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Preliminary Groundwater Assessment

Tauriko West - Tupenga

WWLA1621 | Final

02 July 2026

Tauriko West - Tupenga

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Qualifications, Experience and Code of Conduct

The qualifications and experience of the author and technical director/reviewer of this report are summarised below. We confirm that we have read the Code of Conduct for Expert Witnesses Contained in the Environment Court of New Zealand Practice Note 2023 and we agree to comply with it. We confirm that the issues addressed in this report are within our area of expertise, except where we state that we are relying on the evidence or advice of another person. We have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this report.

Report Author

Asanka Thilakerathne is an Intermediate Hydrogeologist. 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.

Signed: [redacted] **Date:** 02 July 2026

Report Reviewer

Jonathan (Jon) Williamson is the Managing Director of WWLA with over 31 years of professional experience in New Zealand and Australia. He holds a BSc in Earth Science and an MSc (Tech) 1st Class Honours in Hydrology and Geology from the University of Waikato. His career includes 15 years in senior roles at SKM (now Jacobs) and extensive international consultancy in the mining and municipal sectors.

Jon specialises in hydrogeology, hydrology, and stormwater engineering. His project experience includes technical reviews and expert dewatering, groundwater, surface water and wetland impact assessments for high-profile infrastructure such as the Puhoi to Warkworth, and Otaki to North of Levin highways, Victoria Park Motorway Tunnel, the Waterview Motorway Tunnel, and Central Interceptor Sewage scheme. He has provided specialist assessments for numerous major mines (including Oceana Gold, Rotowaro Coal, Pike River Coal, and Southland Lignite) and large-scale quarries (such as Drury, Kings, Taharoa, and Ihumatao).

Signed: _[redacted] **Date:** 02 July 2026

Acronyms, Definitions and Abbreviations

Term	Definition
AutoCAD	Computer-Aided Design software used for drafting and design
BBO	Bloxham Burnet and Oliver Consultants
BECA	BECA Group (engineering and consultancy firm)
BH	Borehole
BH07	Borehole 07 (specific bore referenced in geotechnical reports)
BOPRC	Bay of Plenty Regional Council
CMW	CMW Geosciences
Control Level	The design carriageway level
CPT	Cone Penetration Test
DRAFT	Preliminary / non-final version of a document
IGN	Ignimbrite (used as a lithological unit code)
km	Kilometre
LiDAR	Light Detection and Ranging (remote sensing method)
LINZ	Land Information New Zealand
m	Metre
mAMSL	Metres above mean sea level
mBGL	Metres below ground level
NZGDB	New Zealand Geotechnical Database
REF	Reference (to drawings or plans)
RS	Road Section / Road Structure (interchange identifier, e.g., RS250)
SH29	State Highway 29
SH29A	State Highway 29A
SQEP	Suitably qualified and experienced person
SWL	Static Water Level
WRC	Waikato Regional Council (used in bore data tables)
WSP	WSP Global (engineering consultancy firm)
WWLA	Williamson Water & Land Advisory
Chainage	Distance measured along the road alignment
Cut	Excavated slope section
Piezometric Surface	Surface presented by groundwater level contours that represent the hydraulic head in groundwater
Unconfined Aquifer	Aquifer open to atmospheric pressure
Confined Aquifer	Aquifer bounded above by low-permeability layers
Perched Aquifer	Localised groundwater body situated on a confining layer above the regional water table

Executive Summary

This preliminary investigation identifies potential groundwater drawdown, dewatering and groundwater mounding effects and requirements associated with cuts and structures proposed within the Tauriko West - Tupenga Project. The investigation utilises interpolation of measured groundwater data and low-complexity numerical three-dimensional modelling of groundwater levels and drawdown, which will inform design, dewatering management, and groundwater diversion decisions and effects assessment where required.

The planned road corridor traverses geology dominated by recent alluvial deposits comprising gravel, sand, silt, mud, and clay with localised peat in lower-lying areas and ignimbrite in higher-elevation areas. Permeability is expected to be moderately high in the alluvial deposits and low in the ignimbrite.

