TECHNICAL MEMORANDUM

PROJECT NO.: WGA251435
DOCUMENT NO.: WGA251435-MM-HG-0001_B
DATE: 7 NOVEMBER 2025

COMPANY NAME	Greenhill Industrial Park
ATTENTION	Briar Belgrave Barker and Associates
SUBJECT	Outline of Hydrogeological Assessment for Fast track

1. PROJECT DESCRIPTION

The project for which a fast-track application is being applied for is the consenting and construction of the proposed Greenhill Industrial Park.

Greenhill Industrial Park is of irregular shape and approximately 195 hectares. It is situated within the Waikato District, adjacent to the eastern side of the Waikato Expressway (Figure 1).

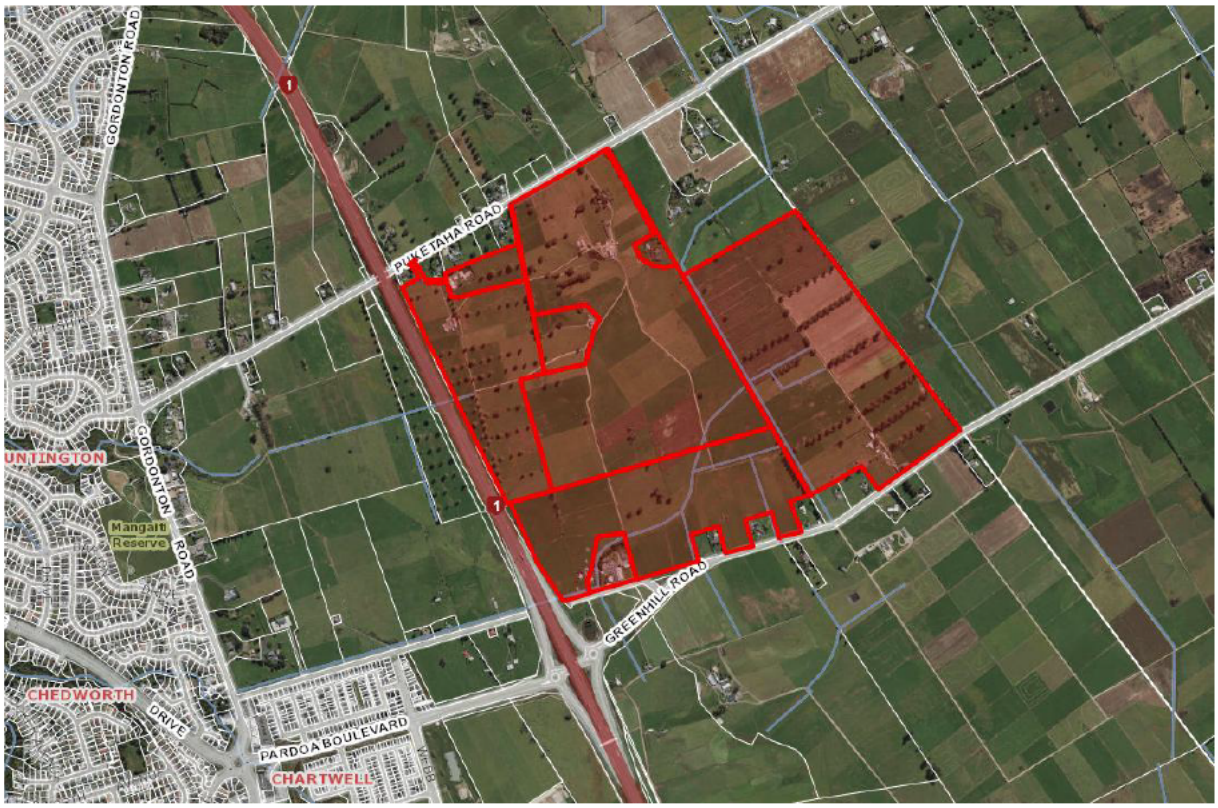

Figure 1: Site Location and Parcel Boundaries for Greenhill Industrial Park

The site is accessed from Puketaha Road to the north and Greenhill Road to the south. The Waikato District and Hamilton City jurisdiction boundary is defined by Gordonton Road, which is located approximately 1 kilometre to the west of the Waikato Expressway.

