they comply with the consent's conditions.

To achieve such certification, any new stormwater diversion and discharge activity in SL1 must meet these two tests:

1) It must be consistent with the conditions of the CSDC; and

2) Either:

a) Where it is in a greenfield area, it must be consistent with an ICMP; or

b) Where it is to be established in an existing urbanised area, it must not increase peak discharge rates or flow volumes in the receiving water body above those that would have occurred when the CSDC was granted in 2012, unless it is demonstrated that any such increases will have no adverse effects.

New stormwater diversion and discharge activities established in developing catchments that are not consistent with Catchment Management Plans will remain as single site resource consents. I.e., the Council's CSDC will not authorise them.

This SMP has been derived on the basis that the future discharge consents will be sought in compliance with the CSDC and the consents will be transferred to Council, alongside the constructed stormwater infrastructure.

3.1.4. Mangakootukutuku Integrated Catchment Management Plan (Consultation revision November 2020)

Hamilton City Council has prepared a draft ICMP for the Mangakootukutuku Catchment, which is proximity to Rogerson block. Therefore, basis of the CMP for Rogerson block is established based on the Mangakootukutuku Catchment. The Mangakootukutuku Catchment is in the southwest of Hamilton, with some headwater tributaries extending south across the boundary into Waipa District. The Mangakootukutuku stream flows into the Waikato River directly northeast of the intersection of Peacocke Rd and Norrie St. The SL1 southern Residential area is wholly located within the Hahawaru sub-catchment.

The preparation of this SMP has been developed in accordance with the draft ICMP, as the future stormwater management within Rogerson block will need to remain consistent with any approved ICMP. The primary outcomes envisaged within any approved ICMP are summarised below:

1. Water quality in a treatment train (two or more treatment devices in series).
2. The final treatment device is likely to be artificial wetlands which will also carry out attenuation functions.
3. 24 hour extended detention (ED) to reduce erosion potential and manage stream base flows for the Water Quality Volume (WQV) runoff event.
4. 2 year and 10 year peak flow attenuation to reduce erosion potential resulting from increased runoff from development.
5. 100 year ARI peak flow attenuation (80% pre-development flow) to reduce erosion potential resulting from increased runoff from development
6. Retention of the first 10mm of stormwater, and/or the initial abstraction volume required for new Road surfaces.
7. Retention of On-lot predevelopment initial abstraction depth is required as per WRC stormwater Management Guidelines.
8. Utilisation of soakage for stormwater disposal where practical to replenish groundwater and minimise runoff volume.

3.1.5. National Environmental Standards for Freshwater

The National Policy Statement for Freshwater 2020 provides local authorities with updated direction on how they should manage freshwater under the Resource Management Act 1991. The Freshwater NES set requirements for carrying out certain activities that pose risks to freshwater and freshwater ecosystems. Anyone carrying out these activities will need to comply with the standards.

The standards are designed to:

- protect existing inland and coastal wetlands.
- protect urban and rural streams from in-filling.

- ensure connectivity of fish habitat (fish passage).
- set minimum requirements for feedlots and other stockholding areas.
- improve poor practice intensive winter grazing of forage crops.
- restrict further agricultural intensification until the end of 2024.
- limit the discharge of synthetic nitrogen fertiliser to land and require reporting of fertiliser use.

The proposed development falls just outside the draft Mangakootukutuku ICMP with a discharge into Waitawhiriwhiri West Stream. From Maven's understanding an ICMP for this area has yet to be developed, and given the proximity to the Mangakootukutuku ICMP area, a stormwater management approach in line with this ICMP has been assumed in this feasibility assessment. This will require further investigation and discussions with HCC to determine whether there are any specific stormwater management requirements for this area.

Whilst the majority of the above standards set out to restrict rural uses, specific emphasis has been placed on the protection of all natural wetlands. Earthworks within 10m of natural wetlands are prohibited, and consent is also required for the change in natural drainage patterns within 100m of any natural wetland. The mapping of all existing wetlands is currently underway by Fresh Water Solutions, and any identified areas will need to be avoided and suitably protected by the future development and associated management of stormwater.

3.1.6. Hamilton City Council Code of Practice for Subdivision and Land Development

The Regional Infrastructure Technical Specification (RITS) (Waikato Local Authority Shared Services, 2018) set standards for design and construction of earthworks, transportation, water, wastewater and stormwater infrastructure, landscapes, and accepted materials. Resource consents for subdivisions and developments in the Catchment will require developers to comply with RITS when constructing such infrastructure.

The RITS and Hamilton District Plan require stormwater to be managed according to a hierarchy, which is based on sustainability and efficiency principles. Preference is given to disposing of stormwater by a method that is higher in the following hierarchy – "a" is higher than "b", which is higher than "c", which is higher than "d":

a) Retention of rainwater/stormwater for reuse on site.

b) Soakage techniques.

c) Treatment and detention and gradual release to a watercourse.

d) Treatment and detention and gradual release to a piped stormwater system.

Although both the RITS and the Hamilton City District Plan ascribe the term "hierarchy" to this list of measures, neither document provides criteria for determining when adoption of a lower hierarchy measure is justified.

Below specifies Water Quality Standards required to be achieved via use of Treatment Train system as detailed in section 3.3.2.

SECTION 4 – STORMWATER UPDATED MAY 2018

CRITERIA	DESIGN PARAMETER	WHEN REQUIRED
Water quality treatment[12]	Refer to the stormwater management disposal hierarchy (section 4.2.3.1) and treatment devices hierarchy (section 4.2.16) for disposal and treatment preferences. Water quality requirements include: • Total suspended solids (TSS) (75% removal of post development loads taken as measured at the discharge point from site). • Total Metals (copper, zinc) to achieve maximum practical removal possible. • Temperature (<25°C) • Nutrients (total nitrogen, total phosphorus and ammoniacal nitrogen) to achieve maximum practical removal rates.	Always.

Figure 2 – Excerpts from RITS specifies Water Quality Standards.

In addition, stormwater quantity control standards specified in RITS table 4-3 are to be complied with which includes:

a. Extended Detention for WQV (1/3 of 2 year ARI storm) – a 1.2 factor is to be applied to the WQV volume/Storage.

b. 2 year ARI storm – Attenuation back to pre-development flow is required

c. 10 year ARI storm – Attenuation back to pre-development flow is required

d. 100 year ARI storm – Attenuation back to 80% pre-development flow is required

3.2. Design Parameters

Rainfall information from the NIWA High Intensity Rainfall Design System V4 (HIRDS) has been used for the site location including an allowance for climate change.

The RITS does not currently provide guidance on which HIRDS climate change RCP to use. However, RITS section 4.2.4.4, notes the post-development design storm shall account for 2.1C climate change adjustment. This corresponds closest to an RCP 6.0 (2081-2100) which has been used to determine the 24-hour rainfall depth for each design storm. We note that HCC is currently reviewing the RCP assumptions within the RITS and the expectation is stormwater modelling will require sensitivity checks using a climate scenario of RCP 8.5 for resource consent and engineering plan approval.

Therefore, stormwater design shall be based on the following parameters.

Table 1 – HIRDS hydrology Data

Rainfall Event	RCP 6.0 Rainfall Depth	RCP6.0 Rainfall Intensity
2 Year ARI	75.3mm	-
WQV	25.1mm	-
10 Year ARI	116mm	126.4 mm/hr
100 Year ARI	179.8mm	-

Table 2 – CN Values

Scenario	Impervious (CN)	Pervious (CN)
Pre-development		61
Post-development	98	74

Maximum probable development (MPD) = 70% impervious and 30% pervious as per the draft ICMP, refer to image below.

3.3. Stormwater Quality and Quantity - Mitigation Options Assessment

An assessment has been undertaken to establish the best practical design options for the stormwater quality and quantity design in support of Rogerson block. These options include:

- At source stormwater quality control through the following controls:
    - Inert roofing materials for all future buildings.
    - Reduction of impervious areas using permeable paving (where possible).
    - Lot development supported by approved propriety devices such as raingardens, tree pits, recharge pits, stormwater filters etc.
- Treatment of public roads and right of ways via approved propriety devices (raingardens, swales, stormwater filters etc) as per GD01 design guidelines.
- Stormwater quality management for Sub-catchment using detention basins and wetlands.
- Planting of riparian areas and protection of any existing bush features within SL1.
- Use of the treatment train devices (Swales and/or Amalgamated Raingardens and Artificial Wetlands) to provide storage and attenuation for the required storm events from WQV, ED, 2year, 10year and 100year ARI.
- Option to provide storage and attenuation within the existing (rehabilitated) streams (refer to section 4) in addition to wetlands.

3.4. Best Practical Options

The overall preference is for stormwater to be managed as close to source as possible. This requires careful consideration of the wider use of smaller devices (such as inert materials, pervious paving, swales, and rain gardens) in preference to larger devices such as wetlands. These at-source devices are most efficient at improving water quality from frequent short and medium duration events.

The best practical options to mitigate the stormwater quality and quantity risk is detailed in the following sections.

3.4.1. On-Lot Stormwater Soakage

Low-lying plains of the Rogerson block are formed by a peat bog that has been drained over time and converted to agriculture and horticultural use. Careful consideration of stormwater management is required on peat soils.

Soakage and recharge of stormwater into peat is likely required to maintain hydrology to prevent dewatering of downstream wetlands and streams and to mitigate shrinkage. Recharge or soak pits should be designed at regular intervals throughout the development to encourage even distribution of groundwater recharge.

A soakage system is a stormwater device supported by both the RITS and the ICMP for on lot primary system to manage stormwater from roofs, accessways and parking areas.

Depending on the soakage rate available on site, this stormwater device can provide full compliance with the draft ICMP for both quality and quantity mitigation requirements as listed below.

<u>Retention</u>

- Pre-development Initial abstraction depth is required, referencing WRC stormwater Management Guidelines.

<u>Detention/Attenuation</u>

- Extended detention of 1.2 x WQV
- 2 and 10-year attenuation to pre-development flow.

See Figure 4 below for a typical soakage pit detail from WRC's stormwater management guidelines.

Soakage pit

Soakage pits function in a similar fashion with the excavated subgrade being filled with stone and relying upon the void spaces to provide for stormwater storage until the runoff infiltrates into the soil as shown in Figure 8-18.

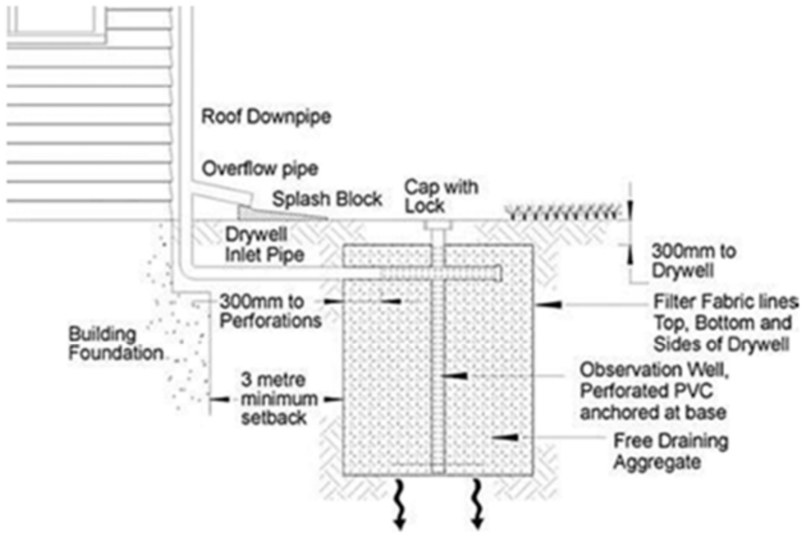


Figure 8-18: Schematic of a soakage pit[115]

Figure 4 – Excerpt from Waikato Stormwater Management Guideline of a soakage pit device.

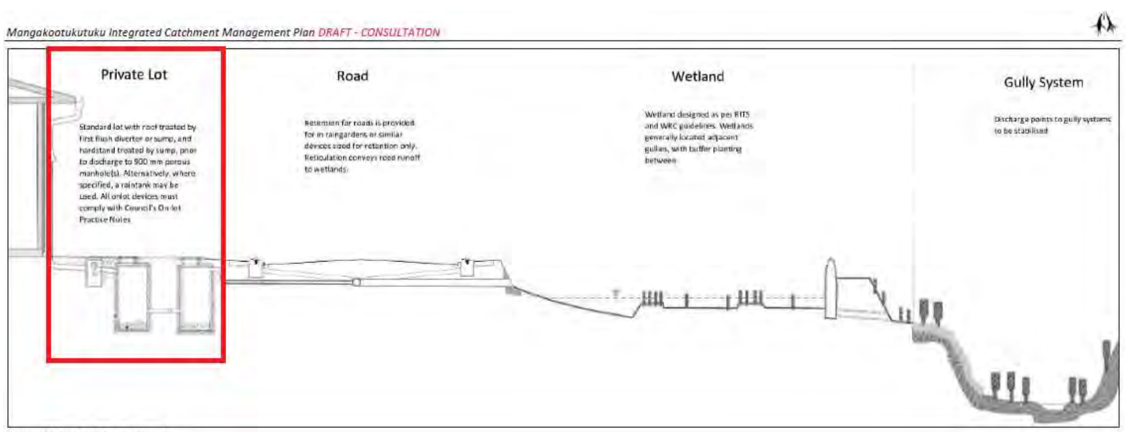


Figure 5 – ICMP excerpt.

Figure 5 above is an excerpt from the ICMP depicting the overall treatment system, the on-lot requirements highlighted as being relevant to this section.

It is recommended that percolation testing is carried out at least once for each soakage device. Detailed investigations for each area will be required by a suitable qualified geotechnical engineer to determine the correct requirements for recharge and to provide development controls for infrastructure and buildings throughout the various catchment areas.

For areas that do not meet the required soakage rate, a bubble up system can be used whereby a stormwater line for each lot will discharge into a sump with a grated lid that allows water to bubble up into the carriageway during events exceeding the sump volume and the 3000L tank as proposed under Plan Change 12.

3.4.2. Rainwater Harvesting/Reuse

Reusing rainwater can significantly reduce the amount of water supply demand by household units by up to 50%. Decreasing demand on water supply has multiple benefits including meeting Water-sensitive urban design (WSUD) criteria and decreasing household water use. Allowance for water metering is suggested for any future changes to Hamilton Water Supply requiring a meter box at the boundary.

Rainwater can be harvested and used for a range of different applications; for watering the garden or washing the car, for use in the laundry and toilet. Rainwater is harvested directly off the roof and travels through downpipes to a water tank which sits either above ground or below.

Rainwater harvesting requires a building consent and would be enforced by a condition of Resource Consent and consent notice on each title. The use of rainwater reuse and their effects on water supply demand will need to be investigated and confirmed with the council. Rainwater reuse options will be further investigated as part of the future Resource Consent application.

Rainwater harvesting can significantly reduce the amount of water supply demand from household units. Rainwater harvesting will be incorporated where possible into the proposed development during house construction.

3.4.3. Treatment Train

Section 6.12.3 of the draft ICMP provides a concept stormwater treatment train approach for greenfield developments. Whereby stormwater discharge from public roads is directed to raingardens or similar devices sized for retention only, before discharging into artificial wetlands prior to discharge into streams.

The treatment train solution proposed would be in the form of an integrated forebay, amalgamated raingarden and wetland for each catchment. This provides two step treatment and reduces the amount of maintenance required by creating one location per catchment to attend to.

A similar develpemnt was approved by Hamilton City Council adopting the below design approach.

- Baseflow enters the forebay and bypasses the raingarden to the wetland.
- Small storms equivalent to approximately a quarter of the 2-year flow (suitable to engage the infiltration and freeboard storage of the undersized raingarden (sized for 25% of normal) flow through the raingarden media and discharge to the wetland.
- Medium sized storms between one quarter of the 2-year flow and the 2-year peak flow bypass the raingarden and enter the wetland.
- Large storms greater than 2-year ARI peak flow bypass all treatment to the high-flow channel.

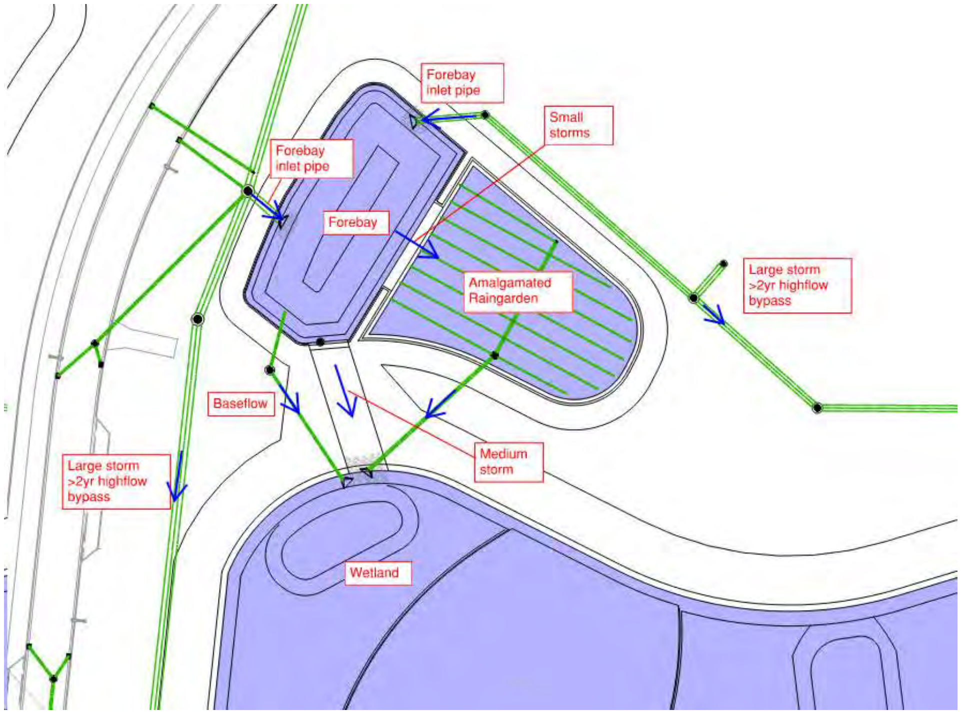


Figure 6 – Typical layout of amalgamated Raingarden in relation to the wetland and forebay as part of the Treatment train.