Detailed review of key interaction areas along the Project shows significant topographical variation, however the regional groundwater is estimated to lie below the deepest proposed cuts. Modelled and interpolated groundwater levels, supported by recent monitoring data, provide a reliable representation of current conditions. Consequently, prolonged or significant dewatering is unlikely along the cuts, and no adverse effects on neighbouring bores, wetlands, or land settlement are expected.

Whilst the measured piezometric surface is significantly below the Project Control Levels, the pre-construction modelled groundwater table under winter conditions was close to the Control Level at the Kaweroa Drive Shared Path Underpass, Belk Road Underpass and the Kōpūrererua Stream Bridge (without any subdrain groundwater controls) at approximately 0.9 m, 1.6 m and 0 m mBGL, respectively.

However, with 1.3 m deep subdrains beneath the road carriage, the model for the winter recharge scenario indicates that the sub-drains will intercept groundwater to effectively prevent groundwater inundation. Consequently, passive dewatering of groundwater is predicted at a number (18) of localised low-lying locations.

Groundwater modelling indicates the effects associated with the proposed works are highly localised with the extent of drawdown up to approximately 450 m and maximum depth of less than 2.6 m. The maximum rate of passive dewatering was estimated to be 1.68 L/s or 145 m^3/day (Zone DD-15). Conversely, groundwater mounding caused by fill placement is confined to an even smaller area, with a maximum increase in groundwater levels of approximately 0.5 m and an extent of about 230 m.

Overall, the modelling indicates that the proposed works will result in only minor, localised changes to groundwater flow patterns, and the potential for adverse effects on the wider groundwater system is therefore also low and localised. This is because groundwater intercepted through passive dewatering will be discharged as surface water to the same receiving environment that would have naturally received the original groundwater flow.

Accordingly, no adverse effects are anticipated on neighbouring groundwater users, wetlands, or land stability, and no land settlement is expected. The proposed drainage design is considered adequate to mitigate potential groundwater-related inundation following construction.

There is potential for perched groundwater to occur in the high-elevation areas, particularly at Chainages 4,360 to 4,700 (SH29 Cut 5). However, BH1012 is located approximately 17 m from SH29 Cut 5 (Chainage 4,420), with a measured groundwater level of 24 m AMSL, which is about 12 m below the base of the cut. Therefore, perched groundwater is not expected to affect this cut or any other cuts.

Finally, as the proposed cuts are above both the regional water table and identified potential perched groundwater levels, year-round excavation is feasible without the need for seasonal scheduling or specialised dewatering measures. The overall conclusion is that the proposed 1.3 m deep sub soil drains within low lying areas are appropriate to safeguard against inundation in low lying area of the project. Data from the existing network of 13 continuous and 4 manual piezometers will be utilised to verify groundwater separation distances are maintained throughout the construction period.

Contents

1. Introduction

This report considers:

- the potential need for, and possible effects of, groundwater dewatering (if any) associated with cuts; and
- possible groundwater interaction, design factors or effects arising (if any) in relation to foundation structures.

An overview of the road corridor is shown in **Figure 1**.

1.1 Scope of the Assessment

The scope of this assessment includes:

1. Describing the existing groundwater resources and environment along the proposed road alignment and surrounding areas including the review and/or construction of:
   - geological maps;
   - previous geological and geotechnical reports containing aquifer hydraulic testing and groundwater level data;
   - borehole information for the local strata held by the Bay of Plenty Regional Council (BOPRC), the New Zealand Geotechnical Database (NZGD), and CMW;
   - depth to groundwater (m) contour maps based on available bore data, hydrogeological experience, and known sink locations e.g., streams, wetlands and the Wairoa River;
2. Describing the groundwater level assessment methodology;
3. Identifying any effects of the Project on groundwater resources, and how groundwater impacts on the indicative design of the Project alignment and configuration; and
4. Outlining any recommended geotechnical mitigation options and design philosophies to mitigate potential groundwater effects.

