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Milldale Wastewater Treatment Plant

Groundwater Assessment

FULTON HOGAN LAND DEVELOPMENT LTD

WWLA1244 | Rev. 1

25 February 2025

Groundwater Assessment

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Contents

1. Introduction

This report has been prepared in support of the application by Fulton Hogan Land Development (FHLD) for a resource consent to the Environmental Protection Authority (EPA) under the Fast-Track Approvals Act 2024 (FTAA).

Resource consent is required for the construction and operation of a Wastewater Treatment Plant (WWTP) involving earthworks, wastewater discharges, which we understand involves the discharge of treated wastewater into a Land Contact Infiltration Basin, where it will permeate through a drainage bed and after land contact, will ultimately end up in the Waterloo Creek (Apex, 2025)[1].

Williamson Water & Land Advisory (WWLA) was commissioned by FHLD to undertake a groundwater assessment for the proposed construction of a WWTP for their Milldale Development (**Figure 1**). This report utilises the groundwater model prepared by WWLA in December 2023[2] for the analysis of potential groundwater drawdown. Analysis of treated wastewater discharge effects on groundwater has been assessed using analysis at a conceptual level.

The drawdown analysis addresses the activity status under the regulatory provisions outlined in Chapter E, Section 7 of the Auckland Unitary Plan – Operative in Part. The relevant permitted activities assessed include:

- Permitted activity rule E7.6.1.6 is for "Dewatering or groundwater level control associated with a groundwater diversion permitted under standard E7.6.1.10"; and
- Permitted activity rule E7.6.1.10 is for "Diversion of groundwater caused by any excavation, (including trench) or tunnel".

1.1 Site Description

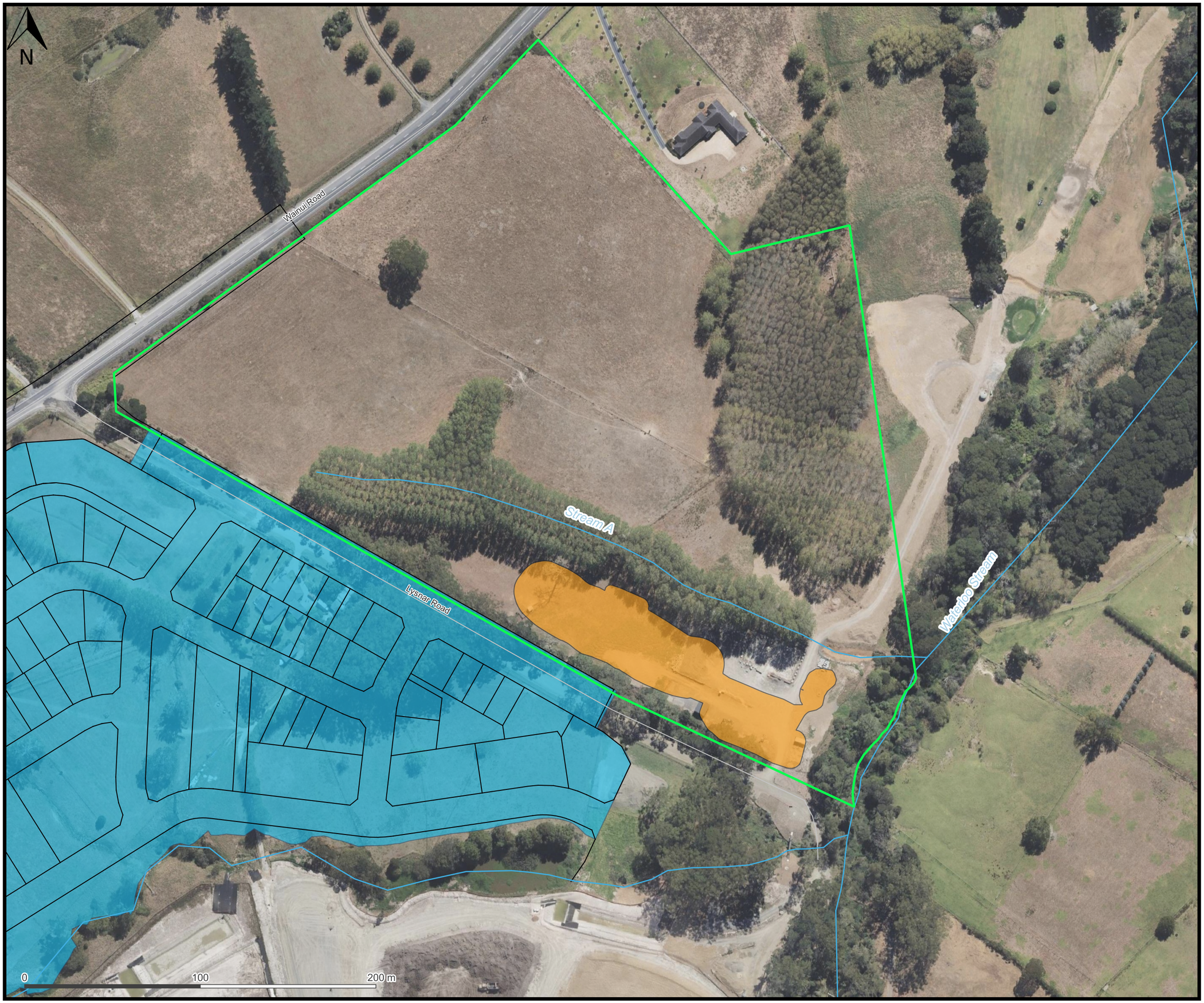
The WWTP site (the Site) is located within Lot 4 DP 353309 which has a total area of 10.45 ha. The Site is on the northern side of Lysnar Road, Wainui and is located directly adjacent to the Milldale development and just outside the Wainui Precinct.