HCC have noted their current preference is for the consolidated/amalgamated raingarden approach above. However, roadside raingardens or swales could be used in place of amalgamated raingardens before discharging into wetlands if required.

Further information on proposed raingardens, forebays and wetlands is provided in the following sections.

3.4.4. Raingardens

As mentioned, the draft ICMP requires retention for roads provided in raingardens or similar. The raingardens or bioretention device will be sized to retain the initial abstraction depth for its catchment.

Raingardens and/or swales will also be required to provide pre-treatment when required for high contaminant load surfaces, defined in RITS as "Roads or intersections with VPD > 10,000 VPD1, zinc or copper roofs, all industrial zones and uncovered carparks over 750 m2."

The amalgamated raingardens integrated into the artificial wetlands along with the forebay as shown in figure 6 above can be explored to provide this mitigation. HCC have noted their current preference is for the consolidated/amalgamated raingarden approach above. However, roadside raingardens or swales could be used in place of amalgamated raingardens before discharging into wetlands if required as further detailed in section 3.4.6.

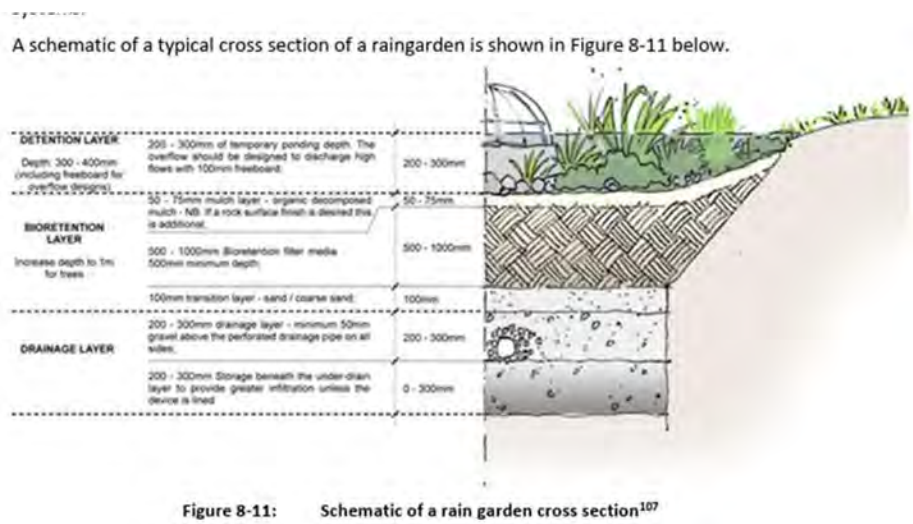


Figure 7 Excerpt from Waikato Stormwater Management Guideline, typical section of Raingarden.

The raingarden shall be designed to comply with the below requirements:

Retention

- 10mm retention of proposed road surfaces

Treatment

- Treatment of incoming flows from the roadways and potentially lot areas (including roof areas) where soakage cannot be achieved.

3.4.5. Forebay

Forebays will be sized to meet a minimum area of 10% of the artificial wetland as per RITS. WRC TR20-07 requires a forebay sized to minimum 15% of the WQV. Both RITS and WRC requirements will be achieved for each wetland. Rainfall events less than the 2year event will be directed to the forebays. The forebay will provide energy dissipation of incoming flow and minimizes erosion and scour within the wetlands.

Conceptual minimum forebay sizes based on the current catchment and wetland sizes are provided in the table below. Forebay areas will need to be reviewed and refined as required during Resource Consent and Engineering Plan Approval in accordance with RITS and WRC TR20-07.

Table 3 – Minimum forebay area

Wetland	m2
1A	229
1B	296
2A	604
2B	532

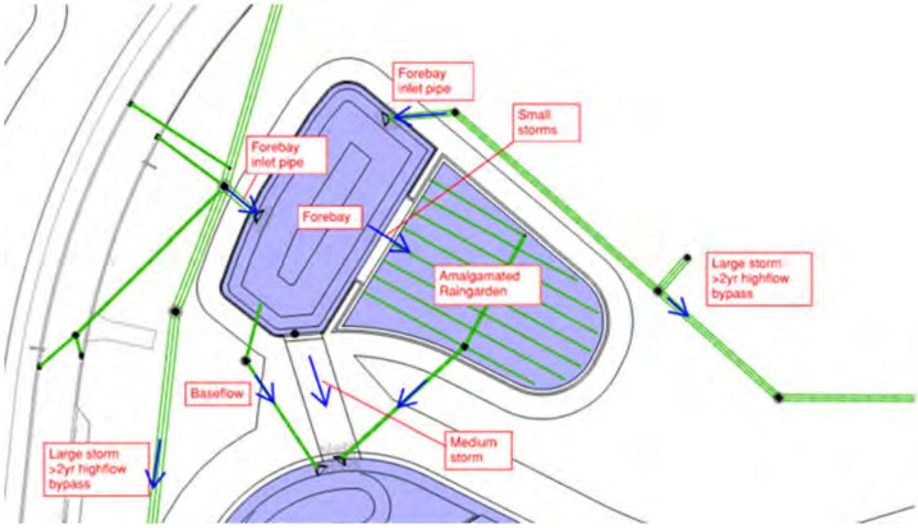


Figure 8 Typical layout forebay as part of the Treatment train.

3.4.6. Roadside Treatment Device

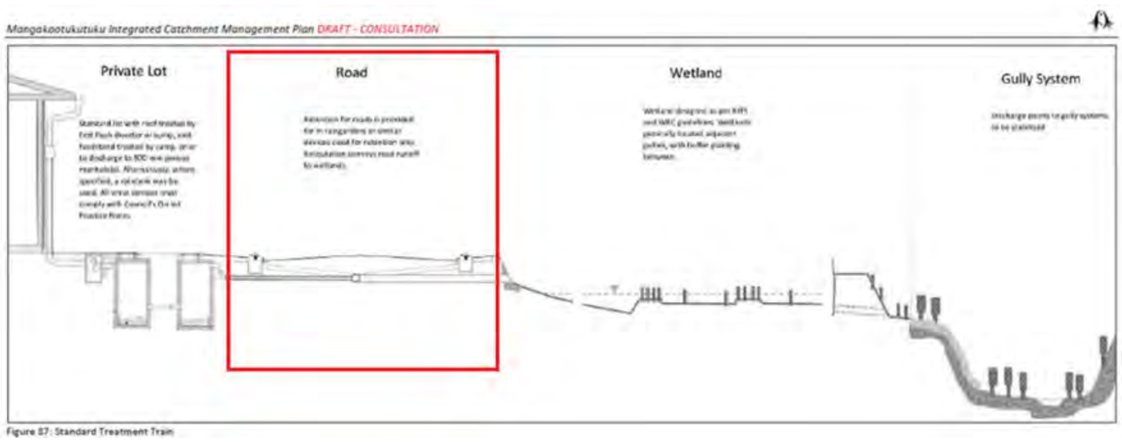


Figure 9 – ICMP excerpt.

An alternative approach to meeting the required treatment or initial flush requirements outlined in the ICMP is to implement roadside soakage, wetlands, and or raingardens. This will be in place of the amalgamated raingarden as depicted in figure 8. These options will be further investigated during the resource consent stage. By adopting these stormwater treatment options for this area it will help manage the underlying peat soils through groundwater recharge.

A similar solution was proposed for one of our recent development projects in Matamata .and we adopted roadside soakage, as illustrated below in figure 18.

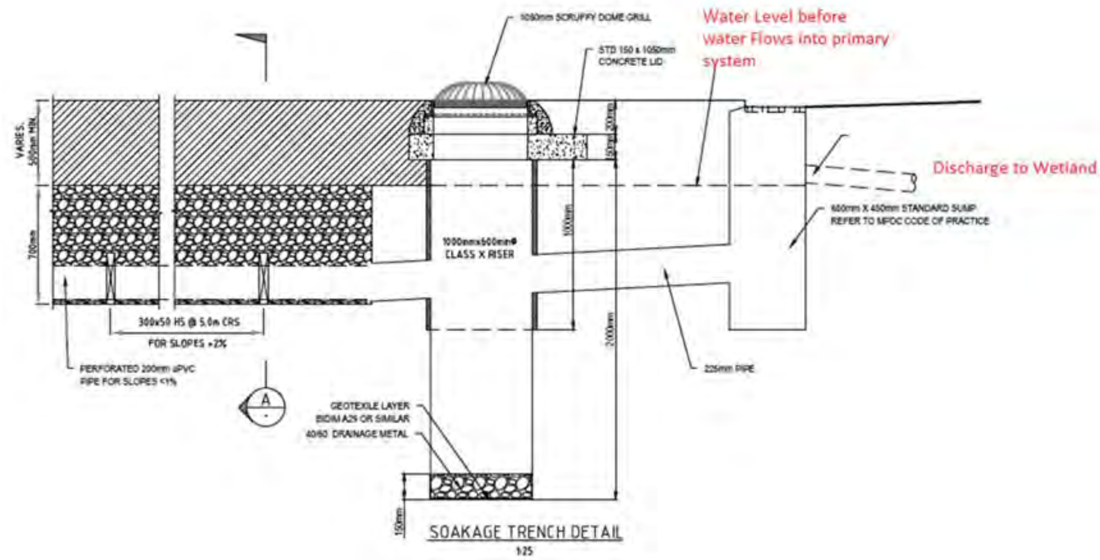


Figure 18 – Subsurface Soakage/Storage Device

The configuration allows stormwater to flow into the device via a catchpit provide pre-treatment by capturing sediment. Stormwater is then stored within the soakage trench and infiltrated into the ground beneath the trench and manhole. Flows exceeding the capacity of the soakage device will discharge out of the high flow bypass pipe outlet that would likely be connected to a primary system or it would backflow into the water and drains downstream of the Wetlands.

3.4.7. Artificial Wetlands

Wetlands will be designed in accordance with Waikato's Reginal Infrastructure Technical Specifications (RITS) and other relevant standards including TR20-06 Waikato Stormwater Runoff Modelling Guideline (TR20-06) and TR20-07 Waikato Stormwater management Guideline (TR20-07). Wetlands will provide secondary treatment (following forebay and raingardens and/or swales) and extended detention prior to discharging to the existing/enhanced stream or primary network. Wetlands will be located offline to the existing/enhanced stream, to allow upstream flows to bypass the wetland.

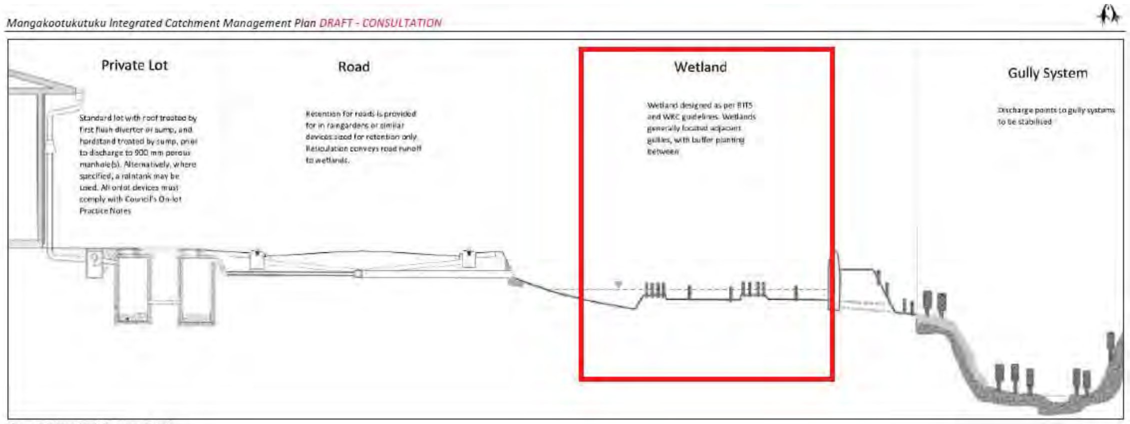


Figure 87: Standard Treatment Train

Figure 9 – ICMP excerpt.

Figure 9 above is an excerpt from the ICMP depicting the overall treatment system, the wetland requirements highlighted as being relevant to this section.

Each wetland will be sized to treat the full water quality volume (WQV) including storage and slow release of the extended detention to protect the downstream natural receiving environment.

Any rainfall event larger than the WQV ED will bypass the wetland and be directed via a high-flow bypass to the existing stream.

Wetland bathymetry will be banded and consist of a mix of deep and shallow pools to allow for dispersed flow through vegetated areas per RITS guidelines. The extended detention level or live storage zone (LSZ) will be set at a maximum depth of 0.35m above the permanent water level to support healthy plants per table 4-21 of the RITS document.

According to the TR20-07, when the impervious area for the contributing catchment is less than or equal to 70%, the wetland is to be sized at 3% of the catchment. The wetland is to be sized at 4% of the catchment once imperviousness exceeds 70%. According to the ICMP, the site is placed within a 70% impervious MPD zone (refer to section 3.2). This would suggest a 3% sizing factor may be satisfactory for the proposed wetlands. However, due to the high-level nature of this assessment, conceptual wetlands have been sized at 4% of their respective catchment. Refer to Maven's stormwater drawings for preliminary proposed catchments and wetland locations. Table 4 below provides conceptual wetland sizes for each catchment.

Table 4 – Conceptual Wetland sizes

Catchment	Catchment Area (Ha)	Wetland Area (m2) 4% of Catchment
1A	5.7	2290
1B	7.4	2960
2A	15.1	6040
2B	13.3	5320

Figure 10 below shows the proposed wetlands, enhanced streams and their associated catchments. This stormwater drawing can also be found in Appendix A.

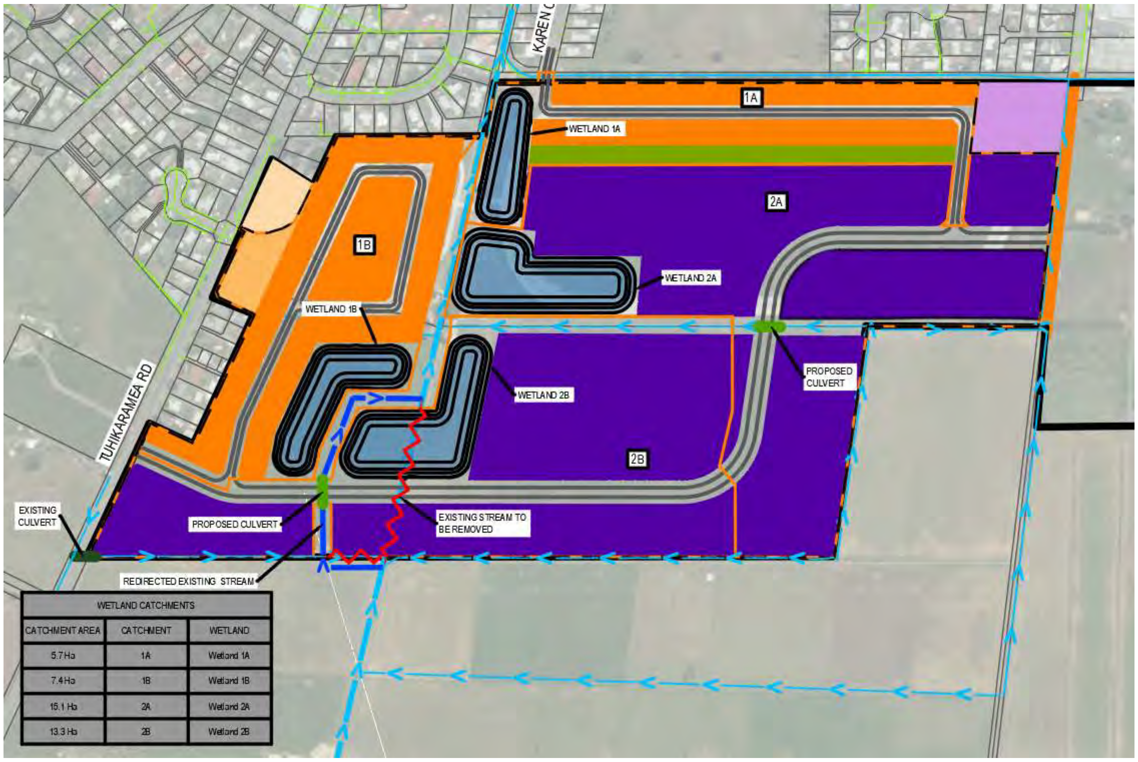


Figure 10 Preliminary Wetlands, Enhance Streams and Catchments

To achieve extended detention, an Orifice is to be designed and placed at the permanent water level within the wetland zone to allow slow release of WQV ED storage within 24hrs into the high-flow bypass. An overflow in the form of a weir or similar will be located above the WQV ED Storage level for higher flow events into the high-flow bypass. The high-flow bypass is detailed under 3.3.7 below.