2. Project Overview

An overview of the indicative Project alignment showing the proposed earthworks footprint, cut and fills depths / extents and the main structure locations is presented in **Figure 1**. SH29 is 8.78 km long and the SH29A portion is 2.12 km long. There are six significant cuts along the main road corridor and at intersections, as well as a number of subsurface structures (bridges and underpasses), each of which is assigned a unique chainage and reference code, as shown in **Table 1.** The chainage and reference code identifiers are used throughout this report to accurately locate and reference cuts, structures, and other key features along the corridors (**Figure 1**).

2.1 Cuts

The Project traverses both valley floors and rolling low hill country, necessitating cuts and embankment fills at several locations. As indicated above, each cut is labelled using the highway code followed by a sequential number in the direction of increasing chainage. For example, the first cut along SH29A is designated SH29A_Cut 1. The same labelling convention is applied consistently to SH29. **Table 1** summarises the locations and maximum heights of the indicative cuts along the Project corridor and its interchanges.

The Project design information (CMW, 2026) shows that along SH29 six cuts are planned between chainages 1,680 m and 5,280 m (**Figure 1**). Cut depth vary, with a maximum depth of 19.6 m, which occurs at chainage 5,280 m. The cut depth gradually decreases up to chainage 5,400 m, beyond which no further cuts are present along the proposed alignment up to the end of construction at chainage 8,780 m. Along SH29A, two cuts are planned between chainages 460 m and 1,360 m (**Figure 1**), with maximum cut depths ranging from 4.1 m to 8.8 m. Overall, the SH29 corridor involves deeper cuts than SH29A, warranting a greater focus for groundwater assessment along this section.

Six road interchanges structures and two road crossings (**Figure 1**) also involve deep cuts, with maximum cut depths ranging from 4 m to 22.7 m. The deepest cut occurs in the Redwood Lane interchange (described as existing SH29 extension (RS250)).

Table 1. Summary of the locations of the cuts

Road and Slope Cut	Chainage (m)	Maximum Depth of Cut (m)
SH29_Cut 1	1,680	12.4
SH29_Cut 2	2,940	7.8
SH29_Cut 3	3,660	10.8
SH29_Cut 4	4,040	9.8
SH29_Cut 5	4,400	12
SH29_Cut 6	5,280	19.6
SH29A_Cut 1	460	4.1
SH29A_Cut 2	1,360	8.8
Belk Road (RS120)	120	18.3
Redwood Lane Interchange (Existing SH29 Extension (RS250))	120	22.7
Redwood Lane (RS210)	20	5.3
Redwood Lane Interchange Westbound Exit Ramp (RS240)	440	13.5
Takitimu Drive Interchange Westbound Entry Ramp (RS330)	800	19.2
Takitimu Drive Interchange Westbound Exit ramp (RS320)	180	4
Barkes Corner Interchange Westbound Exit Ramp (RS530)	1,260	7.6
Barkes Corner Interchange Eastbound Entry Ramp (RS520)	260	4
Kaweroa Drive Shared Path Underpass	80	5.5

A more detailed description of the Project is contained within the Substantive Application Report (SAR).

2.2 Subsurface Structures

Table 2 summarises the key structures along SH29 and SH29A, including underpasses, overbridges, interchanges, and stream crossings. For each structure, the approximate chainage along the relevant highway and the minimum control level for the carriageway over and under the structure are provided.

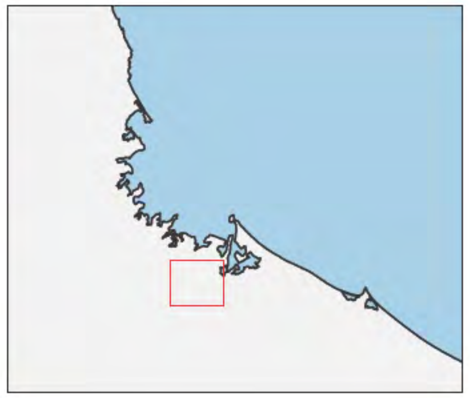
Table 2. Summary of Bridges (Ref. Consent Level Designs)

