TECHNICAL MEMORANDUM

PROJECT NO.: WGA221352
DATE: 21 NOVEMBER 2022

COMPANY NAME	Barker Associates
ATTENTION	Fraser McNutt
SUBJECT	Outline of Hydrogeological Assessment for Covid Fasttrack

1. PROJECT DESCRIPTION

The proposed project for which a fast-track application under the COVID-19 Recovery (Fast-track Consenting) Act 2020 is being applied for is the consenting and construction of:

- The Rotokauri Greenway;
- The Minor Arterial;
- The bulk watermain under the Minor Arterial and other roads;
- The wastewater rising main, and
- Strategic wastewater pipeline and pump station.

The purpose of this project is to provide the necessary infrastructure pertaining to stormwater management and discharge along with critical roading connectivity to enable the residential development of the Rotokauri, a 'live' zoned residential growth cell in Hamilton north. The Rotokauri growth cell has a planned capacity of approximately 7,000 homes for approximately 20,000 people (noting this could increase with the recent proposed changed under HCC's Plan Change 12). Appropriate and necessary infrastructure is required to enable the balance of this growth cell. The key objective of this project is to design, consent and enable high-quality infrastructure that supports well-functioning urban development that can provide for the social, cultural and economic well-being of the community and wider Waikato region.

As highlighted above, there are two key components to this proposal, the Greenway and the Minor Arterial (Figure 1), which integrate and need to be designed and consented in parallel. Both pieces of infrastructure are critical features of the existing Rotokauri Structure Plan contained in the Hamilton City District Plan and certified Rotokauri Integrated Catchment Management Plan (ICMP).

The Greenway is a multi-functioning ecological corridor that will provide for stormwater management, open space and an active transport network, traverses a range of adjacent land use and offering a range of opportunities including ecological restoration, water runoff treatment recreational activities and cultural re-instatement. The Greenway will include a fluvial system of swales, artificial wetlands and ponds, with extensive planting of indigenous species along the length of the corridor. The approximately 4.7 km length corridor will run between Lake Waiwhakareke (high point) and Lake Rotokauri (low point) to effectively manage and attenuate stormwater within the area, treating stormwater prior to discharge to enhance the water quality and surrounding natural environments and ecosystems. The overarching purpose of the Greenway is to provide treatment, conveyance and storage of flows from Lake Waiwhakareke at the upper extent of the catchment) to Lake Rotokauri approximately 4 km north. Construction of the Greenway includes major re-alignment and re-contouring of the existing Rotokauri Drain, as well as an upgrade to the culvert below Exelby Road and the construction of check dams in the lower reaches to assist in managing flows. The Greenway includes a 5 metre wide shared path on the southern side and a 3 metre wide secondary path on the north side.

The Minor Arterial is a key piece of enabling infrastructure that promotes a housing development within Rotokauri. The Minor Arterial extends 3.8 km in length from Te Wetini Drive to the northern boundary of Hounsell Holdings land, including the collector road to the Chalmers Road underpass and the northern boundary of Hounsell Holdings land to the underpass that links to Te Kowhai East Road. Supporting three water infrastructure which is sized to cater for the wider catchment is also proposed which includes:

- The bulk watermain under the Minor Arterial;
- Wastewater rising main;
- Strategic wastewater pipeline, and
- Pump station will also be included in the project.

The Minor Arterial will prioritise and enable active transportation with wide footpaths and separated cycleways, supported by planted medians to improve safety. There will be public transport connections provided, which will connect to the Rotokauri Transport Hub (1 km east of Rotokauri), with bus stops along the length of the corridor.