The Wetlands shall be designed to comply with the below requirements;

<u>Detention/Attenuation</u>

- 2, 10 and 100 year ARI attenuation
- WQV ED Storage and slow discharge over 24hrs

<u>Treatment</u>

- WQV treatment

3.4.8. High-flow bypass (HBP)

High-flow bypasses are proposed for each sub-catchment which diverts high flows greater than the 2-year flow, up to the 100-year event around the treatment train (forebay, raingarden and wetlands) to the downstream channel/stream in accordance with RITS secondary system design section 4.2.3.4.

Each high-flow bypass includes flow splitters to divert high and low flows. Flow splitters will consist of either a manhole with a weir, or a weir structure installed within the high-flow swale. The weir height will overtop during flows larger than the WQV ED storage.

High-flow bypass swales connect to the Existing Stream with wingwalls and riprap. Open channels are HCC's preference for high-flow bypasses/secondary systems. In most cases open channels are proposed, however a few specific locations may require piping these flows.

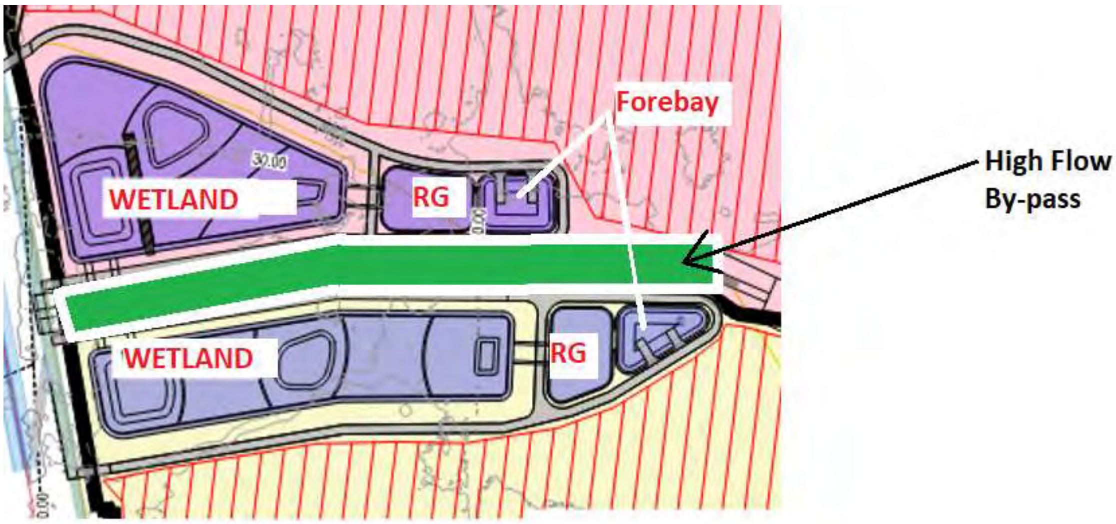


Figure 11 – High-flow By-pass as shown in Green area above.

The high-flow bypass (HBP) is proposed to include a discharge device consisting of a 2-10yr ARI orifice and weir or similar to attenuate the 2,10 and 100year flow prior to entering the stream as set out under section 3.1. During the 2,10 and 100yr rainfall events, the high-flow bypass discharge device will then enable flows to backup and enter into the wetland, utilizing the wetland for storage. This is in line with RITS guidance.

Alternatively, the channel downstream could be rehabilitated and used for storage and attenuation within the development. This is detailed further in section 6.5.2.

The Wetlands shall be designed to comply with the below requirements.

Detention/Attenuation.

- 2, 10 and 100year ARI attenuation as detailed in section 3.1

3.4.9. Discharging into Existing Streams

The proposed artificial wetlands are located adjacent to existing conveyance channels/streams within and around the development area. This will allow ease with conveyance of flow from the development area into the existing environment following treatment and attenuation. Attenuation devices located within the high-flow bypasses will release at 80% of the pre-development flow in accordance with the draft ICMP.

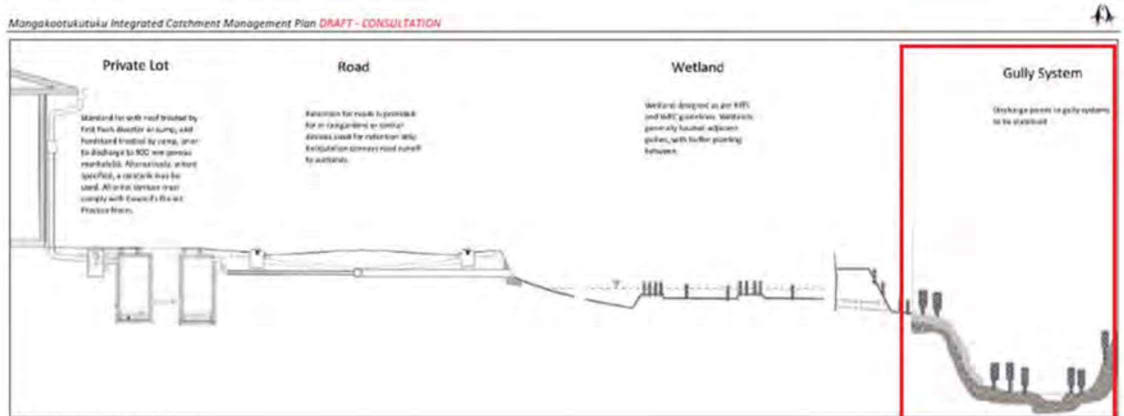


Figure 57: Standard Treatment Train

The option of using integrated raingarden and wetland as described in section 3.4.3, this requires approximately 4m level difference between the stream invert and top of wetland. Alternative treatment solutions could include roadside soakage trenches, swales or raingardens, which will help reduce the required head for water quality treatment, as detailed in section 3.4.6.

There is also the opportunity to place additional fill to achieve the level differences required. Based on this, deepening of the stream may not be required for this development stage. Further site investigations will be required, which will include surveying the existing streams and detailed modelling of the wetland and high-flow bypass is recommended, to confirm whether or not enhancement/deepening of the existing stream is required and to determine the level of filling required for the stormwater drainage.

The Rogerson block discharges into an existing shallow stream/drain with an approximate depth of 2.47m. As above, the stormwater solution will require level differences in the order of 4m, possibly less if adopting roadside soakage trenches, swales or raingardens. The existing drain discharges through a culvert approximately 1km downstream. Referring to Google view and 3 Waters GIS viewer, this drain continues downhill and discharges into the Waikato River approximately 6.5km downstream from the site. Depending on the invert level of the downstream culvert, this may limit the ability to enhance or deepen the existing channel. Therefore, it is expected this area will require the land to be infilled to achieve the required grade through the site.

3.4.10. Other means of stormwater quality treatment

In addition to the methods described above, other means of stormwater quality treatment would include:

- Restrictions around building materials (via consent notices) to ensure roofing materials are non-contaminant yielding.
- Minimisation of impervious areas within the residential lots through the promotion of permeable paving and use of propriety devices prior to discharge into the public network.
- Planting of riparian margins, wetlands, and detention basins. Protection of existing areas of vegetation where practical and possible.

These options would be expanded on further as part of any Plan Change application and would be administered through a comprehensive SMP and/or rules in the District Plan.

Subject to the inclusion of the above controls, all stormwater from site can satisfy the requirements of the relevant statutory documents outlined above.

4. Farm Drains and Existing Channels

The Rogerson block contains multiple farm drains and one main primary drainage channel traversing through the site and connecting to the Waitawhiriwhiri stream running along the northern boundary of the site.

As part of the initial stormwater strategy, this main drain will be redirected westward along the southern boundary, traversed back into the site and connect into the existing major stream approximately 200m into the site. Refer to the stormwater plan C400 in appendix A.

Some minor farm drains will be infilled to accommodate the industrial and residential development areas. Some new stormwater channels will be formed to help convey the overland flows to the artificial wetlands for water quality treatment.

The proposed wetlands are located adjacent to existing conveyance channels/streams within the Rogerson block development. This will provide ease of conveyance of flow from the development area into the existing streams through a spillway device. We have investigated the existing stream depths and levels based on Linz data and it appears that most of the existing streams are between 1-2m in depth along these channel drain within the site. In their current state, this will restrict attenuation and flood storage ability for the adjacent catchment.

See below table showing depths available for each catchment based on the available LINZ data of the area.

Table 5 –Existing Stream vs Wetland Levels

Catchment	Area (Ha)	Ex Stream IL	Wetland Top Level	Elevation Difference
1A	5.7	33.78	36	2.22
1B	7.4	34.33	35.31	0.98
2A	15.1	34.5	36.2	1.7
2B	13.3	34.33	35.8	1.47

The integrated forebay, raingarden and wetland require approximately 4m level difference between the stream invert and top of wetland. According to the above data, no sub-catchments are considered to have enough depth, with the majority failing to meet the minimum depth required.

Based on the investigation above, to allow treatment, storage and attenuation within the proposed wetlands and high-flow bypass areas, an option to resolve this would be to deepen the existing streams. Another option would be to infill the land adjacent the streams to achieve the grade required or a combination of the two options.

Achieving the required height, depth or head from top of proposed wetlands to the invert level of the stream would allow the wetlands to be sized based on 4% of the attributing catchment areas. However, if the existing streams were to remain unaltered, the use of very large and shallow flood storage wetlands/basins or tanks would be required to achieve the required attenuation storage.

If existing streams were to be altered by deepening them, further investigation would also be required to determine whether the streams should also be widened. A greenway as proposed for the residential area it could be furthered investigated, as this would further enhance the existing stream , however given the limited space in this development this may not be feasible.

5. Catchments

The Rogerson block is split into four main catchment areas as detailed in the table below. The catchment areas have been delineated by the existing streams and the proposed landform. HCC have advised their preference is to consolidate the wetland catchment areas as much as possible, which we have taken this into consideration for our design.

Table 6 –Catchment Areas

Catchment	Catchment Area (Ha)
1A	5.7
1B	7.4
2A	15.1
2B	13.3

The proposed catchments are preliminary in nature and are only based on the available information at the time. The catchments areas will be refined to suit the future development layouts, for the detailed design.

Most catchments sit within a low-lying flat farmland with existing grades ranging between 0.05 to 0.5%. It is recommended these flat areas be partially raised as needed, to provide sufficient gradient to allow stormwater and wastewater gravity systems to service the site and to help reduce the need for pumping.

6. Flooding

Catchment modelling has been undertaken to provide input into the structure planning exercise. This modelling has confirmed the extent and location of flooding and overland flow within SL1 (Figure 12).

The following sections provides a summary on the flood modelling completed, investigates the known or assumed downstream constraints before outlining a high-level development framework, which will enable the future development of the areas.

6.1. Modelling Summary and Methodology

HEC HMS was used for the hydrology and HEC RAS was used to model flooding as part of the SL1 overall development area. The Rogerson block forms part of the overall SL1 area. The modelling confirms the extent, location, flow, and depth of flood waters. The Existing flood assessment was modelled by Golovan in 2021. Maven was provided with the raw data of the mentioned model and have carried out assessment based on this data.

The existing terrain has been revised for the flood modelling, since the original assessment was done, with new LINZ data added for the Rogerson block area. The new results from HEC-RAS were consistent with the previous model.

No survey or drone data was available for the Rogerson block area. However newLINZ data was used to provide a high level analysis and to help establish the existing flood scenario for the Rogerson block area.

6.2. Existing Flooding within Rogerson Block

The flood result below (figure 12) indicates flooding throughout the proposed Rogerson block area, particularly around the low-lying areas, specifically within the existing horse racecourse area. The two main conveyance channels in the area, are the Waitawhiriwhiri stream and the existing stream that runs through the site both play a critical role in directing the flood waters downstream, north of the site through the main Waitawhiriwhiri stream.

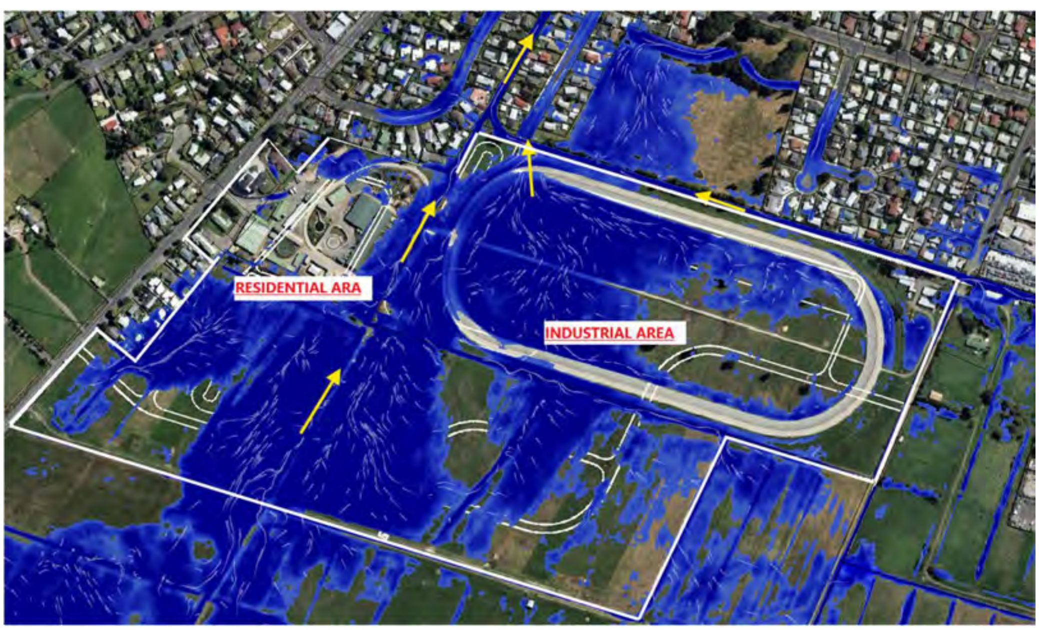


Figure 12 – Pre-Development Flood Modelling

6.3. Downstream Flooding

It is expected that downstream flooding will increase with the proposed development, considering the increased impervious areas created within the site. This will be further investigated at the Resource Consent stage.

Further survey and assessment within and downstream of the development is required to fully understand the downstream conditions and to determine any site constraints.

Further assessment is also required downstream of the site. This will include identifying downstream exit points and establishing existing overland flow downstream from this development

Sensitivity analysis of the overall flooding analysis would be required once detailed plans and levels have been established.

6.4. Downstream Flood Mitigation Solutions

To avoid any downstream flooding effects, flood mitigation will be required in support of the future development of the Rogerson block development. Post-development run-off from the development areas will require attenuation of peak flows from the site to 80 % of the pre-development level for storm events up to 100-year ARI (average recurrence interval). Subject to this, there will be no downstream flooding effects.

As detailed in section 3 of this report, the 100year ARI flow rates is proposed to be attenuated within the proposed wetlands and high-flow bypass areas. Alternatively, the attenuation could be provided within the wetlands and rehabilitated stream as detailed in section 6.5.2.

There is also the option to deepen the existing stream downstream or infill lands adjacent existing streams in order to minimise the size of the wetlands and/or storage basins when allowing for attenuation of the 100yr event which will also maximise land-use for private properties.
Existing flood hazards will need to be mapped and detailed, as part of any future plan change process. Resource consents will be required for any earthworks within the flood plain/flood prone areas. Applicants will need to demonstrate that the development allows for the existing flood plain volume and that there will be no adverse upstream or downstream effects.

6.4.1. Minimum Floor Levels

Floor level requirements in relation to floodplains will be set through rules in the future District Plan. Minimum floor levels freeboard) over the 100-yr flood level will be required for all habitable buildings in accordance with the recommendations provided below:

TABLE 7: MINIMUM FREEBOARD REQUIREMENTS

Freeboard	Minimum Height
Vulnerable Activities	500mm
Les Vulnerable Activities	300mm

** Vulnerable activities defined as residential activities*

** Less vulnerable activities defined as commerce, industry, and rural activities*

All future freeboard clearances shall be in accordance with the criteria stipulated above and would need to demonstrate compliance with Building Code E1 – Surface Water as required.

6.4.2. Mitigation Strategy

Flood volumes and flows/runoffs are proposed to be managed either within each wetland or by using both wetland and the enhanced existing streams if this proves more efficient in terms of use of space and wetland sizing. These two options have been described in more detail below.

Option 1 – Within artificial wetlands only

This option utilizes the wetland footprint and high-flow bypass to provide flood storage and attenuation. The high-flow bypass would include a discharge device to limit flows entering the downstream channel. During a flood event, water backs up into the high-flow bypass and wetland and provides the overall storage required. Attenuation and flood storage will be isolated to each catchment and discharge to the existing streams running through the development, will be limited to 80% of the 1:100-year pre-development flow.