The parent site is characterised by undeveloped rural land that has historically been used for farming. The topography of the parent site generally slopes from north-west to south-east and has two stands of poplar trees. There is an unnamed tributary of the Waterloo Stream that bisects the southern portion of the site.

The area subject to the works and enhancement planting covers a total land area of approximately 1.21 ha and has been positioned in the southern corner of the parent site, directly adjacent to Lysnar Road as illustrated in **Figure 1**. The works site is generally flat and has been utilised in the past as a construction compound supporting the delivery of ongoing delivery of the Milldale development.

A full description of the Site and surrounds is provided in the application AEE.

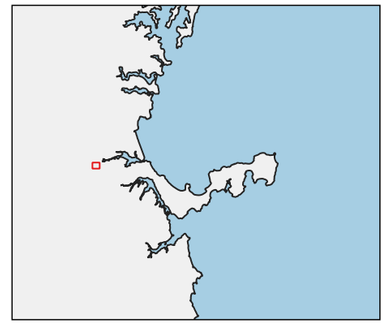
[1] Apex Water, 2025. Wastewater Treatment Plant Design Report – For Consenting. Design report prepared for Fulton Hogan Land Development Limited. January 2025.
[2] Williamson Water and Land Advisory (WWLA), 2023a. Numerical Groundwater Model Development, Factual Technical Report. Report prepared for Fulton Hogan Land Development



Map Title:
Overview Map

Project:
Milldale WWTP Groundwater Assessment

Client:
Fulton Hogan Land Development Ltd.



Legend

- Existing Streams
- Roads
- Wastewater Treatment Plant
- Stage 10 to 11
- Land Plot (Lot 4 DP 353309)

Data Provenance
Aerial Imagery from Land Information New Zealand

Drawn by: Asanka Thilakerathne
16/01/2025

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Figure 1

1.2 Project Description

As indicated above, FHLD is seeking approval to authorise the construction and operation of a WWTP on Lysnar Road, Wainui. A full description of the project is provided in the application AEE. However, the key elements of the proposal addressed in that report include:

- Site compound;
- Wastewater Treatment Plant;
- Site Establishment;
- Ownership & Operation; and
- Duration & Disestablishment.