Location Name	Structure	Description	Approximate chainage and Road	Minimum Finished Levels	
				Carriage way over (mAMSL)	Carriage way under (mAMSL)
Belk Road	Underpass	SH29 over Belk Road	1840 (SH29)	14.6	5.0
Redwood Lane	Interchange	SH29 over Kaweroa Drive	2220 (SH29)	19.7	10.4
Tauriko Village	Overbridge	Tauriko northern access over SH29	4440 (SH29)	48.3	38.0
Cambridge Road	Overbridge	Cambridge Road over SH29	5100 (SH29)	47.4	35.4
Takitimu Drive	Interchange	SH29 over SH29A	6140 (SH29)	16.8	7.8
Barkes Corner	Interchange	Cameron Road over SH29A	1340 (SH29A)	41.4	32.1
Kōpūrererua Stream	Stream Bridge	SH29A over Kōpūrererua Stream	160 (SH29A)	8.9	3.9
Nanako Stream	Stream Bridge	SH29A over Nanako Stream	700 (SH29A)	17.9 -	Not specified

Map Title:
Location Map of Slope Cuts and Bridges

Project:
Tauriko West Groundwater Assessment

Client:
CMW Geosciences



Legend

- Centerline SH29
- Centerline SH29A
- Chainage SH29
- Chainage SH29A
- Bridges
- Interchanges
- Area of Interest

Top Level Basemap Data

- Roads
- State Highway
- Rivers/Streams
- Lake/Pond
- Wetlands

Slope Cuts

- SH29
- SH29A

Data Provenance
Aerial Imagery from Land Information New Zealand

Drawn by: Asanka Thilakerathne
21/03/2026

Layout & Project File
Surface Water

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Figure 1

3. Existing Groundwater Environment

3.1 Topography

The Project traverses gently rolling terrain. Along SH29, ground elevations range from a maximum of approximately 62.4 mAMSL to a minimum of about 0.7 mAMSL. Along SH29A, elevations range from approximately 46.3 mAMSL to 3.4 mAMSL. **Figure 2** and **Figure 3** illustrate the topographic variation, proposed road surface levels, and the locations of cuts along the SH29 and SH29A corridors.

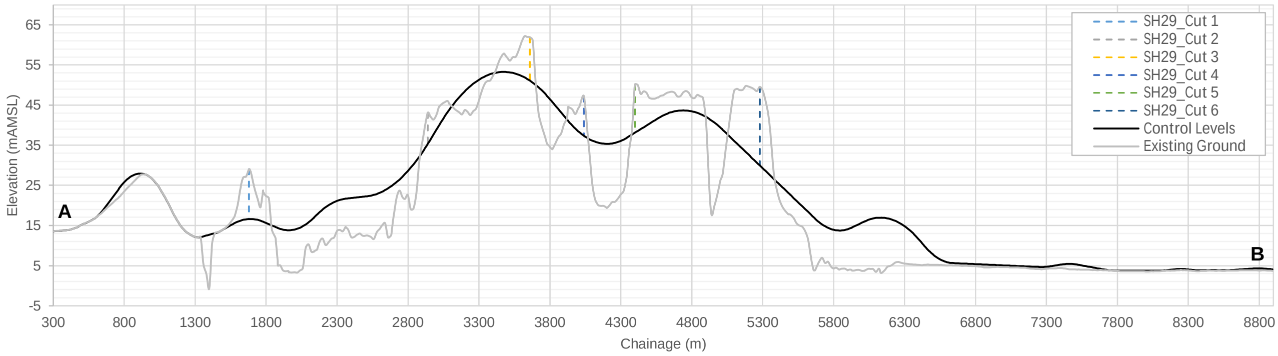


Figure 2. Long section along SH29 road corridor.