As mentioned in section 4, the existing stream is subject to further investigation at further detailed design and may require to be deepened or the land raised either side of existing streams to allow for stormwater attenuation.

Option 2 – Within artificial wetlands and enhanced streams

The second option is the use of enhanced or rehabilitated streams/channels. The existing stream would be both widened and deepened to allow attenuation and flood storage within both the stream and adjacent artificial wetlands. In this option, the rehabilitated stream would become a greenway swale This will provide attenuation by way of using both wetlands and the swale/stream as storage, with an attenuation orifice located at the downstream end of the development to ensure discharge leaving the development is limited to 80% of the 1:100 year pre-development flow. This option provides attenuation and flood storage for the whole site rather than per each catchment as per option 1.

6.5. Flooding Summary

Subject to the future development complying with the above mitigation, there will be no adverse downstream effects from the Rogerson block development area. Additional investigation and detailed design are required to refine the preferred solution as part of any future resource consent or plan change approval.

Figures 12 below illustrate the pre -development model outputs during the 100 year ARI storm. As mentioned in section 6.1, further assessment will be required once confirmation of local roads, development layout and grading has been established to allow for actual conveyance in the model and provide better clarity.

7. Overland Flow paths

Future development of Rogerson block will need to consider and allow for the modelled overland flow paths up to and for the 100-yr cc event.

7.1. Overland Flow paths – Options Assessment

An options assessment has been undertaken to establish the best practical design criteria for the overland flow path design in support of SL1 and this development. These options include:

- Retention and protection of existing overland flow paths through the development area, ideally within green corridors where the overland flow doubles as watercourse.
- Maintaining the flow of OLFPs up to the 100yr cc ARI rainfall event under the maximum probable development scenario.
- Directing all internal OFLPs within the proposed roading network, where possible.
- Piping of upstream OLFPs through the development site.

7.2. Overland Flow paths – Best Practical Option

The best practical option to mitigate OLFP effects is as follows:

- Retention of natural OLFPs where possible (and practical). Emphasis is provided on the OLFPs which correlate to intermittent or permeant streams within the development area.
- Maintaining the flow of OLFPs up to and for the 100yr cc ARI rainfall event under the maximum probable development scenario.
- OLFPs are to be designed where possible within the roading network and discharge into the stormwater devices or existing watercourses (green corridors).
- Minimum freeboards for habitable buildings to be provided as per below:
    - 500mm freeboard for OLFP flow rates above 2m3/s.
    - 500mm freeboard for OLFP less than 2m3/s with average flow depths of 100mm when inundation is against the building.
    - 150mm freeboard for OLFP less 2m3/s
- Resource Consents will require the provision of a depth-velocity assessment to indicate that the hazards associated with OLFPs within the road reserves are minor, with safe passage of vehicles and pedestrians within the road reserve in accordance with best practice guidelines.

8. Conclusions

The proposed stormwater management plan utilises a treatment train approach, incorporating soakage, raingardens, swales and wetlands to manage post development flows within the Rogerson Block.

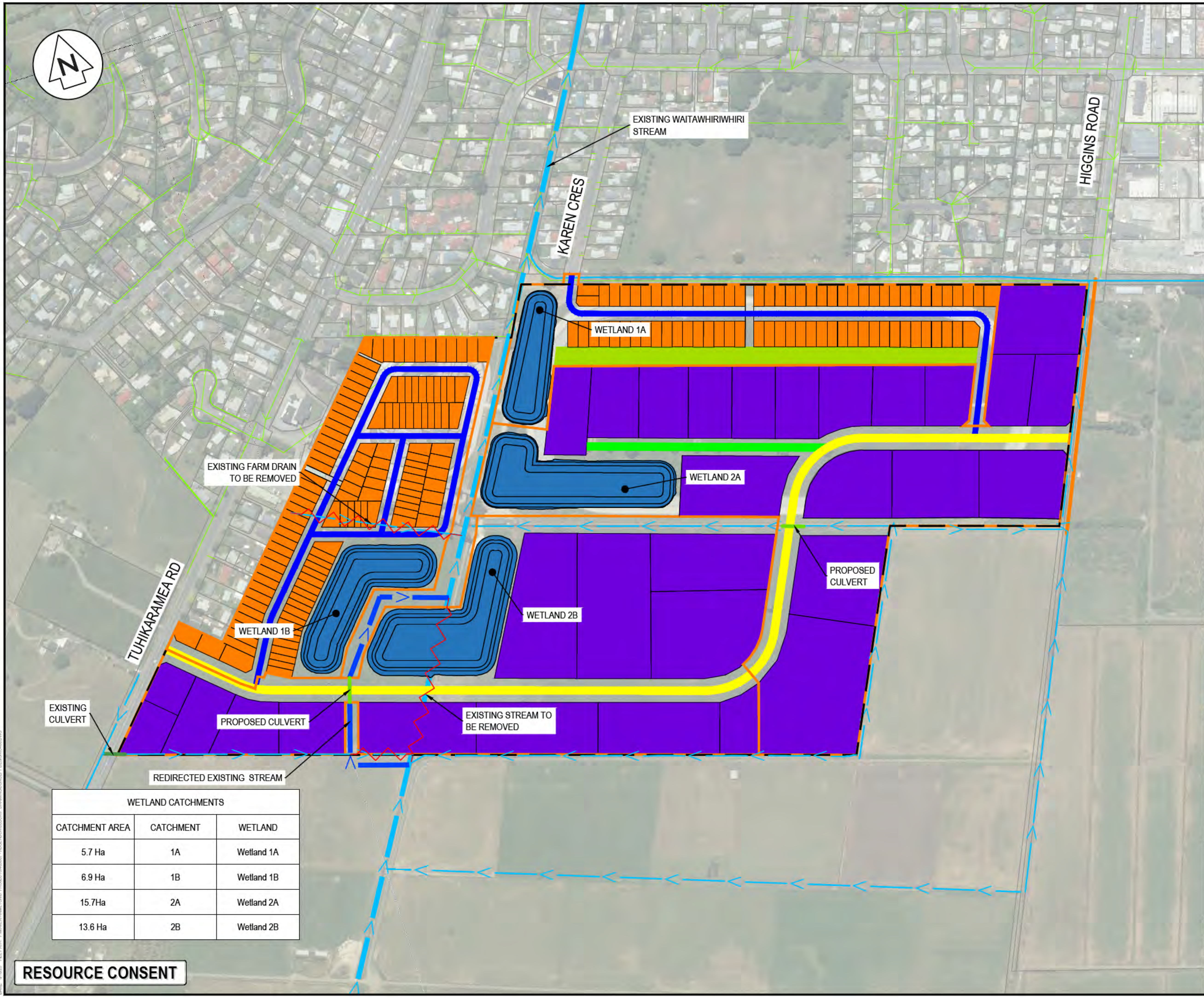
For stormwater quantity and flowrate control, the Existing streams may require enhancing through deepening or widening it. alternative solution is infilling of adjacent catchments to provide required level difference as indication in sections 3 and 4. Treatment options to be considered includes amalgamated raingardens or roadside stormwater devices.

Stormwater flowrate control and required Storage for stormwater mitigation purposes will be provided through the proposed artificial wetlands and upstream stormwater devices.

A detailed survey of the site will be required to refine these strategies. further refinement of both hydraulics and hydrological modelling is required as well to validate proposed strategies for resource consent purposes.

Lastly, what has been provided in this high level stormwater management plan, should provide guidance for Rogerson block development so it aligns with local government guidelines and standards for stormwater, available at the time of this report.

Appendix A – Stormwater Plans



WETLAND CATCHMENTS		
CATCHMENT AREA	CATCHMENT	WETLAND
5.7 Ha	1A	Wetland 1A
6.9 Ha	1B	Wetland 1B
15.7Ha	2A	Wetland 2A
13.6 Ha	2B	Wetland 2B

RESOURCE CONSENT

LEGEND

- EX BDY
- SITE BOUNDARY
- PROP 27.8m INDUSTRIAL ROAD
- PROP 20.0m INDUSTRIAL ROAD
- PROP 16.8m RESIDENTIAL ROAD
- CATCHMENT BOUNDARY
- EX WATERCOURSE
- EX MAJOR WATERCOURSE
- PROP WATERCOURSE
- PROPOSED INDUSTRIAL
- PROPOSED RESIDENTIAL
- PROPOSED SWALE

Rev	Description	By	Date
C	FAST TRACK APPLICATION	TCH	06/2025
B	FAST TRACK APPLICATION	TCH	05/2025
A	DRAFT	NAK	02/2025

	By	Date
Survey	LINZ	
Design	TH	02/2025
Drawn	NAK	02/2025
Checked	DJM	05/2025

Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
ROGERSON BLOCK FOR GRAEME ROGERSON AND DAVE MACPHERSON

Title
PROPOSED STORMWATER DRAINAGE

Project no.	403001
Scale	1:4000 @ A3
Cad file	C400.DWG
Drawing no.	C400
Rev	C

Appendix D – Wastewater Calculations

Maven Associates	Job Number 403001	Sheet 1	Rev B
Job Title: Hamilton South Links - Rogerson Block Calc Title: Rogerson Block - WW Demand Calc	Author TH	Date 13/05/2025	Checked MS

As per Waikato Local Authority RITS standards

Domestic Average Daily Flow (Water Consumption)=	200	*l/person/day*
Infiltration Allowance=	2,250	*l/Ha/day*
Surface Water Ingress=	16,500	*l/Ha/day*

Refer to C450-1 for catchment details

No. of residential dwellings =	**200**		Based on 300m2 per lot
Catchment area =	**6.0**	*Ha*	
Total Population	270		
Wastewater Peaking factor as per Table 5-2=	4.0		

Using a population value person (max development scenario)

Average Daily Flow (ADF)=	67.50	*m³/day*
Peak Daily Flow (PDF)=	2.66	*L/sec*
Peak Wet Weather Flow (PWWF)=	**3.80**	*L/sec*

Pipe Ks (uPVC) = 0.60

PWW Flow *l/s*	Pipe dia *m*	Gradient *%*	Capacity *l/s*	Velocity *m/s*	Check *OK*
3.802	0.15	1.00	**17.96**	1.02	OK

Appendix E – Water Supply Calculations

Maven Associates	Job Number 403001	Sheet 1	Rev B
Job Title: Hamilton South Links- Rogerson block Calc Title: Residential - Water Demand	Author TH	Date 13/05/2025	Checked TH

Water Catchment

As per RITS Standard 6.2.3		4	people per dwelling
	Demand	260	l/person/day

Demand Rates

Average Demand =	260	litres/person/day
Peak Demand (5x) =	1300	litres/person/day

Population	Dwellings	People	Occupancy
Proposed Dwellings	200	4	800
Commercial Unit (0.95ha x 45 person per ha)			0
Total			800

Demand	Persons	Rate l/p/day	Flow l/s
AD Water	800	260	2.41
PD Water	800	1300	12.04

Peak Demand	Persons	Rate l/p/day	Flow l/s
PD Water	800	1300	**12.04**

Appendix F – CMW Geotechnical Desktop Review

Dean Morris

From: Ben McKay s 9(2)(a)
Sent: Monday, 4 March 2024 5:20 pm
To: Kelliher, Dillon; Alicia Lawrie; Dean Morris; Cameron Inder; Dol, Robert; Fraser McNutt
Cc: Kori Lentfer
Subject: #HAM2024-0017 - Southern Links SL1 - Meeting Summary

Hi Team

Nice to meet you all earlier.

To outline what was discussed earlier in the meeting regarding the Southern Links SL1 development area from a geotechnical POV:

- The development area consists of 3 major soil units:
  - Hinuera Formation - alluvial plains deposit – over low lying areas, comprised sands and silts of varying strength.
  - Recent Peat – wetland area deposit – widespread wetland and paleochannel deposits, comprised wet and muddy peat, estimated to be up to 6m deep over development area. Overlies Hinuera Formation.
  - Walton Subgroup –volcanic deposits comprising silt and clay mixtures, typically high strength. Can be sensitive if over trafficked. Forms low hills. Underlies Hinuera Formation.
- The major geotechnical challenges posed by the site area:
  - Peat, which is susceptible to static settlement, has been mapped over approximately 75% of the development area.
    - This will require either removal and replacement with engineered fill, or preloading by use of temporary surcharge fills to induce consolidation of peat material, in order to mitigate the risk of settlement under future building/traffic loads.
    - Based on our recent experience working with the peat at Temple View, preloading peat material with overburden materials (such as site-won silts/clays/sands) is an effective way to reduce settlement magnitude to acceptable levels.
      - Using preload that is ~50% of the thickness of the compressible soils to be treated has resulted in necessary consolidation occurring within 9-12 months. Similar rates of consolidation are expected within the peat materials identified in the SL1 area, however this is to be determined during specific preload design.
      - Subsoil drainage network or granular fill drainage blankets will be required to allow groundwater pressure dissipation during preloading.
      - Wick drains may be used to speed up the consolidation process, however these can be expensive to install.
  - Hinuera Formation soils, which are susceptible to liquefaction-induced settlement/lateral spread under ULS design seismic loading, has been mapped over approximately 75% of the development area beneath the peat and in some areas at the ground surface.
    - Based on current CPT data, liquefaction-induced vertical settlement has been estimated up to 160mm (without any aging/pumice content factors).
      - For residential development purposes, this is equivalent to a TC2/3 hybrid categorisation. Dwellings in these areas would require ground improvement and TC2 level waffle slab foundations.
      - For infrastructure and roading, this would need consideration during design.
- A gap analysis of the geotechnical investigations will be provided as part of the desktop geotechnical report for the SL1 area.

I had a chat to the team who worked on the recent Temple View development in peat materials, and they advised that shallow swales were used for stormwater storage/soakage for the development areas in peat for that project. Ponds were proposed, but there were significant challenges around long-term pond stability when constructed within peat material. Shallow swales take up more area than ponds, but have less batter stability issues when constructed in the surficial peats.

CMW actions are:

- We will provide screengrabs of the 3D model that has been developed to date and distribute to the project team.
- Confirm if shapefile of peat contour plan can be sent to Alicia.
- CMW to receive green/brown map of development area.

Any questions, please let me know.

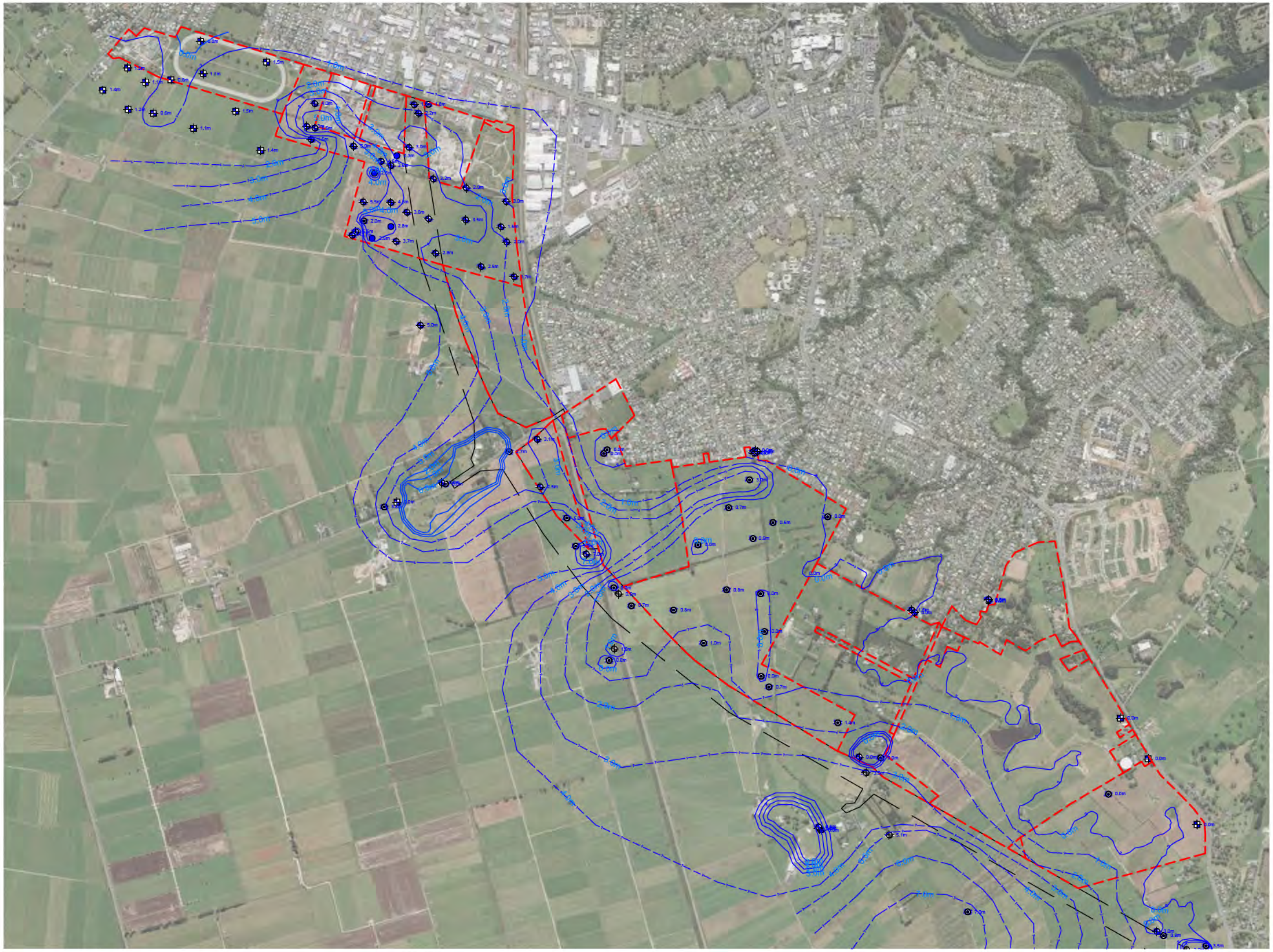
Cheers

Ben

Ben McKay | Project Geotechnical Engineer

Phone: s 9(2)(a) **Mobile:** s 9(2)(a) **Email:** s 9(2)(a)
Website: www.cmwgeosciences.com

CMW Geosciences
Great People | Practical Solutions



LEGEND:

HA01	HAND AUGER (HA, HA-DCP, Other) LOCATION
BH01	DEEP MACHINE BOREHOLE (BH) LOCATION
CPT01	CONE PENETROMETER TEST (CPT) LOCATION
TP01	TEST PIT (TP) LOCATION
DCP01	DYNAMIC CONE PENETROMETER (DCP) LOCATION
	SOUTHERN LINKS (SL1) LAND HOLDINGS BOUNDARIES
	PROPOSED SOUTHERN LINKS DESIGNATION
?	PEAT DEPTH CONTOURS

NOTES:

1. SITE BOUNDARIES ADAPTED FROM INDICATIVE LAND OWNERSHIP PLAN SUPPLIED BY THE CLIENT.
2. AERIAL IMAGE COURTESY OF HCC ONLINE MAPPING SERVICES.
3. HISTORIC TEST LOCATIONS SOURCED FROM NZGD DATABASE AND ARE INDICATIVE ONLY.
4. PEAT DEPTH CONTOURS AT 1m INTERVALS.