2. INTRODUCTION

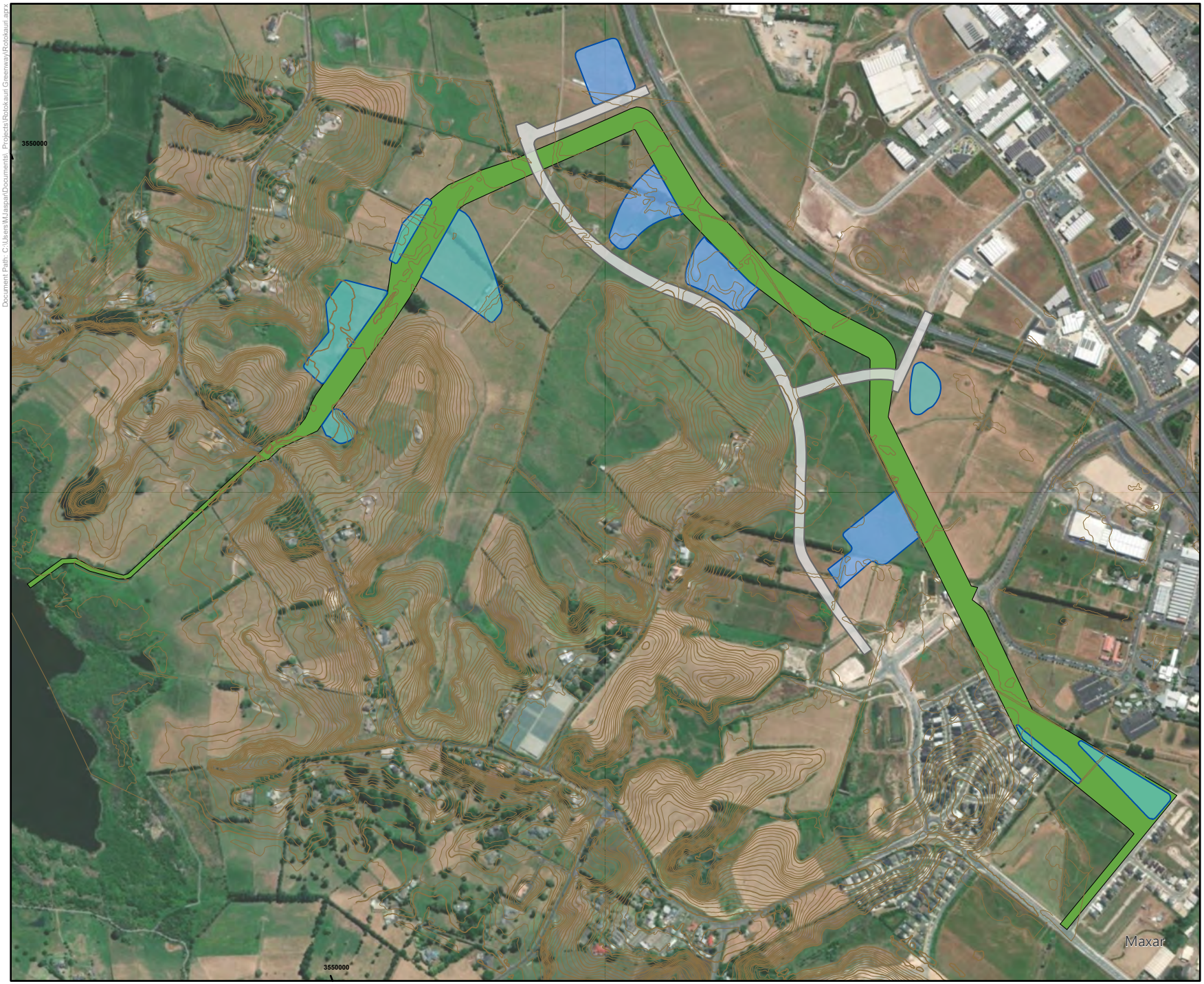
The hydrogeological assessment is to cover two separate activities at the Rotokauri subject site:

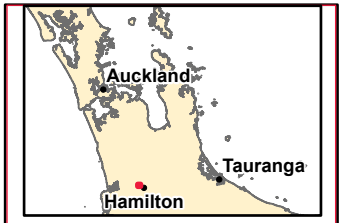
- The construction and on-going dewatering effects of the Rotokauri Greenway and associated artificial wetlands.
- The construction and on-going effects of the Minor Arterial, which includes road construction effects, drainage and installation of water and wastewater services.