1.3 Report Objectives

The overall objective of this assessment is to assess the effects of the WWTP development with regard to the following potential effects:

- Groundwater drawdown and dewatering requirements based on the cut and fill plan associated with the proposed earthworks;
- Changes to stream baseflow due to landscape modification during development; and
- Effects of discharging treated wastewater to a Land Contact Infiltration Basin, including on stream baseflow and water quality.

Regulatory assessments in relation to dewatering (Chapter E, Section 7 of the AUP) have been performed in relation to these potential effects.

1.4 Report Structure

The report structure is summarised in **Table 1**.

Table 1. Report structure.

Section	Heading	Description
1	Introduction	This section provides an introduction and overview of the project.
2	Background Data	This section provides information on the proposed landscape modification associated with site development.
3	Methodology	Provides an overview of the methodology used to calculate the extent, magnitude of drawdown from the development.
4	Analysis of Results	Analysis of the excavation on groundwater levels, and the potential effects resulting from groundwater drawdown. .
5	Regulatory Assessment	Provides a summary of the results in the context of the AUP.
6	Summary	Summary of the work completed, and the conclusions drawn.

1.5 Statement of Qualifications and Experience

WWLA a niche employee-owned consultancy with core expertise in the fields of water resources and contaminated land. We conduct hydrogeological assessments and provide groundwater related advice to a wide range of clients. Our services include numerical groundwater modelling, monitoring, geophysical investigations, and undertaking regulatory assessments to support resource consents applications.

The qualifications and experience of the author and reviewer of this report are summarised below. We confirm that we have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

1.5.1 Report author

Asanka Thilakerathne is an Intermediate Hydrogeologist at WWLA. He has been employed at WWLA since February 2024 and has 13 years of professional experience as a Hydrogeologist. His expertise includes groundwater management, groundwater modelling, geophysical exploration, groundwater recharge, borehole construction and test pumping.

Asanka's qualifications include a Bachelor of Science in Geology from University of Peradeniya, Sri Lanka, completed in 2007 and a Master of Science in Hydrogeology and Environmental Management from the Technical University of Darmstadt in Germany completed in 2013. He also holds a certificate in Numerical Groundwater Modelling from IHE Delft Institute for Water Education in Netherlands, completed in 2019.

Since joining WWLA, Asanka has been a central contributor to numerical groundwater models developed for the Whanganui area, commissioned by the Whanganui District Council, and for the Rotowaro Extension Mining Project commissioned by Bathurst Resources Limited. He has also gained experience in the resource consenting process through numerous AEE assessments for numerous groundwater takes and bore construction proposals.

1.5.2 Report reviewer

Jonathan (Jon) Williamson, holds a Bachelor of Science in Earth Science, and a Master of Science and Technology first class honours in Hydrology and Geology from the University of Waikato.

Jon is the Managing Director of WWLA, a firm he founded in January 2015. Jon has 28 years of professional experience in New Zealand, Australia and the Pacific regions. For the 15 years prior to starting WWLA he held various technical and managerial roles in the water resource management and irrigation sectors within the Auckland office of Sinclair Knight Merz (now Jacobs). Prior to that, Jon was employed in a global multidisciplinary consulting firm in Sydney and undertook a range of hydrogeological work in the mining and municipal water supply sectors.

Jon has specialist technical expertise in hydrogeology, hydrology and irrigation engineering in a wide spectrum of services including data collection and analysis; field investigations and testing; modelling; engineering design; construction contract management; technical report writing, community and stakeholder consultation; resource consent hearings; and technical working panels. Examples of Jon's previous work experience includes:

- Assisting with a wide range of surface water take consent applications for primary sector, municipal, and industrial/trade use.
- Providing specialist surface water take consent application peer review services to Hawke's Bay Regional Council.
- Undertaking a conceptual hydrogeology and Lake Water Balance Assessment of Lake Kereta, South Head, Kaipara peninsula.
- Undertaking a Lake Okaihau Water Balance Assessment to assist my client in designing a marquee class golf course and associated infrastructure that borders the lake near Muriwai, Auckland.
- Undertaking a groundwater and stream depletion effects assessment from dewatering associated with turbine foundation construction of the Wavery Wind Farm on similar west coast recent sand dune deposits for Trustpower Limited (now Tilt Renewables).