0 200 400 600 800 1000 m

1:20 000

CMW Geosciences

CLIENT: COLLIERS PROJECT LEADERS LIMITED	DRAWN: BM		PROJECT: HAM2024-0017
PROJECT: SOUTHERN LINKS DEVELOPMENT	CHECKED: MM		DRAWING: 02
	REVISION: 0		SCALE: 1:20000
TITLE: PEAT CONTOUR PLAN	DATE: 01/03/2024		SHEET: A3 L

C:\Users\BenMcKay\CMW Geosciences Pty Ltd\Hamilton Office - HAM2024-0017 Southern Links Geotechnical Assessment\Drawings\HAM2024-0017_(BM Edits Rev B)_Southern Links_Overview Plan.dwg

3 June 2021 Document Ref: HAM2021-0035AA Rev 2

Maven Associates Ltd
Level 2, Garden Place,
Hamilton

Attention: Jon Crooks

Dear Jon,

RE: GEOTECHNICAL DESKTOP REVIEW
PROPOSED SOUTHERN LINKS 1 SUBDIVISION DEVELOPMENT, HAMILTON

1 SCOPE

We are pleased to present our geotechnical desktop review for the proposed Southern Links 1 (SL1) development area located on the southwestern outskirts of Hamilton, as shown on the attached B & A, Urban & Environmental plan. We understand that this report will be used for initial information purposes only.

This report identifies the approximate distribution of prevailing landforms and geologies for the local area, typical geotechnical challenges associated with subdivision development on those landforms and presents strategies to mitigate hazards by further geotechnical investigation and design.

2 LANDFORM

The SL1 development area comprises a circa 500ha block of land having a northwest to southeast orientation spanning from Dinsdale in the north to Rukuhia in the south.

Apart from some areas of rolling hill topography in the southeast and isolated elevated terraces, most of the site comprises locally low-lying land that was once a peat bog in pre-European times. The peatlands have been progressively drained for farming.

Existing contour data within and adjacent to the site is shown on the attached ***Drawing 01.***

3 PROPOSED DEVELOPMENT

Based on our discussions we understand the proposed plan change involves the redevelopment of both the low-lying land and elevated hills for industrial and residential purposes with associated neighbourhood centres, school, reserve/open space areas, roading and infrastructure.

A number of stormwater attenuation wetlands areas are proposed.

4 TYPICAL GEOHAZARDS & MITIGATION STRATEGIES

Landform	Geology[1]	Liquefaction	Slope Stability	Earthworks	Building Foundations
Rolling hills	Walton Subgroup - Pleistocene age volcanic soils. Typically comprise mantle of Hamilton Ash (clays) overlying weathered ash (Kauroa Ash) and weathered alluvial clayey silts, silts and sandy pumiceous silts (Puketoka Formation)	Low to very low risk due to geological age and soil fabric (fine grained cohesive) requiring no specific mitigation.	Inherently stable for slopes <25 degrees to horizontal. Cut and fill batters graded at 1:2.5 (vertical to horizontal) subject to drainage.	Upper Hamilton ash suitable for earthworks borrow, underlying ashes sensitive, wet and difficult to earthwork. Not suitable for in-ground stormwater soakage.	Typically adopt conventional NZS3604 foundations designed in accordance with building code amendment 19 for residential housing in Hamilton ash, shallow footings for industrial and 1 to 2 level commercial buildings. Raft foundations in underlying sensitive silts due to reduced bearing capacity.
Terraces	Hinuera Formation - alluvial fan deposit of cross bedded pumiceous and rhyolitic silts, sands and gravels, with minor organic layers.	Moderate risk where high water table and sandy soils requiring specific geotechnical investigation and analyses.	Seismic stability issues where liquefaction risk is identified requiring possible setbacks from open drains and ponds or ground improvement.	Groundwater typically 1m to 3m below ground surface, upper 1m to 2m of silts can be sensitive to earthworks. Typically, suitable for in-ground stormwater soakage.	Liquefaction risk typically demands TC2 or TC3 raft foundations for residential buildings, shallow footings for industrial and 1 to 2 level commercial buildings.
Low-lying Plains *	Holocene Alluvium - recent soft and compressible peat, alluvial clay and sand deposits of the Piako Subgroup. The Peat is described as soft, dark brown to black, organic mud, muddy peat or woody peat. Typically overlies Hinuera or Walton Subgroup.	Low risk in peat, moderate risk in underlying sands where underlain by Hinuera Formation.	Poor foundation for fill embankments, requires shear key undercut and / or geogrid reinforcement, 1:3 graded batters. Requires temporary support for trenching works.	Groundwater near ground surface, not suitable as borrow material or stormwater soakage. Construction of fill embankments induces large settlements, typically requires drainage blanket and pre-loading to support future development or undercut and replace where shallow.	Either pile foundations beyond base of peat or construct min. 1.5m thick structural fill raft and pre-load to induce ground settlement. Typical pre-load heights 2m to 3m with settlement hold period of 6 months subject to peat thickness. TC2 raft foundations.

Note: * refer to Section 5 below for further detail on development over peat soils

[1] Edbrooke, S.W. (compiler) 2005. Geology of the Waikato Area. Institute of Geological and Nuclear Sciences 1:250,000 Geological Map 3. 74 p.

5 DEVELOPMENT ON PEAT SOILS

The low-lying plains are dominated by peat soils and it is anticipated that placement of bulk fill will be required to raise ground levels above flood levels.

Based on the results of our recent geotechnical investigations where up to 6m of peat was present at the Temple View eastern development located just to the west of the SL1 area, we consider that residential and industrial development over the SL1 peat soils is feasible. The geotechnical design approach is documented in our Geotechnical Interpretive Report (GIR) ref. HAM2016-0001AA Rev.0 dated 21 October 2015, which is publicly available on the Hamilton City Council website.

It must be noted that the peat soils in particular present a number of challenges that will demand that an appropriate level of geotechnical design, management and construction observation is implemented to produce building platforms that perform to code requirements. The Temple View GIR provides significant detail on the design approach for residential development over peat and includes recommendations as follows:

- The low-lying land is underlain by soft and compressible peat soils that will exhibit significant settlement in response to the proposed placement of the overlying fill raft. Specific underfill drainage, temporary pre-loading and settlement monitoring, under the direction of the project geotechnical engineer, will be required to help limit post construction ground settlements;
- Preload design must take into account both primary and secondary creep settlement magnitudes projected over the appropriate design life of proposed structures and infrastructure including roads and buried services;
- Lightweight buildings across the treated low-lying peatland areas will require raft foundations that are designed to accommodate total and differential long term ground settlements. Foundations for larger structures will require specific design with geotechnical input.

6 LIMITATION

The preliminary information contained within this report is based on a high-level desktop study of published maps and previous geotechnical investigations. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, can it be considered that these findings represent the actual state of the ground conditions away from the investigation locations.

Given the farming history of the area being assessed, previous uncontrolled earthworks may also be present across parts of the site that have not been identified in this initial high-level review. Similarly, soil contamination potential has not been considered as part of this review.

This report has been prepared for use by Maven Consultants in relation to the SL1 Project to be used for internal information and preliminary guidance purposes only. It is not suitable to support any future plan change or resource consent application process. No other warranty, expressed or implied, is made as to the professional advice included in this report. Use of this report by parties other than Maven Consultants and their respective consultants and contractors is at their risk as it may not contain sufficient information for any other purposes.

For and on behalf of CMW Geosciences

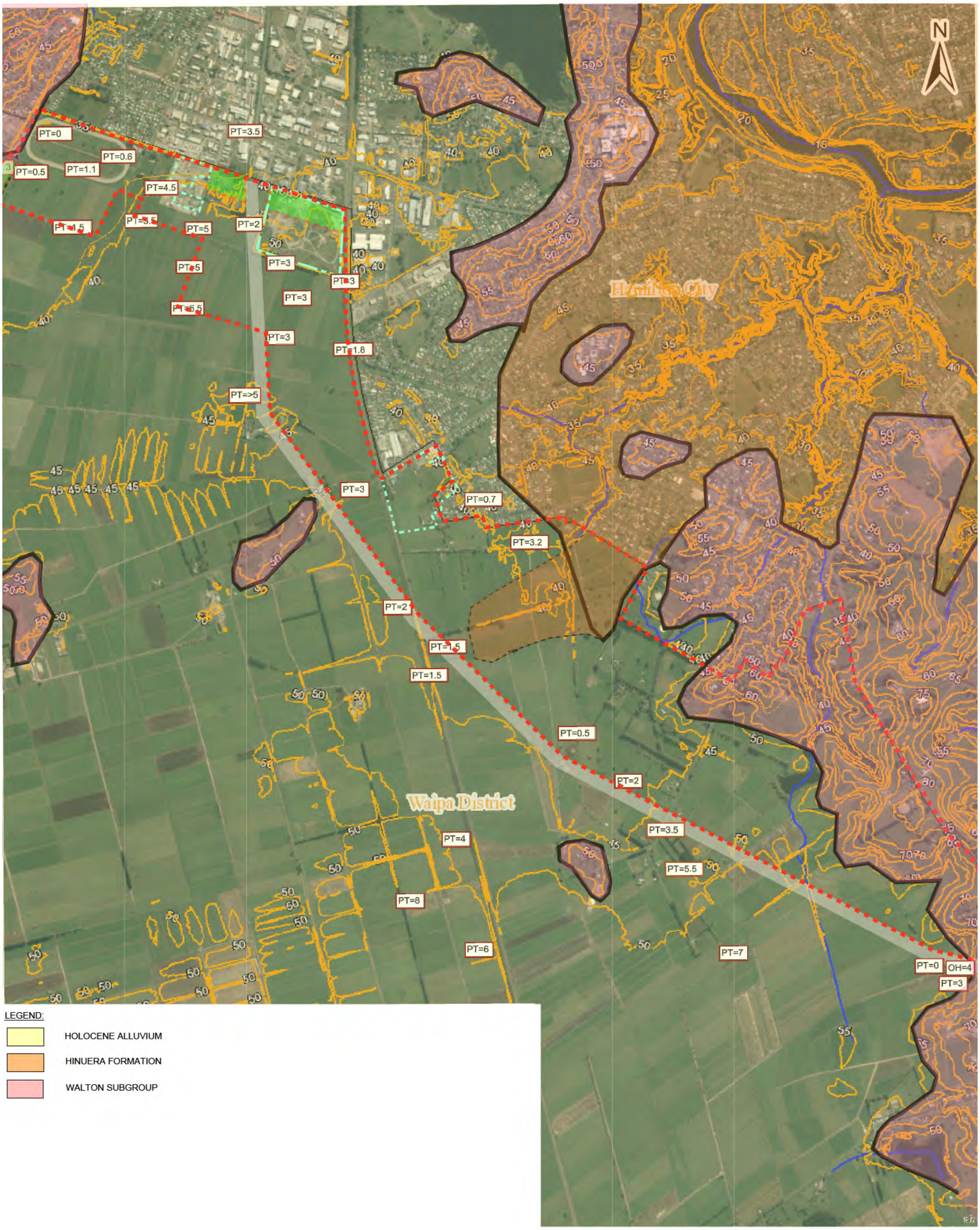
Prepared by:	Reviewed and authorised by:
Lance Knauf	Kori Lentfer
Projecting Engineering Geologist	Associate Engineering Geologist

Attachments: Drawing 01: Desktop Plan

B&A Urban & Environmental SL1 Structure Plan

Distribution: 1 electronic copy to Jon Crooks via email

Original held at CMW Geosciences



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1:20 000

NOTES:

1. BASE PLAN ADAPTED FROM WAIKATO REGIONAL COUNCIL MAPS.
2. CONTOURS ARE IN 5M INTERVALS.
3. GEOLOGICAL AND PEAT DEPTH LOCATIONS ARE APPROXIMATE ONLY.

CMW Geosciences

CLIENT: MAVEN ASSOCIATES LTD		DRAWN: LK	PROJECT No: HAM2021-0035
PROJECT: SL1 PROJECT HAMILTON		CHECKED: KL	DRAWING: 01
		REVISION: 2	SCALE: 1:20,000
TITLE: SITE GEOLOGY PLAN		DATE: 03/06/2021	SHEET: A3P

Appendix G – WGA Hydrogeological Desktop Review

WGA

WALLBRIDGE GILBERT AZTEC

Maven Associates Limited
Level 2, 11 Garden Place
HAMILTON NZ 3204

19/05/2021

PROJECT NO. WGA210896

Attention: Jon Crooks

Dear Jon

HYDROGEOLOGICAL ADVICE ON POTENTIAL FOR GROUNDWATER SUPPLY MANGAKOTUKUTUKU, SOUTH WEST, HAMILTON.

Maven Associates Limited have engaged Wallbridge Gilbert Aztec (WGA) to prepare a high-level desktop assessment on possibilities for bore water supply to a potential suburban development area (Mangakotukutuku) together with comments on potential issues, constraints, and opportunities. This letter outlines our findings from this high level review of available information.

1. GEOLOGICAL AND HYDROGEOLOGICAL SETTING

Hamilton Basin, a large tectonic basin centred on Hamilton City with an area of approximately 2,000 km^2 and traversed by the Waikato River. The basin is surrounded by ranges of Mesozoic (Manaia Hill Group) and Tertiary age (Te Kuiti and Waitemata Groups) rocks. At depth, basement greywacke underlies the sedimentary deposits that infill the basin (GNS 2005).

The basin is infilled with Tauranga Group alluvial sediments dating from the Pliocene to the middle Holocene, overlain by late Holocene unconsolidated alluvial and colluvial sediments. The Tauranga Group sediments are up to 300 m thick and include gravels, sands, silt, muds and peats of fluvial, lacustrine and distal ignimbritic origin. The Hinuera Formation of the Tauranga Group underlies much of the Hamilton basin. This formation was deposited by braided river systems of the Waikato River, initiated by the supply of large volumes of sediment from volcanism in the Taupo Volcanic Zone (Petch 1987). Overlying the Hinuera Formation sediments in the Mangakotukutuku area is peat of the Rukuhia Bog. Underlying the low hills are older ignimbrites, tephra fall deposits and alluvium (Figure 1; Lowe 2010).

The Hinuera Formation contains the aquifers used most extensively for water supplies across the Hamilton Basin. Within this formation, the most productive aquifers consist of well sorted coarse sands and gravels. Discontinuous sequences of rhyolitic and pumiceous gravelly sands and gravels are interspersed with pumiceous silt, clay and peat layers. Lithological variability generally results in a number of zones of higher permeability within the formation rather than a single, continuous aquifer (Figure 1; Schofield 1972). The upper layers contain perched aquifers, which can dry out over the summer period and will drain to the closest gully system.

Literature values for the hydraulic conductivity of sediments in the Hamilton Basin range from 0.5 m/day in the silts and peat layers to 13.5 m/day in the course gravelly sands. Aquifer transmissivity values derived from pumping tests range from 10 m^2/day to 1,000 m^2/day but are usually less than 100 m^2/day. The deeper aquifers have variable aquifer properties and local pumping tests have resulted in transmissivities calculated at between 20 m^2/day and 300 m^2/day. Storativity values vary from 0.001 for deep, confined or semi-confined aquifers to 0.1 for shallow, unconfined aquifers in the Hamilton Basin (Petch and Marshall 1988). In some areas these discontinuous aquifers may provide bore yields of up to 30 L/s (Petch 1987). Local bore flow rates in the Mangakotukutuku area are described in Section 2.