Greenhill Industrial Park is for a comprehensive new industrial park, with direct access to the Waikato Expressway in both directions via Greenhill Road and Pardoa Boulevard. The project is to create vacant lots that can accommodate a range of industrial and compatible commercial activities and associated buildings. The proposal also includes all required infrastructure, including transport, three waters, and associated site and civil works. (Figure 2).

Figure 2: Greenhill High Level Masterplan

2. INTRODUCTION

The hydrogeological assessment is for the following activities at the Greenhill subject site:

- General construction for excavations below the water table
- The operation of a production bore for dust suppression and firefighting purposes
- The abstraction of surface water from the Waikato River to supply the development
- The construction and on-going effects of stormwater management infrastructure
- The construction and on-going effects of wastewater treatment and disposal Infrastructure

The site has a shallow groundwater table that is connected to existing surface water bodies. Therefore, a detailed assessment is required to ensure that the effects of the proposed urban development are acceptable. The types of activities required to establish the necessary infrastructure for the development that may result in effects on groundwater and connected wetlands 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.

Table 1: Activities which Require Resource Consent and Affect Hydrogeology

ACTIVITY	TECHNICAL ASSESSMENTS REQUIRED	CONSENTS
Water Supply		
Abstraction of Groundwater for dust suppression and firefighting	Groundwater/hydrogeology, including effects on surface waterbodies/wetlands, and other groundwater users.	Controlled activity under WRP Rule Section 3.
Abstraction of surface water from the Waikato River for drinking water	Hydrology, including effects on the surface water bodies and other surface water users.	Controlled activity under WRP Rule Section 3
Stormwater Management Infrastructure		
Temporary and permanent diversion of surface water	Groundwater/hydrogeology, including effects on wetlands and settlement	Discretionary Activity under WRP Rule 3.6.4.13 Discretionary Activity under Regulation 54 of the NESFW
Permanent damming and diversion of groundwater (changes to groundwater flows resulting from the creation of the stormwater infrastructure)	Groundwater/hydrogeology, including effects on surface water bodies/wetlands, other groundwater users, mobilisation of contaminants, and settlement. The stormwater infrastructure may 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 54 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 clean fill disposal	Groundwater/hydrogeology, including effects on wetlands.	Discretionary Activity under Regulation 54 of the NESFW

ACTIVITY	TECHNICAL ASSESSMENTS REQUIRED	CONSENTS
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)
Wastewater Treatment and Disposal Infrastructure		
Permanent damming and diversion of groundwater (changes to groundwater flows resulting from the creation of the wastewater treatment and disposal infrastructure)	Groundwater/hydrogeology, including effects on surface water bodies/wetlands, other groundwater users, mobilisation of contaminants, and settlement. The stormwater infrastructure may 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 54 of the NESFW
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Construction of specified infrastructure, including earthworks and clean fill disposal	Groundwater/hydrogeology, including effects on wetlands.	Discretionary Activity under Regulation 54 of the NESFW
Treatment and disposal of wastewater	The potential effects of discharging treated wastewater will need to be assessed. This required assessment will need to assess effects on surface water bodies/wetlands and other groundwater users.	Controlled Activity under WRP Rule 3.5.7.5

3. HYDROGEOLOGICAL BACKGROUND

The Greenhill site is located within the Hamilton Basin; a large tectonic basin centered on Hamilton City with an area of approximately 2,000 km^2 and traversed by the Waikato River. 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). Underlying the low hills are older ignimbrites, tephra fall deposits and alluvium (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 (Scholfield, 1972).