2. Background Data

2.1 Construction Details

Construction of the WWTP will require a process of cut and fill earthworks to grade the topography and promote gravitational flow through the plant for energy efficiency. The proposed cut and fill plan for the WWTP has been provided as AutoCAD drawings by Woods Engineering[3] for the purpose of this assessment, and is presented in **Figure 2.**

The key changes to the land are summarised below:

- The maximum excavation depth is 1.8 m on the Proposed Rain Garden at south-eastern perimeter;
- The maximum fill is 1.7 m on southern end of Biological Treatment Plant;
- The proposed changes do not change the maximum elevation (18.6 mAMSL); however, earthworks flatten ridges and fill hollows to create a more gently sloping flat terrain.
- The stream “Stream A” has no interference with the construction area.

[3] Woods Engineering, 2024. AutoCAD data provided to WWLA by Woods via email on 13 December 2024 providing technical figures for proposed development.

N

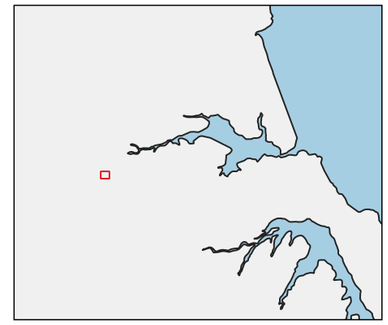
Lysnar Road

0 50 100 m

Map Title:
Cut and Fill Plan of Wastewater Treatment Plant

Project:
Milldale WWTP Groundwater Assessment

Client:
Fulton Hogan Land Development Ltd.



Legend

- **Existing Streams**
- **Roads**

Cut and fill contours

(m)

Cut and Fill Depth (m)

1.8 Fill
0
Cut -1.8

Data Provenance
Aerial Imagery from Land Information New Zealand

Drawn by: Asanka Thilakerathne
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Figure 2

3. Assessment Methodology

3.1 Groundwater Model

WWLA has developed a numerical groundwater model, to simulate hydrological conditions in the Milldale area and surrounding catchments for the purpose of evaluating dewatering requirements and potential groundwater effects around the FHLD Milldale development area (WWLA, 2023a). A single layer model was developed, enabling an efficient and flexible approach that can be adapted to support a range of applications related to the ongoing FHLD project.