Regional groundwater flows in the area of Hamilton are generally towards the north west, from the basin edges to the southeast. Major groundwater discharge occurs into the Waikato River and its tributaries located in deeply incised gullies (Petch and Marshall 1988).

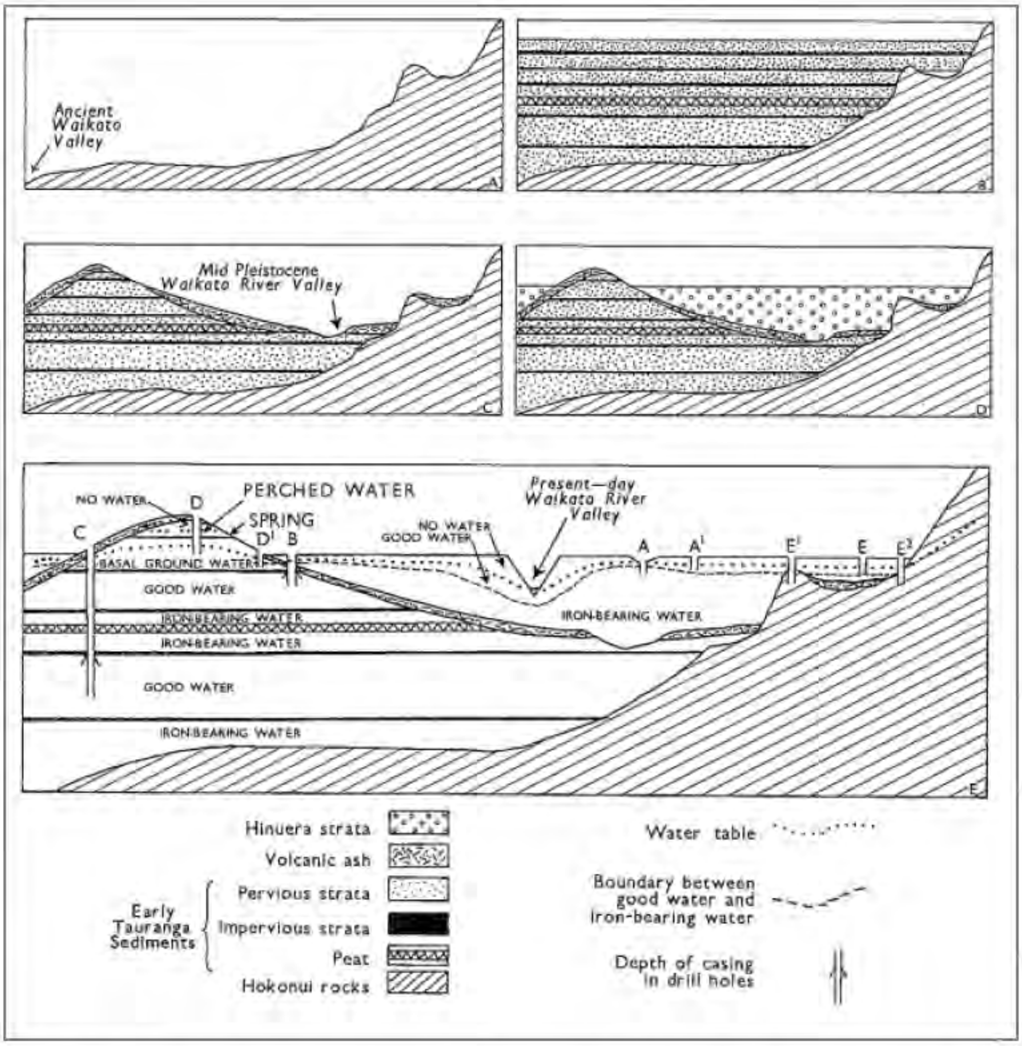

Figure 1: Simplified Geological History and Formation of Local Aquifers (Schofield 1972).

2. GROUNDWATER QUANTITY

Current groundwater use and historical flow testing information provides some indications on the potential flow rates from production bores although many local bores have targeted domestic supply quantities only. Local nearby bores have been tested at rates up to 1,750 m^3/day. This was pumped from bore number 70_624, which is a 150 mm diameter bore used for irrigation. Most bores have been tested at rates less than 200 m^3/day as they are designed to meet smaller demands.

To the south of the Mangakotukutuku area, Rukuhia School has a relatively shallow bore (35 m deep) that was tested up to a rate of 54 m^3/day. There are also two local irrigation consents for approximately 1,200 m^3/day each:

- Pandarosa Farms Limited has a resource consent (AUTH140833.01.01) to take 1,050 m^3/day for irrigation.
- Grayling Agriculture Limited has a resource consent (AUTH140211.01.01) to take 1,200 m^3/day for irrigation.

These consented abstractions indicate the local availability of groundwater but the operation of these bores may also provide some interference effects on any new water supply bore. To avoid the risk of drawdown interference, any new water supply bores could be drilled to a different aquifer layer, taking into consideration the supply bores will be targeting the best water quality as a priority.

If we consider the average water requirement as 600 litres per person per day average (MfE 2007) a bore that can produce 1,700 m^3/day (1,700,000 L/day) is therefore equivalent to an average supply for 2,833 people. MfE (2007) outlines that peak demand rates can be variable and are not consistent throughout New Zealand. They recommend storage of treated water to meet peak demand periods. If the option of groundwater supply is to be further investigated, the average and peak daily water demands in Hamilton should also be investigated further.

3. GROUNDWATER QUALITY

The local aquifers contain some areas of high dissolved iron concentrations. Dissolved iron concentrations vary between aquifers (Figure 1) and laterally within the same aquifer. The iron concentrations in water from a targeted aquifer will not be known until test bores are drilled and samples taken. Iron causes staining and taste effects but is not considered a health risk in potable water supplies. Removal of iron through water treatment is not a complicated process and usually involves aeration followed by filtration. Sometimes the process can also involve increasing the pH, chemical oxidation followed by filtration, greensand filters or ion exchange.

Deeper bores have low nutrient concentrations, which is beneficial as elevated nutrients can be problematic with respect to complying with the drinking water standards. For example, nitrate removal through water treatment is costly. It is generally easier and more cost effective to target deeper aquifers with low nutrient concentrations in the water, even if the water in these aquifers also has elevated dissolved iron concentrations.

4. OPPORTUNITIES

Using bores for a water supply option could provide a “transition” option for a future development area to supply water for the initial stages of the development. This would allow development to start while waiting for the Hamilton town network to be developed to a standard to support the new subdivision areas.

Aquifers provide natural water storage in comparison to surface water storage. This capacity can be utilised through installing bores that will be less affected by climate fluctuations and summer low flow conditions as experienced in rivers and streams in summer.

In terms of costs and timing of a water supply set up, it is cheaper and quicker to install a bore (short vertical pipe) compared to long distribution pipelines.

Aquifers also present increased security from surface events that might disrupt a water supply take from the Waikato River (e.g. volcanic eruptions, spills). Therefore, the infrastructure could potentially be promoted to the Hamilton City Council as a future back up supply system in case of emergency when presenting the plans to council.

5. REQUIREMENTS

Based on the available information from nearby bores it appears that multiple water supply bores would be needed to provide the volumes required for the size of the development (up to 9,000 homes). These bores could be located in at least two or three locations, strategically positioned to allow for future connection to the Hamilton City Council supply network.

Local water treatment would be required for pathogens and potentially iron through standard water treatment systems. These treatment systems can be designed based on initial water testing results from test bores.

Higher water flow rates are expected to be needed to meet peak use demands. Local storage of treated water may be required to match the expected peak rates. Further investigation onto the peak and average rates is recommended.

Regular local water testing and treatment system operation and maintenance will be required for the water supply at each of the bore sites. This will be an operational cost and responsibility to delegate.

Overall, based on our high-level review of the available information, it appears that new water supply bores could provide a transitional supply to enable initial development of the land parcels in the Mangakotukutuku area. These bores could then provide a supplementary supply for the development and for the wider Hamilton area if required into the future. Further investigation could be carried out to refine the areas for exploratory drilling and then carry out test drilling to determine flow rates and water treatment requirements.

6. REFERENCES

GNS 2005. Geology of the Waikato Area, Edbrooke SW (Ed). Institute of Geological and Nuclear Sciences.

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Yours faithfully

Clare Houlbrooke
for
WALLBRIDGE GILBERT AZTEC

Attachment A – Images for presentation

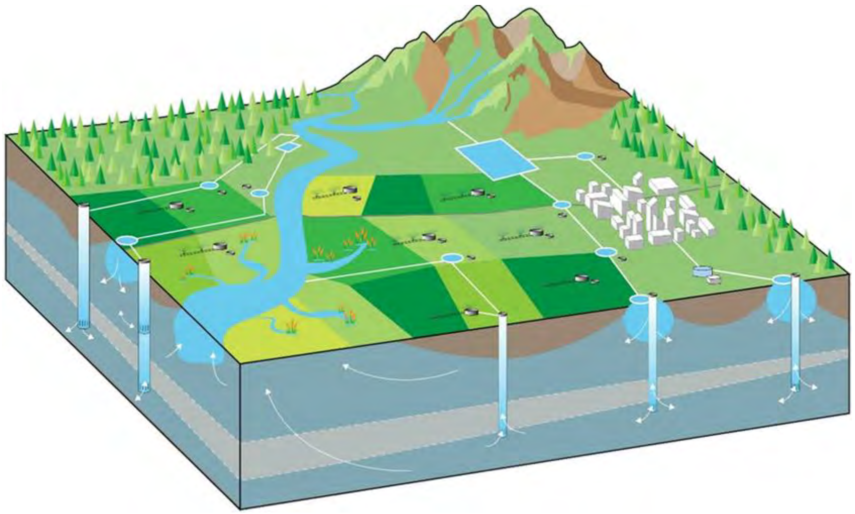
CHO:BAS:sbr

APPENDIX A
IMAGES FOR PRESENTATION

WALLBRIDGE GILBERT AZTEC

Maven Associates

Mangakotukutuku



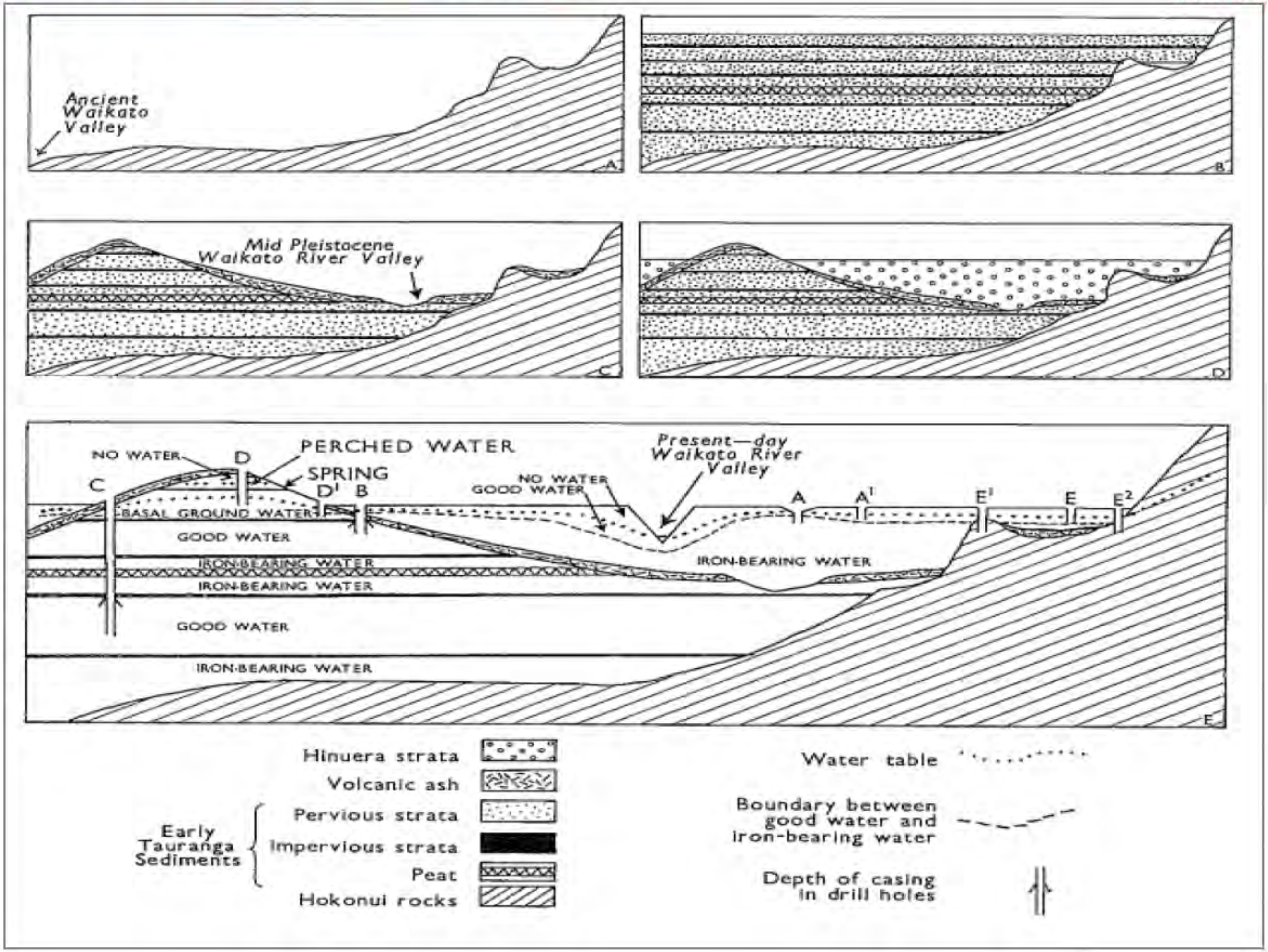
13 May 2021

WGA210896

Geology

Riverlea
Hamilton Gardens
Bader
Melville
Fitzroy
Deanwell
Glenview
Peacocke
Rukuhia
Alluvial/Pumice
Walton Sub-Group
(Older, more clay)
Swamp Deposits
Old Waikato River Channels
Old Waikato River Channels
Maxar | LINZ, Stats NZ, Esri, HERE, Garmin | GNS Science, Lower Hutt, N

Groundwater Setting



Schofield 1972

Groundwater – Mangakotukutuku

WGA
WALLBRIDGE GILBERT AZTEC

- **Groundwater Quantity**
  - Local bores have been tested up to 1,700 m^3/day (150 mm bore for irrigation)
  - Two local irrigation consents approximately 1,200 m^3/day each
  - 600 litres per person per day average (MfE 2007)
  - Up to 1,700,000 litres per day is equivalent to a supply for 2,833 people

- **Water Quality**
  - Some areas of high Iron: staining and taste
  - Deeper bores low nutrient concentrations (nitrate removal is costly – easier to deal with iron in deeper bores)

Groundwater as a drinking supply

- **Opportunities**
  - Transition supply to start development
  - Aquifers provide natural water storage (less surface area storage)
  - Short vertical pipe compared to long distribution pipe lines (speed and cost)
  - Security from surface events (e.g. volcanic eruptions, spills)

- **Potential Issues**
  - Some layers have high Iron that will require treatment
  - Risk of bores only achieving low flow rates

- **Requirements**
  - Multiple bores needed
  - Local water treatment
  - Higher rates for peak use will require storage of treated water
  - Regular local water testing

- **Treatment for Iron**
  - Aeration followed by filtration is usually effective in removing iron. Sometimes increasing the pH, chemical oxidation followed by filtration, greensand filters or ion exchange is used


Treatment Options for Small Drinking-water Supplies
Resources for Drinking-water Assistance Programme

This document is available at: www.health.govt.nz

MINISTRY OF HEALTH

Appendix H – MBR/Aeration Wastewater Case Study

New German MBR Technology Now in New Zealand Makes Previously Uneconomic Subdivisions Viable.

Executive Summary

Proven Technology that has been mainstream in Europe for decades for the treatment of wastewater is now available in New Zealand with the first large scale development underway in Whitford, South of Auckland.

Stewart and Cavalier, a long standing Te Awamutu based engineering company have teamed up with MENA WATER, the German maker of MBR technology based package plants and are building the first New Zealand plant sold to a private developer.

MENA WATER package plants can be used on a small scale or for large subdivisions and for entire cities. The plants are very compact compared to the current 20th century technology used in this country and have a number of other significant advantages. The two main advantages are:

1- Developers can now put very cost effective plants into an area where development was previously impossible because there was insufficient capacity available from the municipal scheme or costs of connection or building a new sewage treatment plant were too high.
2- MENA WATER MBR plants produce a very high quality effluent which is virtually free of any suspended solids, microbes and viruses, making it safe for discharge to environment or reuse in application that do not require potable water quality.

MBR treatment plants have been expensive systems in the past but with the development in the technology and improvements in the components quality and durability, the cost of building and operating this type of wastewater treatment plants has dramatically dropped.

The fact that MBR treatment plants produce the best effluent quality make them the number one choice in the developed countries and now even more and more MBR treatment plant are built in developing countries.