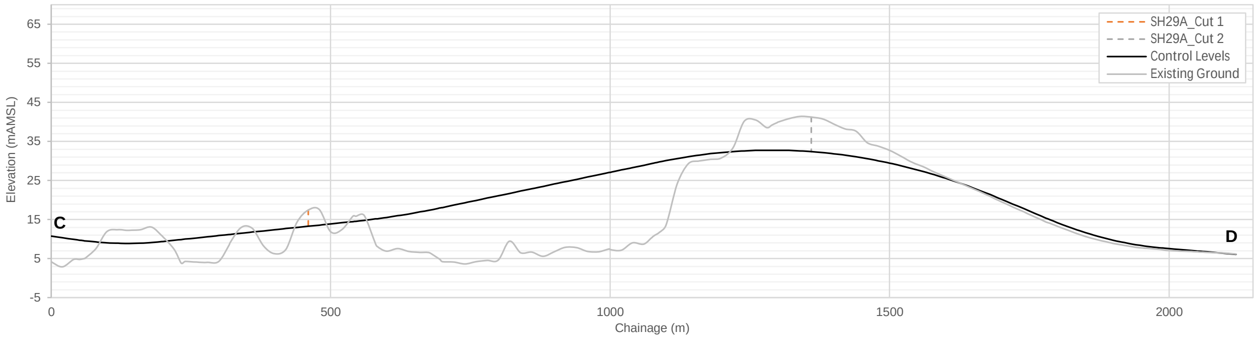


Figure 3. Long section along SH29A road corridor.

3.2 Geology and Hydrogeology

3.2.1 Geological Framework and Stratigraphy

The Project area is situated within the Tauranga Basin, which is a complex structural depression partially infilled by a sequence of terrestrial and estuarine sediments, and overlying volcanic ashes. The surface geology is mapped by Geological and Nuclear Sciences[1] as presented in **Figure 4,** with each primary unit summarised as follows and defined in more detail in Table 3:

- ***Surficial Tephra:*** A blanket of Late Pleistocene to Holocene volcanic ash (tephra) covers much of the rolling hill country, often weathering into sensitive, clay-rich soils (e.g., Hamilton Ash).

[1] Leonard, G.S.; Begg, J.G.; Wilson, C.J.N. (compilers) 2010. Institute of Geological & Nuclear Sciences 1:250 000 geological map 5. Lower Hutt, New Zealand. Institute of Geological & Nuclear Sciences Limited.

- ***Tauranga Group (Alluvial/Estuarine***): Dominated by the Matua Subgroup, these deposits include poorly to moderately sorted gravels, sands, silts, and clays with localised peat. These represent old river channel and swamp deposits that exhibit high lateral and vertical heterogeneity.
- ***Volcanic Basement (Ignimbrites):*** The sedimentary sequence is underlain by Pliocene-Pleistocene rhyolitic ignimbrites, including the Pokai, Ongatiti, and Waiteariki Formations. These units vary from non-welded, loose pumice breccias to strong, coherent welded rock.

Table 3. Description of the local geology.

Strata Name	Unit	Description	Main Rock	Sub Rock	Age Million Years	
					Min.	Max
	Q1.alvgvl	Alluvial gravel, sand, silt, mud and clay with local peat, includes modern river beds.	gravel	sand, silt, clay, peat	0	0.012
Tauranga Group	mQ.snd	Poorly to moderately sorted gravel with minor sand and silt underlying terraces; includes minor fan deposits and loess.	gravel	sand, silt	0.128	2.12
Pokai Formation	Q8.ign8	Rhyolite ignimbrite with brown matrix, orange pumice clasts, non-welded, cream-coloured base to welded jointed; minor fall deposits.	ignimbrite	pumice, lapilli, ash	0.265	0.285
Chimp Formation	Q8.ign7	Non-welded, poorly-consolidated rhyolite ignimbrite, commonly with nearly aphyric pumice; minor fall deposits.	ignimbrite	pumice, lapilli, ash	0.3	0.3
Ongatiti Formation	eQ.ign3	Compound, weakly to strongly welded, vitrophyric, pumice- and crystal-rich ignimbrite with abundant lithics.	ignimbrite		1.17	1.33
Waiteariki Formation	IPl.ign2	Crystal-rich dacitic welded ignimbrite.	ignimbrite		2.06	2.12

3.2.2 Hydrogeological Characteristics

Relative permeability in this geological environment is governed by the grain size and degree of sorting in the alluvial sediments, and the degree of welding/jointing in ignimbrites.