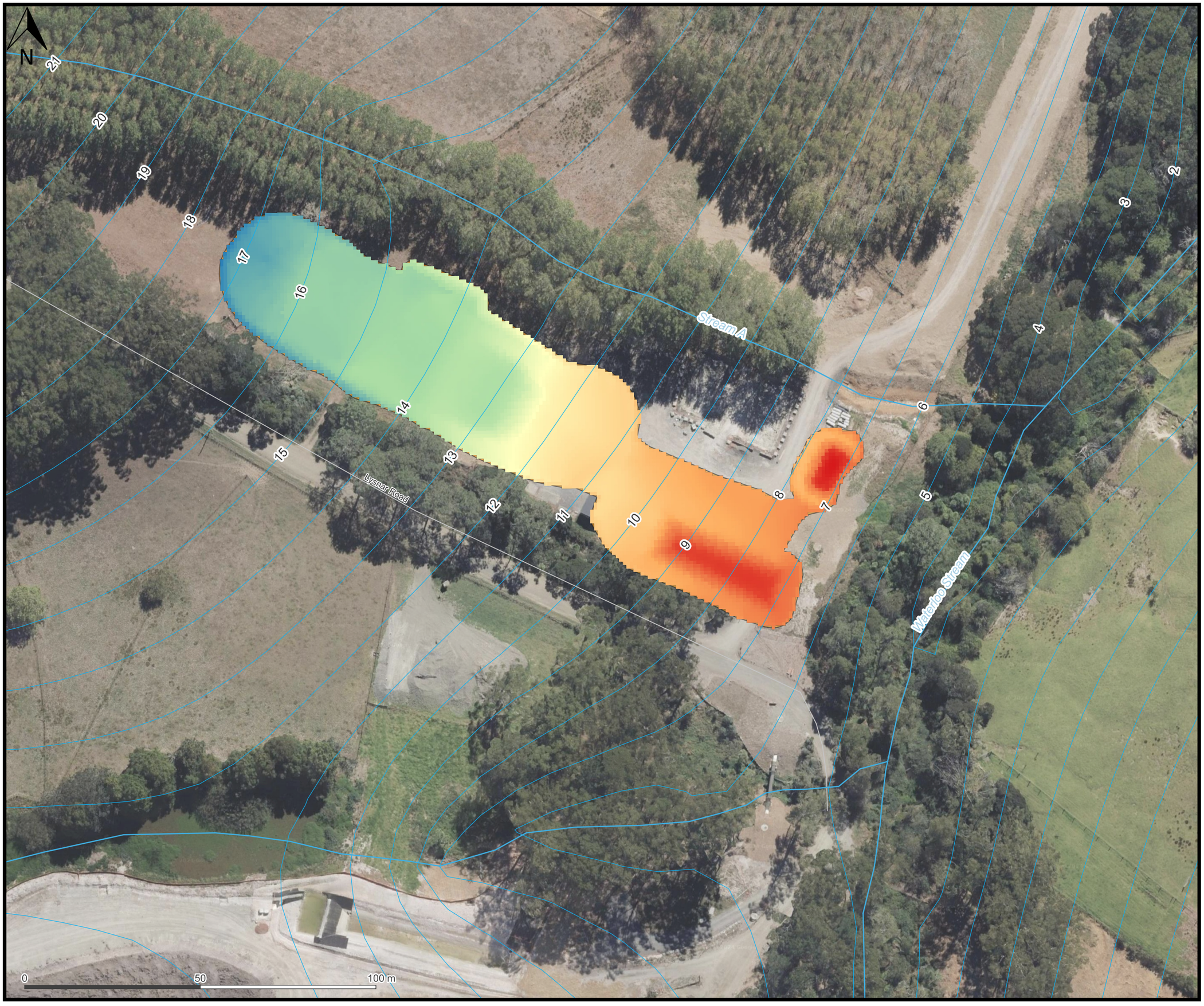
Understanding the existing groundwater level and the depth to groundwater in relation to the depth of the proposed excavation is a primary consideration for initiating a regulatory drawdown assessment. The numerical groundwater model was calibrated with up-to-date groundwater observations based on 18 piezometers including monitoring bores with in Milldale precinct.

Hydraulic conductivity is the most sensitive parameter in terms of simulated water levels and hydraulic gradient. The calibrated hydraulic conductivity of the model was $1.74x10^{-7}$ m/s (0.015 m/d) which aligns with other analyses of East Coat Bays Formation (ECBF) materials that are predominant in the development area. A groundwater recharge rate of 9 percent of annual rainfall was applied, which amounted to 110 mm/year (0.0003039 m/day).

An analysis of groundwater discharge into adjacent streams (i.e. stream baseflow) was undertaken to compare the pre and post construction baseflow conditions.

3.1.1 Simulated Groundwater Conditions

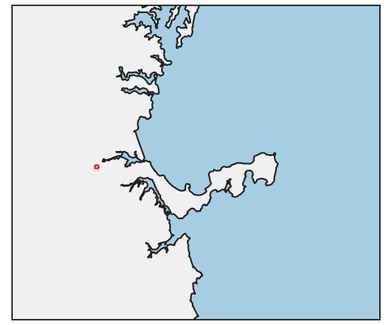
The simulated piezometric surface (water table) modelled for the site under natural (i.e. current) conditions is presented in **Figure 3.** Groundwater levels range from approximately 7 mAMSL to 17 mAMSL, with groundwater generally flowing from north-west to south-east.



Map Title:
Water table map

Project:
Milldale WWTP Groundwater Assessment

Client:
Fulton Hogan Land Development Ltd.