Lack of proper infrastructure is an obstacle in front of many developers in New Zealand. While existing infrastructure are struggling to keep up with the growth in the country many development projects have to be delayed or even cancelled as there is no sewage treatment plant to serve the development area.

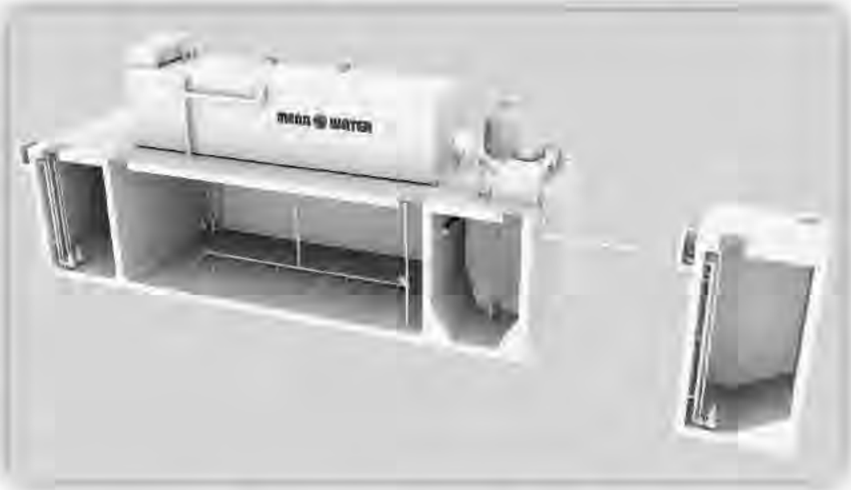
Conventional wastewater treatment plants are very expensive to build and have a lengthy construction time and often are not economical when they only serve a limited number of dwellings and with ever tightening environmental standards, they are sometimes unable to cope and require expensive upgrades.

They are usually built far from cities and towns so transferring sewage to the plants requires a complex collection network with multiple lifting and transfer stations that must be maintained fit for operation at all-time resulting in high operation and maintenance costs.

For a country the size of New Zealand with many small towns and cities that have a population of less than 20,000 or new residential development projects that cannot easily be connected to a sewage network, a decentralized wastewater treatment plant is an ideal solution.

MBR treatment technology is one of the most recent and advanced technologies for wastewater treatment which occupies an area less than 1/3rd of the area a conventional treatment plant occupies and produces a very high quality treated effluent which is suitable for recycling and reuse in applications that do not require potable water quality such as wash-down water, irrigation water, firefighting water etc.

MENA WATER state of the art containerized MBR plants are taking wastewater treatment package plants to the next level of cost reduction and simplicity in plant construction and operation.



Membrane modules, being the heart of the treatment plant are housed in a standard ISO shipping container next to the plant machine room where key mechanical equipment is located.

Plant control panel is fitted in the same container as well, inside an air conditioned compartment.

Raw sewage is pumped to the treatment plant inlet works where physical treatment stage happens as a screen removes large solid material from water and the primary settling tank removes oil and grease, sand and other non-organic solids from water.

Biological treatment stage happens in underground tanks where dissolved organic contamination and nutrients such as Nitrogen and Phosphorus are removed from water.

Finally, ultra-filtration membranes act as a physical barrier, separating any solid material from water and produce a very high quality effluent which is virtually free of any suspended solid materials, bacteria and microbes.

The membrane container sits on ground level and above the biological treatment tanks. This arrangement gives very quick and easy access to the equipment of the treatment plant that operators need to have access to during plant operation and maintenance.

The membrane container with all the items and equipment inside it is a pre-fabricated and shop-tested unit which is ready for operation as soon as it arrives at installation site.

Power is supplied to all equipment in the plant from the control panel in the container.

The treatment plant is controlled by a Siemens PLC and operators can access the control system via a touch screen HMI fixed on control panel door.

A GSM modem allows operators to monitor the plant from anywhere via a PC, tablet or a smart phone and in case of faults in the process an alarm SMS will be sent to plant operators and manager.

MENA WATER is a German engineering and manufacturing company and a member of Huber technology group. Our containerized MBR plants are designed and built based on German standards. German and European made equipment are used in fabrication of the units and all tanks and mechanical equipment in contact with wastewater are made of stainless steel.

The container is clad with Aluminium sheets, giving it a nice clean look that fits well in surrounding environment.

The wide range of plant capacities make it very easy for customers to choose the size of plant suitable for them based on current and future inflow.

MENA WATER Containerised MBR plants are available with the following capacities:

	MW-MR25	MW-MR75	MW-MR150	MW-MR300	MW-MR450	MW-MR600	MW-MR1000
Capacity (m^3/day)	25	75	150	300	450	600	1,000
Houses Served *	40	125	250	500	750	1,000	1,665
Footprint (m x m)	8 x 3	12 x 4	14 x 5	14 x 6	16 x 7	20 x 7	25 x 7

* 200 L per person per day, 3 residents in each house

During the last 10 years, MENA WATER has installed and commissioned more than 50 package MBR plants in Europe, Africa and the Middle East with plant capacities ranging from 10 to 5,400 m^3/day.

Our products and services are provided to our esteemed clients in New Zealand through our local business partner, Stewart & Cavalier Engineers.

STEWART & CAVALIER LTD
ENGINEERS
Te Awamutu

MENA WATER

With more than 60 years' experience in electro-mechanical engineering projects and a vast knowledge of local regulations and requirements, Stewart & Cavalier Engineers are able to do turn-key projects and manage the work at every stage, delivering the plant to the client ready for operation.

At the moment, we are fabricating a 150 m^3/day package MBR plant which will serve a new residential development in Whitford, Auckland.

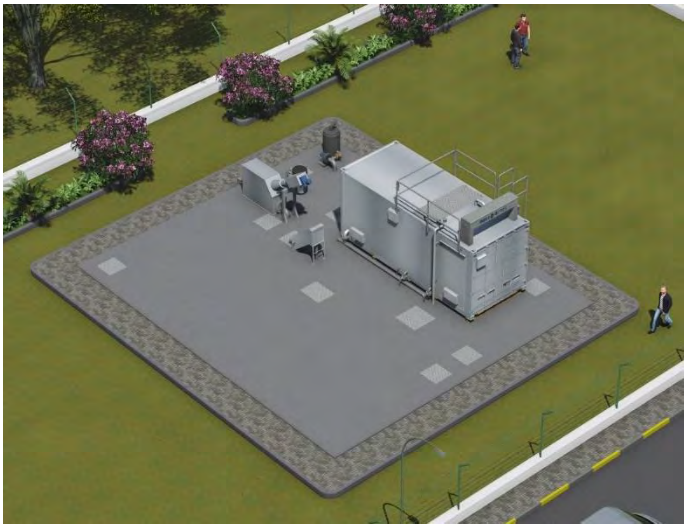
'Whitford Manor Estate' is an exclusive development project with about 150 stand-alone sections, terraced houses and 'Manor House' apartments.

Each dwelling has its own sewage pumping station and via a pressurized sewer network, raw sewage is delivered to the MBR plant which is located on a small section inside the development area.

The plant has enough capacity to receive wastewater from about 70 existing dwellings from Whitford Village as well, serving about 220 dwellings in total.

The treatment occupies a 12 x 10 m section. Plant buffer tank, primary settling tank, biological treatment tanks and effluent tank are all underground reinforced concrete tanks. An odour control system is provided to eliminate any chances of foul odour spreading in the area.

A standard 20' cladded shipping container located on top of the tanks houses the membrane filtration unit, sludge dewatering unit, machine room and control system.



The design of this wastewater treatment system has been fully consented by Auckland City Council and the treated effluent of this MBR plant has such a high quality, that it can be discharged safely to a stream at the boundary of the development area.

In addition to the wastewater treatment plant, MENA WATER is also supplying a Reverse Osmosis unit for the treatment of underground water to produce potable water. While the main source of drinking water for the development is rain water, the RO plant is a backup system that produces potable water during low rain season.

For further information and enquiries, please contact:

Ross Burrell (Stewart & Cavalier Engineers Ltd.)

s 9(2)(a)

s 9(2)(a)

MENA WATER

OUR AIM - YOUR CONFIDENCE

MBR Package Plants
for Sewage Treatment





From Sewage to Pure Irrigation Water

Convenient Operation

Clean Effluent Water

Modular System

Wastewater Treatment with MBR Technology

Our system ensures reliable reduction or elimination of polluting load such as suspended solids, organic matter, nutrients and microorganisms within an efficient process combination of biological treatment and membrane filtration. The result is clean and high quality effluent water, which can be re-used as service water or discharged to (even sensitive) receiving waters.

Scope of Supply for Complete Package Plants

MENA-Water offers complete MBR package plants, pre-assembled as containerized system (ISO sizes). This facilitates easy transportation, fast availability and straight start-up of the MBR plant. Included inside the package housing are all main components such as:

- Stainless steel membrane tank with modules and aeration system
- Blowers for aeration tank and membrane scouring
- Permeate pump, backwash and disinfection system
- Process instrumentation, electrical control cabinet with PLC

For optimized performance of the entire plant, all necessary equipment for installation in the external structures is included in our scope of supply:

- Equipment for lifting station and mechanical pre-treatment
- Diffusers, pumps, mixers for biological treatment
- Equipment for sludge treatment, grit and clean water pumping

If desired, MENA-Water provides comprehensive support for installation, start-up and maintenance activities and can consult anytime via remote monitoring from back office.
Beyond our MBR scope of supply, we can also offer solutions for further plant equipment such as:

- Sludge treatment
- Odor control
- Mobile power generator
- Containerized operator room

MBR Package Plant
MW-MR150

Benefits of our MENA-Water MBR Package Plants

- ✓ Well-proven, complete and clean system solution
- ✓ Compact footprint combined with convenient accessibility
- ✓ Minimum works for site installation and civil structures
- ✓ Full automatic system operation with online monitoring facility
- ✓ Adaptable to future demand due to modular system

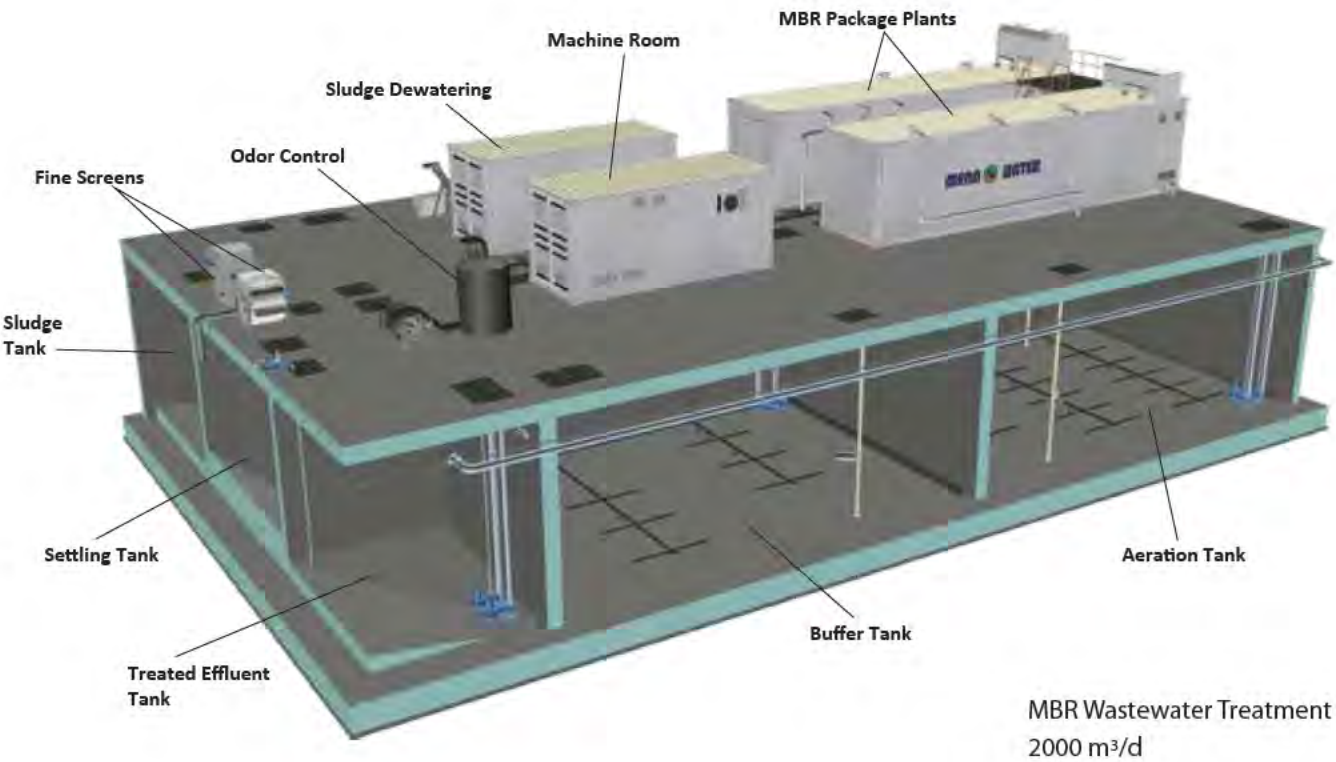
Fields of Application

MENA-Water MBR package plants are capable to handle a wide range of capacities, starting from a daily throughput of a few cubic meters, reaching to some thousands of cubic meters per day. Our plants can be arranged custom-fit to serve your desired wastewater application.

Typical applications are:

- Common municipal sewage treatment
- Independent sewage treatment system for stand-alone operation (hotels / business areas / housing complexes etc.)
- Sanitation solution for outlying locations
- Sanitation solution for close and densely populated residential areas due to minimized smell, dirt and footprint
- Process step for industrial wastewater treatment
- Pre-treatment step for reverse osmosis plants

Standard Sizes	Capacity m^3/d	Population Equivalent	Approx. Footprint
MW-MR10	10	up to 85	8 x 3 m
MW-MR25	25	up to 210	8 x 3 m
MW-MR75	75	up to 625	12 x 4 m
MW-MR150	150	up to 1250	14 x 5 m
MW-MR300	300	up to 2500	14 x 6 m
MW-MR450	450	up to 3750	16 x 7 m
MW-MR600	600	up to 5000	20 x 7 m
MW-MR1000	1000	up to 8300	25 x 7 m