The site has a shallow groundwater table that is connected to existing important surface water bodies (i.e., lakes and natural wetlands). Therefore, a detailed assessment is required to ensure that the effects of the proposed works on natural wetlands as well as nearby infrastructure such as roads and houses are acceptable. Settlement effects on existing buildings and on the adjacent stretch of state highway are considered to be a potential risk and WGA will work alongside geotechnical specialists to review their groundwater modelling with regards to potential settlement in the vicinity of the highway.

The types of activities required for the construction of the Rotokauri development that may result in effects on groundwater, connected wetlands and potential for settlement are listed in Table 1.

The proposed activities are relatively standard for land development projects in the Hamilton area. Commonly used monitoring and mitigation measures could be used at the site, such as groundwater monitoring bores, changes to drainage methods, reductions in pumping rates and reductions in hydraulic connections to reduce potential effects in sensitive areas. Currently the site is mostly used for farming with few sensitive structures that could be affected by the proposed works.





LEGEND

- Contours (m)
- Proposed Greenway
- Minor Arterial Route
- Artificial Wetland
- Artificial Wetland Including Runoff from Minor Arterial Route

N

0 100 200 300 400 m

Scale 1:12,500 @ A4

Coordinate System: NZGD 2000 New Zealand Transverse Mercator

WGA

Figure **1**

Rotokauri Greenway

Rotokauri Proposed Greenway and Arterial Route

Table 1: Activities which Require Resource Consent and Affect Hydrogeology.

ACTIVITY	TECHNICAL ASSESSMENTS REQUIRED	CONSENTS
ROTOKAURI GREENWAY		
Temporary and permanent diversion of surface water including the Rotokauri Drain	Groundwater/hydrogeology including effects on wetlands and settlement	Discretionary Activity under WRP Rule 3.6.4.13 Discretionary Activity under Regulation 45 of the NESFW
Permanent damming and diversion of groundwater (changes to groundwater flows resulting from creation of the greenway)	Groundwater/hydrogeology including effects on surface water bodies/wetlands, other groundwater users, mobilisation of contaminants, and settlement. The greenway corridor will permanently lower the local water table, therefore requiring consent for a groundwater diversion.	Discretionary Activity under WRP Rule 3.6.4.13 Discretionary Activity under Regulation 45 of the NESFW
Temporary water takes during construction for dewatering/lowering of the groundwater table	Dewatering during construction to lower the groundwater table or maintain a dry environment within excavations may be undertaken using spears. The take will be classified as a groundwater take and will require an assessment of the effects on aquifer sustainability, other bore users, and surface water bodies (including wetlands), mobilisation of contaminants, ecological and cultural effects.	Controlled activity under WRP Rule 3.8.4.7 (drilling) Discretionary Activity under WRP Rule 3.3.4.24 (groundwater take)
Construction of specified infrastructure including earthworks and cleanfill disposal	Groundwater/hydrogeology including effects on wetlands.	Discretionary Activity under Regulation 45 of the NESFW
Geotechnical and groundwater investigations	There will be a need to facilitate further groundwater and geotechnical investigation and monitoring to obtain additional information and to monitor the impact of the works on groundwater levels. This will occur prior to works, during works, and post-works.	Controlled Activity under WRP Rule 3.8.4.7 (drilling) Discretionary Activity under WRP Rule 3.3.4.24 (groundwater take) Controlled Activity under WRP Rule 3.6.8.2 (well and aquifer testing discharges)
ROTOKAURI MINOR ARTERIAL		
Temporary water takes during construction for dewatering/lowering of the groundwater table	Dewatering during construction to lower the groundwater table or maintain a dry environment within excavations may be undertaken using spears. The take will be classified as a groundwater take and will require an assessment of the effects on aquifer sustainability, other bore users, and surface water bodies (including wetlands), mobilisation of contaminants, ecological and cultural effects.	Controlled activity under WRP Rule 3.8.4.7 (drilling) Discretionary Activity under WRP Rule 3.3.4.24 (groundwater take)
Construction of specified infrastructure including earthworks and cleanfill disposal	Groundwater/hydrogeology including effects on wetlands. Assess the potential effects of the planned arterial road on groundwater flows through the underlying soils.	Discretionary Activity under Regulation 45 of the NESFW