Available site data from the New Zealand Geotechnical databases is concentrated in the southern portion of the area, consisting of hand augers reaching depths of up to 2.8 m. The underlying lithology of this area from the surface consists of 0.6 to 1.1 m of clayey silt or silt before encountering sandy silt, sand and sand with gravel. Bore 72_11726, on the WRC database, located on the northern section of the site, describes the underlying geology of the site, comprising of 1 m of clay, which is underlain by 2 m of pumice and a further 5 m of clay before encountering pumice and sand to a depth of 18 m.

3.1 Nearby Water Users

Data obtained from the WRC bore database indicates the presence of multiple bores in the area surrounding the development. Nearby bores range in depth from 2.74 m to 104.5 m. Several of these bores are linked to active resource consents for groundwater abstraction used for agriculture, primarily to support dairy farming activities. Nearby consented volumes range from 21 m^3/day to 111 m^3/day.

3.2 Surface Water Bodies

A report completed by EcoLogical Solutions Ltd (2025) has completed preliminary identification of surface water bodies across the site. The primary surface water feature on the site, which has been classified as a “modified watercourse” is an unnamed drain that convey water north across the site, associated with the managed WRC drainage system. Acting as a tributary of the modified Komakorau and Mangatoketoke streams, this system subsequently joins the Mangawara River, ultimately discharging into the Waikato River near Taupiri. The remaining drains across the site are considered artificial drains.

Two putative wetlands have been identified on site, as reported by EcoLogical Solutions Ltd (2025) with a cumulative area of 1,982 m^2. EcoLogical Solutions Ltd propose that the small wetlands could meet the RMA definition of a ‘wetland’ and the NPS-FM (2020) definition of a ‘natural inland wetland’. The wetlands are observed to be highly modified and degraded as a result of farming and grazing practices. EcoLogical Solutions Ltd have also confirmed that the two farm ponds in the northern portion of the site are considered “deliberately constructed water bodies” are therefore excluded from the RMA and NPS-FM wetland definitions.

4. KEY EFFECTS TO BE ASSESSED

The key effects to be considered in the assessment include:

Water Supply

- Hydrological effects from abstracting water from the Waikato River on nearby surface water bodies and other surface water users.
- Groundwater effects from operating a production bore on nearby groundwater users’ streams and wetlands.

Earthworks and Stormwater Network

- 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.

Onsite Wastewater Treatment and Disposal

- Groundwater seepage inflows into any temporary work excavations and dewatering activities
- Effects from the disposal of treated wastewater

5. METHODOLOGY FOR THE ASSESSMENT

WGA understands that further geotechnical investigations will be undertaken at the site in relation to groundwater, to assess liquefaction hazards, settlement potential of soft soils, groundwater depth and drawdown potential. WGA proposes close collaboration with geotechnical specialists, HD Geo Limited, to ensure geotechnical investigations can also be used to inform understanding of the site's hydrogeology.

WGA have been involved in modelling groundwater effects for the recent excavations for nearby residential developments, Rotokauri Rise and Rotokauri Greenway. The information gained at these nearby sites 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.

5.1 Water Supply

WGA understands that it is intended that surface water abstracted from the Waikato River using the existing Hamilton City Council infrastructure is to be used for the drinking water supply of the development. WGA will assess the impacts of this take by compiling water allocation information from the Waikato Regional Council for the Waikato River. This will be used to determine if there is enough water to supply the development.

WGA also understand that it is intended that an on-site groundwater water supply will be used to provide the development with water for firefighting purposes. Additionally, during the construction of the development, an onsite groundwater supply is required for dust suppression and other construction-related activities. There are existing bores on site that may be able to serve as temporary water supplies. WGA consider that, bore 72_6613 could potentially be used as its currently providing up to 21.7 m^3/day to support existing farm operations on site. If this bore can be used to supply water for the site, WGA will assess the impacts of operating the bore by undertaking a stepped rate and constant rate pumping test on the bore. This will allow WGA to analyse the test data and carry out forward projections to assess the effects of operating the production bore on nearby users and nearby surface water bodies.