MBR Wastewater Treatment Plant
2000 m^3/d

MENA WATER

OUR AIM - YOUR CONFIDENCE

MENA WATER FZC

P.O. Box: 120881, D3-11, SAIF Zone

Sharjah, United Arab Emirates

Tel.: +971 6 5575507

Fax: +971 6 5575508

E-Mail: info@mena-water.com

www.mena-water.com

MENA WATER GmbH

Industriepark Erasbach A1

92334 Berching

Germany

Tel.: +49 8462 201 390

Fax: +49 8462 201 239

E-Mail: info@mena-water.de

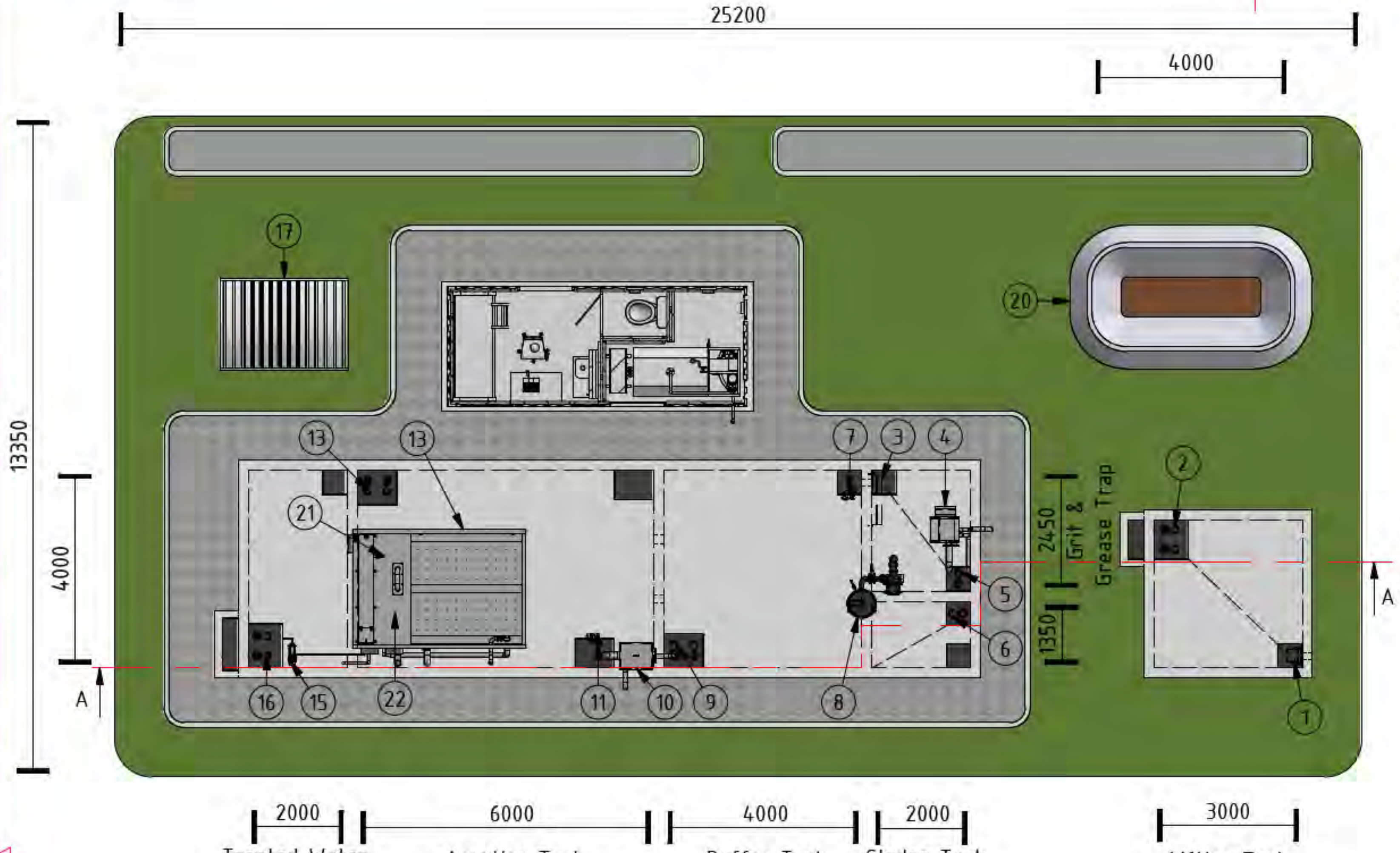
www.mena-water.de

Member of German Water Partnership

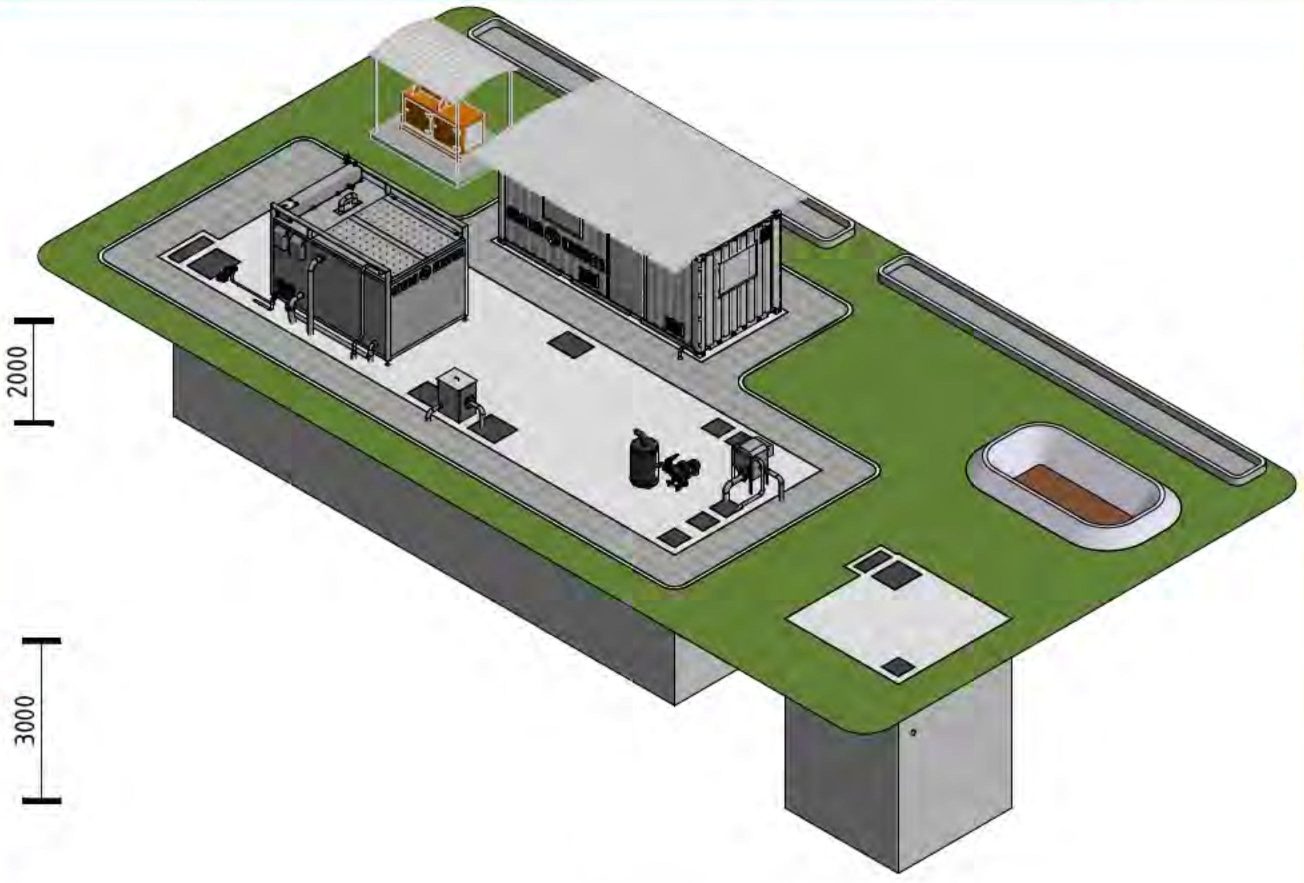
Member of HUBER TECHNOLOGY Group

WASTE WATER Solutions

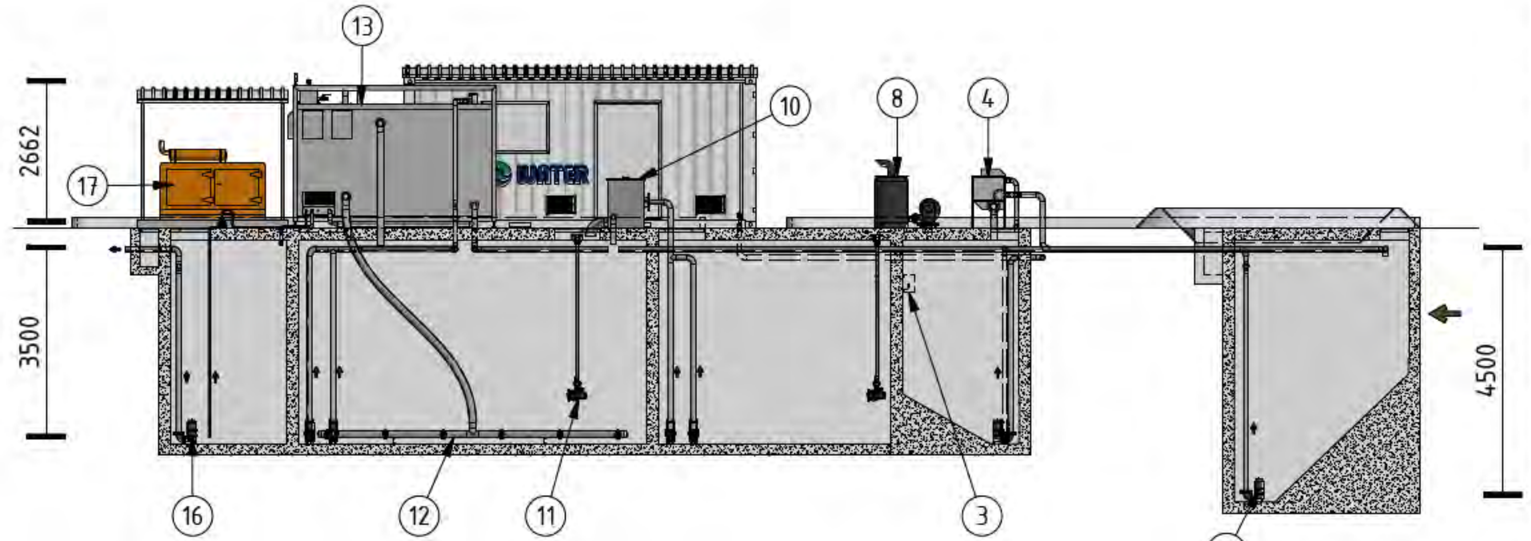
MBR_Esn-0618



Plant Layout



Isometric view



Section-AA

22	1	Machine Room	
21	1	Control Panel	
20	1	Sludge Storage Area	Optional
17	1	Standby Power Generator (DG).	Optional
16	2	Treated Water Discharge Pumps (TWP).	Optional
15	1	Service Water Pump (SP).	Optional
13	1	Package Plant MW-MR150-U	
12	1	Aeration Diffusers (AD).	
11	1	Aeration Mixer (MX).	
10	1	Secondary Screen (Static) (ST-SC 500/1).	
9	2	Balancing Pumps (BP).	
8	1	Odor Control Filter (OD).	Optional
7	1	Buffer Tank Mixer (MX).	
6	1	Sludge Pump (SP).	
5	1	Grit Pump (GP).	
4	1	Automatic Fine Screen (SC).	
3	1	Grease Baffle (GOB).	
2	2	Lifting Station Pumps (LSP).	Optional
1	1	Basket Screen (BKL).	Optional
Itemref	Quantity	Title / Name, designation, material, dimension etc.	Article no./ Reference

Equipment List

Designed by:	Drawn by:	Approved by:	Paper Size:	Date:	Scale:
A.G	J.T./C.p.dhyani	A.G.	A3	06-08-2016	N.T.S.

MENA WATER

Title: MW-MR150-U
Plant Layout

Drawing number:	Version:	Sheet:
PL-MR150-U-GD-(1)	V0	1 / 1

E-mail: info@mena-water.com – Web: www.mena-water.com

Appendix I – Service Provisions

Tuatahi
First Fibre

PO Box 27050
Garnett Avenue 3257
0800 Fibre LTD
tuatahifibre.co.nz

19 March 2024

CONDITIONAL ACCEPTANCE BY TUATAHI FIRST FIBRE LIMITED AS TELECOMMUNICATIONS OPERATOR

Development: SL1, Hamilton South Development
Legal Name: All the land shown in the below Overall Structure Plan

1. Tuatahi First Fibre Limited (TFF) confirms that a TFF telecommunications connection will be made available for each site in the development, **providing the developer was to sign an TFF Installation Agreement.** Upon approval of this agreement, TFF will undertake to become the telecommunications operator of the telecommunications reticulation in the proposed public roads for SL1, Hamilton South (the "**Subdivision**"), to provide network connections to all lots (circa 12,000 lots), in the Subdivision (the "**Reticulation**").

2. The Reticulation will be installed in accordance with:

   (a) the requirements and standards set by the Hamilton City Council and advised to TFF via the Council's website; and

   (b) the requirements of the Telecommunications Act 2001 and all other applicable laws, regulations and codes (as amended).

3. The Reticulation will be installed by our preferred provider to TFF's satisfaction.

4. TFF will be the owner, operator and maintainer of the Reticulation.

5. One or more retail service providers will be available to supply telecommunications services over the completed Reticulation when service is available, provided that TFF shall not be responsible if the retail service provider's offer to supply such telecommunications services or the number of such providers varies from time to time.

SIGNED for and on behalf of **TUATAHI FIRST FIBRE LIMITED** by:

Signature:

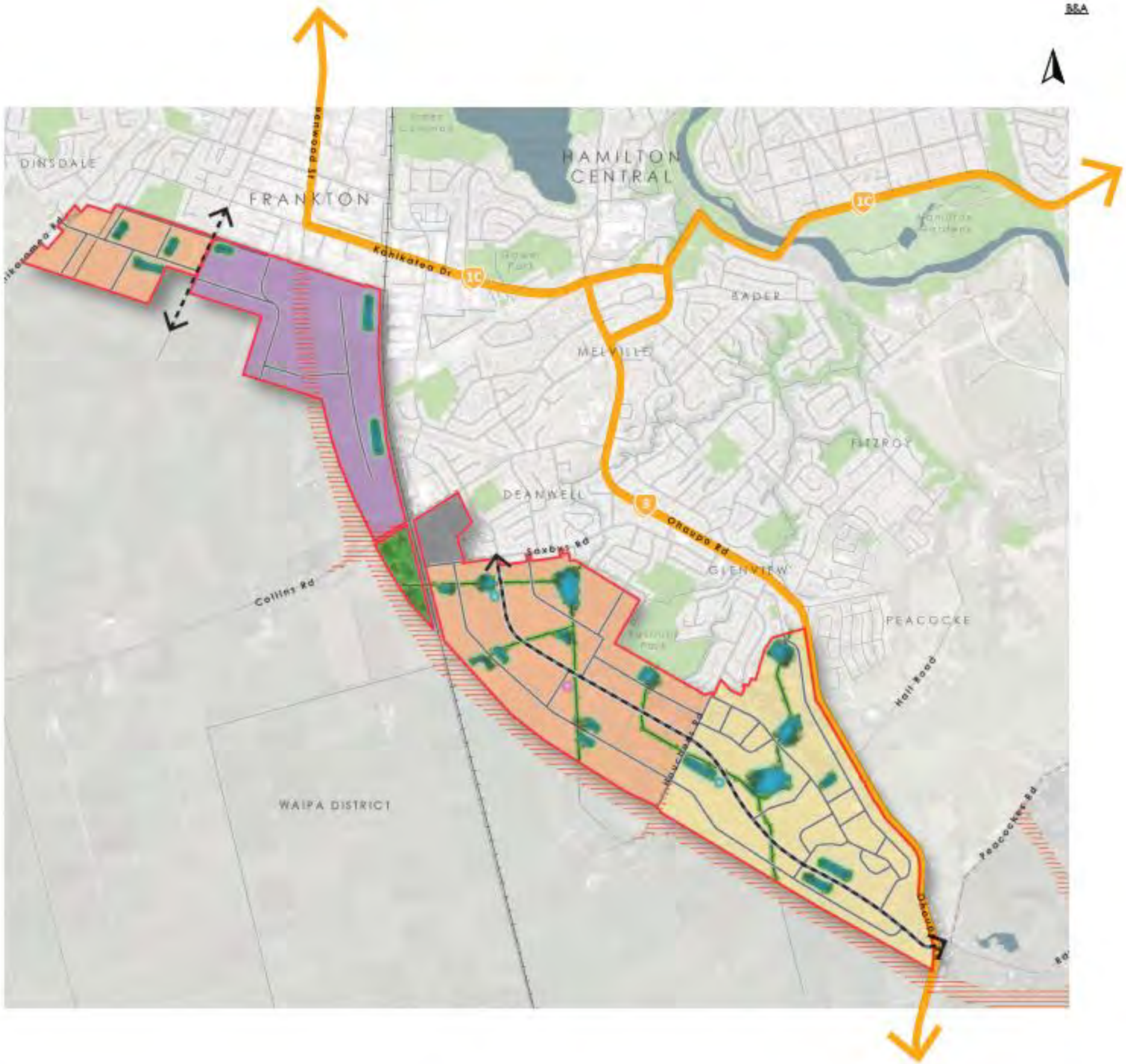
Name: Dan Fenwick

OVERALL STRUCTURE PLAN

Key

- Site Boundary
- Medium Density Residential
- Medium Density Residential (topographical)
- Industrial Development
- Indicative Green Space
- Existing Social Amenities (schools and sport grounds)
- Indicative Stormwater Treatment and Ecological Enhancement Opportunities
- Indicative Key Collector Connection and Movement Road
- Indicative Key Local Connections/Road Network
- Existing Roading Network
- State Highway
- Railway
- Southern Links Designation
- Indicative neighbourhood centre location
- Indicative recreation and open space location

High-level indicative Structure Map
Scale 1:25,000



First Gas Limited
Private Bag 2020, New Plymouth, 4342
New Zealand
P 0800 NEW GAS (0800 639 427)

26 March 2024

MAVEN Waikato Limited
Level 1, 286 Victoria St
Hamilton Central

Attention: Tim Hawke

First Gas Reference
SL 1

Enquiries To
Paul Bird
DDI: s 9(2)(a)

Dear Tim

Natural Gas Availability – SL 1

I refer to your email of March 18th, asking for natural gas availability for a new area of development in Hamilton South.

Firstgas Distribution (Dx) confirms that natural gas can be supplied to the overall development and we look forward to bringing supply to the initial stages in due course.

If you have any further questions regarding this letter, please contact me on s 9(2)(a) or via email.

I look forward to hearing from you.

Kind regards

Paul Bird
Distribution Development Manager
Firstgas

Your Ref: SL1

27 March 2024

Tim Hawke
Maven Waikato Ltd
286 Victoria St
HAMILTON

Dear Tim

RE: PROPOSED SUBDIVISION – SL1 HAMILTON SOUTH

Thank you for your enquiry regarding the power availability for the proposed subdivision of the area known as SL1.

We have investigated the electricity supply requirements for the above proposed subdivision and we are able to supply the electrical reticulation.

In order for us to give clearance to the Hamilton City Council it will be necessary for the power to be extended to the boundary of all lots.

An easement will be required in favour of WEL Networks Ltd over any existing reticulation which currently runs through this property.

An easement will be required in favour of WEL Networks Ltd over any electrical reticulation installed along private right of ways. The requirement for this will be confirmed at time of design.

WEL will prepare the easement but any costs associated with this, the survey, LINZ registration fees, and landowner legal fees will be the developer's responsibility.

If you wish us to proceed with pricing for the installation of the electrical reticulation please contact us at www.wel.co.nz/get-connected/subdivision . Please attach this consent letter with your application.

We thank you for your enquiry. If you have any further queries or require additional information, please do not hesitate to contact me.

Yours faithfully

Miranda McLean
PROJECT MANAGER