3. BACKGROUND

The Rotokauri area has a shallow groundwater table that is connected to several important surface water bodies (i.e., Lake Waiwhakareke, Lake Rotokauri and several natural wetlands). The potential effects of the development on these features have been considered during past technical and planning assessments. The first geotechnical investigations began in 2010 for the preliminary design of the Greenway. Monitoring bores have been in place since March 2010. WGA understands that the Rotokauri Greenway has already been designated and the Minor Arterial will have the Notice of Requirement (NOR) lodged soon.

A detailed Integrated Catchment Management Plan (ICMP) is in place for the Rotokauri area, including a groundwater model of the proposed Rotokauri Greenway. The Rotokauri ICMP is part of the Hamilton City Council Three Waters ICMP Programme and provides best practicable options and integrated catchment management solutions to address the main site-specific issues for the catchment. The ICMP includes the establishment of the Greenway to address multiple water management issues and achieve objectives by creating an open blue-green corridor network. The ICMP also includes requirements for the application of best practice environmental protection and mitigation measures during catchment development and physical works to minimise adverse environmental effects and to safeguard existing biodiversity values. The ICMP will be implemented during the development and there has been intensive groundwater level monitoring over serval years since the development of the ICMP.

4. KEY HYDROGEOLOGICAL EFFECTS TO BE ASSESSED

The key groundwater effects to be considered in the hydrogeological assessment include:

Rotokauri Greenway

- Groundwater seepage inflows to the Rotokauri Greenway.
- Groundwater seepage inflows into any temporary work excavations and any associated dewatering activities.
- Groundwater drawdown effects from the works, including potential effects on existing road infrastructure and wetlands (i.e., lowering the water table in the vicinity of a wetland can impact the wetland hydrology).
- Effects from disposal of the pumped groundwater.
- Potential groundwater mounding effects of any soakage system or constructed wetland.

Rotokauri Minor Arterial

- Groundwater seepage inflows into any temporary work excavations and dewatering activities.
- Effects from construction of the arterial road on underlying groundwater flows.
- Effects from disposal of the pumped groundwater, including potential groundwater mounding effects of any soakage system or constructed wetland.

5. METHODOLOGY FOR THE GROUNDWATER ASSESSMENT

The Rotokauri development area has been under investigation in terms of the hydrogeological conditions since 2010. There are well established records of the shallow groundwater level response to seasonal changes and recent developments in the area. An existing groundwater model of the area has been updated in 2022 to incorporate recent developments within the Rotokauri area (e.g., Te Wetini Crossing) and longer-term groundwater level records. This existing knowledge and information will be used as foundation for more refined focused assessment of the effects of the final Greenway and Minor Arterial designs.

WGA were involved in modelling groundwater effects for the recent excavations at Rotokauri Rise (a neighbouring development for residential). The information gained at this site will be applied to the assessment. In addition, WGA staff have been highly involved in reviewing groundwater effects of the recently completed Waikato Expressway – Hamilton Section.