Legend

- Existing Streams
- Roads
- Groundwater Contours (mAMSL)
- Wastewater Treatment Plant

Design land elevation (mAMSL)

18.6

9.75

Data Provenance
Aerial Imagery from Land Information New Zealand

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Figure 3

4. Analysis of Results

As described in **Section 1**, the key objectives of this work were included the following:

- Assess the depth to groundwater table pre and post development;
- Estimate the degree of effects that may occur as a result of the changes, including groundwater drawdown and changes in stream baseflow; and
- Estimate dewatering requirements during construction.

4.1 Depth to Groundwater Analysis

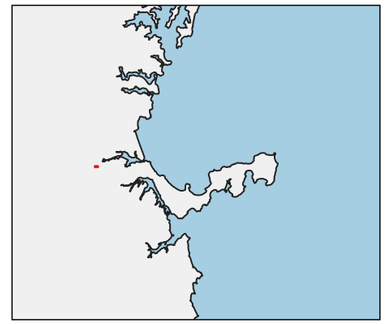
Depth to groundwater across the proposed WWTP site, pre and post development, is presented in **Figure 4.** The pre-development contours represent the difference between the simulated groundwater level and the existing land surface, while the post-development contours incorporate reworked topography and post-construction simulated groundwater levels into the calculation.

It is evident from **Figure 4** that a depth to groundwater greater than zero is maintained pre- and post-construction, which means that the excavation does not extend below the water table. Hence no groundwater drawdown is predicted as a result of the excavation. Model results indicate that the minimum depth to groundwater is 0.4 m after construction, indicating given the changed ground level, a slightly shallower water table in some locations than prior to construction. This occurs in areas where excavation rather than fill is proposed.

Map Title:
Depth to Groundwater;
Pre construction (Top) , Post construction (Bottom)

Project:
Milldale WWTP Groundwater Assessment

Client:
Fulton Hogan Land Development Ltd.



Legend

- Existing Streams
- Roads
- Depth to groundwater contour (m)

Depth to Groundwater in Pre construction stage (Top)	Depth to Groundwater in Post construction stage (Bottom)
5.1	5.1
0	0

Data Provenance
Aerial Imagery from Land Information New Zealand

Drawn by: Asanka Thilakerathne
16/01/2025

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Figure 4

4.2 Dewatering Requirements

The proposed excavation will not intersect the water table, indicating that no dewatering will be required during construction.

4.3 Stream Discharge and Water Quality

No impact on stream baseflow (the portion of stream flow generated by groundwater discharge into streams) due to cut and fill earthworks is anticipated because these works will not penetrate the groundwater table.

However, the disposal of treated effluent into a Land Contact Infiltration Basin, which will ultimately end up in stream that leads to Waterloo Creek is anticipated to increase baseflow by approximately 8 L/s (28 m^3/hr)[1], which is the proposed dry weather flow processed through the wastewater treatment plant.

The increase in flow is likely to be most evident during summer, and have a beneficial effect on maintaining flow during dry periods, hence increasing the mean annual low flow (MALF) over the course of the development.

The APEX (2025) report[1] indicates the design water quality criteria for the wastewater treatment plant is exceptionally high. It is understood that the water quality is suitable for direct application to land in public areas as an irrigation source. Further polishing will take place as the water moves through a Land Contact Infiltration Basin and comes into contact with underlying earth materials before mixing with the waters in the stream and ultimately Waterloo Creek.

We anticipate that the discharge of high quality treated effluent will improve downstream water quality during summer when flow in the stream will be naturally low. During winter flows, the impact of the treated wastewater disposal will be neutral.

Overall, the addition of treated wastewater to Waterloo Creek is considered to have less than minor adverse effects on the existing environment, and potentially significant positive effects.

5. Regulatory Assessment

5.1 Dewatering

The Auckland Unitary Plan – Operative in Part, Chapter E, Section 7, has rules relating to the "*Taking, using, damming and diversion of water and drilling*". Permitted activity rules E7.6.1.6 and E7.6.1.10 are relevant to the proposed dewatering associated with the planned upgrades to the wastewater network.

Permitted activity rule E7.6.1.6 is for "*Dewatering or groundwater level control associated with a groundwater diversion permitted under standard E7.6.1.10*".