If a new production bore is required to supply groundwater for the development, WGA proposes to use the following workflow:

Gather Background Site Information

- Carry out a desktop survey of the site to establish local lithological information and identify any factors that may affect, or be affected by, the proposed groundwater takes.

Drill Pilot Bore

- Drill a 100 mm pilot bore to inform the precise depth that the test bore and production bore will target.
- Collect and record underlying lithology.
- Determine from the underlying stratigraphy if the site is suitable or if another location is needed.

Construct Test Bore

- Construct a 100 mm test bore and carry out a production test.
- Collect a water sample during the production test and have it analysed.
- Decide if the target aquifer can provide the desired water volumes and quality or if the bore needs to be drilled into a deeper aquifer.

Construct Production Bore

- Drill and construct a production bore close to the test bore. The diameter of the production bore will be determined based on pump and water requirements.
- Undertake a stepped rate and constant rate pumping test on the production bore.
- Analyse the pumping test data and carry out forward projections to assess the effects of operating the production bore.

5.2 Earthworks and Stormwater Network

WGA proposes collaborating closely with geotechnical specialists and design engineers to build upon current groundwater knowledge and provide guidance for additional testing of the local hydraulic properties. Once the underlying local soil hydraulic properties are ascertained WGA will then be able to assess the potential mounding effects of any planned soakage systems within the stormwater management network. Given the high groundwater levels and expected low permeability of the shallow soils, WGA proposes using the MOUNDSOLV software package developed by HydroSOLVE to assess potential groundwater mounding effects of the planned soakage systems.

Additionally, once local soil hydraulic properties are ascertained the potential dewatering effects of any construction activities that require the excavations below the water table can be assessed. WGA proposes to use a combination of analytical tools such as trench models and pit models to assess temporary and long-term groundwater drawdown as a result of any construction activities that require excavations below the water table. Additionally, WGA can build upon these models to undertake 2D finite element groundwater modelling if deemed required for excavations conducted in sensitive areas.

Once mounding and groundwater drawdown risk has been analyzed, WGA propose that a monitoring plan will be developed to ensure any potential groundwater drawdown or mounding linked to potentially significant impacts can be detected and mitigated before these impacts arise.

Building upon this monitoring plan, mitigation measures will be developed and documented so that they 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 to reduce the magnitude and extent of groundwater drawdown.
- Optimize 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.

5.3 Onsite Wastewater Treatment and Disposal Infrastructure

WGA proposes to assess the effects of the planned wastewater treatment and discharge facilities by undertaking attenuation modelling using microbial removal rates documented in Pang (2009). WGA proposes to use *E.coli* and rotavirus in the attenuation modelling as these are less likely to be removed by natural attenuation compared to other pathogens.

Once the groundwater quality risk from the wastewater treatment and discharge facilities have been assessed, WGA propose that a monitoring plan will be developed to ensure groundwater is not affected by any wastewater discharge.

If excavations below the water table are required for the construction and operation of the wastewater treatment and disposal infrastructure, WGA will assess these using the same methods proposed for the dewatering associated with the stormwater infrastructure and detailed in Section 5.2. WGA propose that a similar groundwater monitoring plan will be developed to ensure any potential groundwater drawdown or mounding linked to potentially significant impacts can be detected and mitigated before these impacts arise.

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, as the effects on the environment can be managed with suitable conditions.

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 nine-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 30 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.

8. REFERENCES

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Pang, L. (2009). Microbial removal rates in subsurface media estimated from published studies of field experiments and large intact soil cores. Journal of Environmental Quality. 38, American Society of Agronomy, Crop Science Society of America, Soil Science Society pp. 1531–1559.

Petch RA. (1987). Water Resources of the Mangaonua Catchment. In: Mangaonua Catchment Management Plan. Waikato Valley Authority Technical Publication N0.30.

Schofield JC. (1972). Groundwater of the Hamilton Lowland. New Zealand Geological Survey Bulletin No.89.

Yours Sincerely

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