WGA proposes to work closely with the geotechnical specialists and design engineers to build upon the current groundwater knowledge, acquired over several years of monitoring, and provide guidance for additional testing of the local soil hydraulic properties. The assessment will cover the following aspects:

- Use of on-site hydrogeological investigations to confirm the hydraulic behaviour of shallow soils in key areas of the planned development and thereby support focused assessment of the potential drawdown effects.
- Use the on-site investigation results to assess long-term groundwater flow rates to the Greenway and the extent of groundwater drawdown arising from the changed layout of the drainage system, including:
  - Inflows to the Rotokauri Greenway on a section by section basis.
  - Rate of seepage flow to the Greenway channel from existing wetlands and proposed permanent wetlands to be established as part of the Greenway development.
- Assess the extent and magnitude of expected groundwater drawdown arising from various sections of the planned Greenway swale using analytical techniques and results from the local hydraulic testing programme. Given the size and length of the Greenway swale, WGA will assess the effects on a section by section basis, as determined by changes in the swale design depth and local hydraulic parameters.
- Assess the mounding effects of any planned soakage systems within the stormwater management network. Only limited soakage systems are expected to be proposed, given the high groundwater level and expected low permeability of the shallow soils.
- Assess the potential effects of the planned Minor Arterial on groundwater flows through the underlying soils (if any).
- Develop a monitoring plan to ensure any potential groundwater drawdown or mounding linked to potentially significant impacts can be detected and mitigated before these impacts arise.
- Develop and document mitigation measures that may be put in place to reduce any calculated groundwater drawdown at the site both during the construction period and following completion of the earthworks, including for example:
  - Design, installation and monitoring of groundwater level measurement systems.
  - Options to modify dewatering systems on a section by section basis to reduce the magnitude and extent of groundwater drawdown.
  - Optimise pumping rates and incorporate transient adjustments in pumping rates.
  - Returning pumped water to ground in areas where drawdown may lead to excessive ground settlement or other impacts.
  - Reduction in hydraulic connections between groundwater and surface water bodies to reduce the effects of drawdown in sensitive areas.

6. CONCLUSION

Based on WGA's experience and the information which has been received and known to date, WGA can see no reason why the following development could not proceed under a fast track application process with referral, that the effects on the environment can be managed with suitable conditions;

- The construction and on-going dewatering effects of the Rotokauri Greenway and associated artificial wetlands.
- The construction and on-going effects of the Minor Arterial, which includes road construction effects, drainage and installation of water and wastewater services.

7. QUALIFICATIONS AND EXPERIENCE

7.1 Clare Houlbrooke – Principal Hydrogeologist, Project Lead

Clare is a Principal Hydrogeologist (BSc, MSc (Hons) Earth Sciences) with more than 20 years' experience in hydrological resource investigations. Clare's focus is sustainable management of groundwater resources and connected surface water systems. Clare has worked in two regional councils as a Groundwater Scientist over a 9-year period and as a consultant has continued to support regional councils with the review of groundwater related resource consent applications, including reviewing the groundwater effects of the recently completed Waikato Expressway. Clare has been based in the Waikato for 11 years and has in-depth knowledge of the local hydrogeological conditions. She has prepared and presented evidence in regional council resource consent hearings and in Environment Court as an expert witness.

7.2 Brett Sinclair – Senior Principal Hydrogeologist, Project Reviewer

Brett is a Principal Hydrogeologist (BSc, MSc Geology) with more than 28 years' experience in hydrogeology, geology, water management, water quality assessment and environmental effects mitigation. He specialises in the evaluation, utilisation, management, and protection of groundwater resources and groundwater-dependent surface water resources. Brett provides specialist hydrogeological support for geotechnical assessments including major civil infrastructure projects. He has undertaken numerous peer reviews of applications for site dewatering and infrastructure construction projects on behalf of regulatory authorities.

7.3 Catherine Howell – Senior Hydrogeologist, Technical Assessments

Catherine is a Hydrogeologist with a Masters in Groundwater Studies and over 15 years of experience in the United Kingdom, Australia and New Zealand. Catherine has gained experience in hydrogeological investigations through roles in both regulatory bodies and consultancy. Her hydrogeological assessment experience includes pump test analysis, regional scale water assessments, water quality monitoring, and project management. Catherine has prepared technical assessment of effects for other nearby construction works within the Rotokauri development area including effects of dewatering and soakage.

Yours Sincerely

Clare Houlbrooke
Principal Hydrogeologist
WALLBRIDGE GILBERT AZTEC