Permitted activity provision	Assessment
(1) The water take must not be geothermal water.	The water is not geothermal - **COMPLIES**
(2) The water take must not be for a period of more than 10 days where it occurs in peat soils, or 30 days in other types of soil or rock.	No water take is required – **COMPLIES.**
(3) The water take must only occur during construction.	No water take is required – **COMPLIES.**

Permitted activity rule E7.6.1.10 pertains to "Diversion of groundwater caused by any excavation, (including trench) or tunnel". An evaluation of the proposed development with regard to this rule is as follows:

Permitted activity provision	Assessment
(1) All the following activities are exempt from the Standards E7.6.1.10(2)-(6): (a) Pipe cables or tunnels including associated structures which are drilled or thrust and are up to 1.2 m in external diameter. (b) Pipes including associated structures up to 1.5 m in external diameter where a closed faced or earth pressure balanced machine is used. (c) Piles up to 1.5 m in external diameter are exempt from these standards. (d) Diversions for no longer than 10 days. Or (e) Diversions for network utilities and road network linear trenching activities that are progressively opened, closed and stabilised where the part of the trench that is open at any given time is not longer than 10 days.	The proposed excavation will be permanent, thus longer than 10 days; hence the criteria for exempt activities – **DOES NOT APPLY** (therefore PA is subject to conditions E7.6.1.10(2)-(6) below).
(2) Any excavation that extends below natural groundwater level must not exceed: (a) 1 ha in total area; and (b) 6 m depth below the natural ground level.	The excavation will not extend below natural groundwater – **COMPLIES**
(3) The natural groundwater level must not be reduced by more than 2 m on the boundary of any adjoining site.	The excavation will not extend below natural groundwater – **COMPLIES**.
(4) Any structure, excluding sheet piling that remains in place for not more than 30 days, that physically impedes the flow of groundwater through the site must not: (a) Impede the flow of groundwater over a length of more than 20 m; and (b) Extend more than 2 m below the natural groundwater level.	The works do not comprise any structures that can impede the flow of groundwater - **COMPLIES**
(5) The distance to any existing building or structure (excluding timber fences and small structures on the boundary) on an adjoining site from the edge of any: (a) Trench or open excavation that extends below natural groundwater levels must be at least equal to the depth of excavation. (b) Tunnel or pipe with an external diameter of 0.2 – 1.5 m that extend below natural groundwater levels must be 2 m or greater.	The works are at a significant distance from any buildings on adjoining sites – **COMPLIES**.

Permitted activity provision	Assessment
(c) A tunnel or pipe with an external diameter of up to 0.2 m that extends below natural groundwater level has no separation requirement.	
(6) The distance from the edge of any excavation that extends below natural groundwater level, must not be less than: (a) 50 m from the Wetland Management Areas Overlay; (b) 10 m from a scheduled Historic Heritage Overlay; or (c) 10 m from a lawful groundwater take.	The excavation will not extend below natural groundwater – **COMPLIES.**.

The proposed activity status for the excavation of the Milldale Stage 7 area COMPLIES in full with Permitted Activity rules E7.6.1.6 and E7.6.1.10**.**

6. Summary and Conclusion

This report provides a hydrogeological assessment of excavation activities associated with the proposed Milldale WWTP development. The specific objectives of the work were to define the following:

- Determine the effect of the excavation on groundwater conditions, and the depth and extent of drawdown (if any);
- Assess the potential effects on stream baseflow (if any); and,
- Undertake a regulatory assessment in relation to Chapter E, Section 7 of the Auckland Unitary Plan.

A numerical modelling investigation was undertaken to address dewatering, but because the potential excavation will not exceed the groundwater level at the proposed WWTP, drawdown is not a factor and dewatering during construction will not be required.

Treated wastewater of an exceptionally high quality will be further polished through a Land Contact Infiltration Basin before being discharged to ground. This water will make its way down an unnamed gully to Waterloo Creek, and will have a marked effect on stabilising stream flows (i.e. MALF will increase) and potentially improving water quality.

Overall, the addition of treated wastewater to Waterloo Creek is considered to have less than minor adverse effects on the existing environment, and potentially significant positive effects.