Table 4 summarises the relative permeability of the main rock types in the area. Based on the core photos from the recent drilling, the primary deposits appear to be fine to medium sand, with alternating thin layers of silt and clay. Hence, from a permeability perspective, it is anticipated that the bulk permeability will be a hybrid between these material types and is likely to be moderately low to moderate overall (10^{-6} to 10^{-5} m/s).

Table 4. Relative permeability.

Stratigraphic Unit	General Permeability	Hydraulic Behaviour	Representative Hydraulic Conductivity (m/s)
Clean Gravels, Medium to Fine Sands	High	Primary pathways for rapid horizontal groundwater flow.	10^{-3} to 10^{-6}
Non-welded Ignimbrite	Moderate to High	Acts like a granular aquifer due to high porosity and loose packing.	10^{-4} to 10^{-6}

Fine Sands, Silts, Clays, & Peat	Low to Very Low	Act as aquitards, and may create perched water tables above or confined conditions underneath.	10^{-6} to 10^{-8}
Welded Ignimbrite	Low (Matrix)	Flow is restricted to secondary fractures and joints.	10^{-5} to 10^{-9}

3.2.3 Groundwater Flow Systems

The groundwater flow system in the area can be summarised as follows:

- ***Strong Horizontal Flow:*** Within the alluvial aquifers (SH29A corridor and low-lying SH29 sections), groundwater flow is likely dominated by horizontal flow due to the relatively high permeabilities in the more gravelly and sandier deposits, with the silt and clay impeding vertical flow. Groundwater flow patterns are likely to follow gradients toward the Wairoa River and Kōpūrererua Stream.
- ***Vertical Leakage:*** Where lower-permeability silts are thin or absent, vertical leakage occurs between the shallow unconfined system and deeper ignimbrite aquifers. The direction of vertical flow (up/down) is governed by the topographic position within the basin.
- ***Perched Systems:*** Possible in the tephra-covered hills, where infiltrating rainwater is trapped above low-permeability weathered clay layers, independent of the regional water table. The significance of any perched aquifer is largely governed by the contributing surface recharge area i.e. small recharge areas are likely to result in small highly seasonal flow only.

The Project traverse two principal geological formations according to the geological map, as summarised in **Table 5**.

Table 5. Summary of geological formation locations.

Chainages	Description
SH29	
278–540 m, 1,060–1,500 m, 1,880–2,620 m, 5,460–8,900 m	These sections are underlain predominantly by recent alluvial deposits comprising gravel, sand, silt, mud, and clay, with localised peat. Recent drilling tends to suggest the actual lithology is dominated by fine to medium sand, with alternating thin layers of silts and clays.
540–1,060 m, 1,500–1,880 m, 2,620–5,460 m	In the central, higher-elevation sections, the geology is dominated by unwelded ignimbrite (**Figure 4**). These materials are comparatively more consolidated and resistant to weathering. All proposed cuts along SH29 occur within this geological unit.
SH29A	
0–400 m, 1,900–2,120 m	Dominated by unwelded ignimbrite.
400–1,990 m	A low-lying area underlain by recent alluvial deposits comprising gravel, sand, silt, mud, and clay, with local peat and modern riverbed sediments.

The main water-bearing units in the Project area are shallow and unconfined sand layers interbedded with silt and clay. Based on available drilling information and an understanding of the local hydrogeology, two main aquifer types are recognised at the site:

- A shallow unconfined aquifer at the regional groundwater table; and
- A deeper confined aquifer within the basement rocks, which is not expected to influence this project.

Given the presence of interbedded silt and clay within the profile that is predominantly fine to medium sand, as indicated above the overall bulk permeability is likely to be tempered, meaning groundwater flow is more subdued that if the profile comprises cleaner sands and gravels.

3.3 Existing Groundwater Bores

Based on bore records obtained from the Bay of Plenty Regional Council (BOPRC), a total of 24 bores are located within 500 m of the Project's cuts and subsurface structures (**Figure 5**). The key information available in the BOPRC bore database that is useful for this assessment comprises the following:

- ***Static water level*** - is essential for developing a spatially explicit understanding of the piezometric surface (or water table), which indicates the direction of groundwater flow.
- ***Casing depth*** - provides insight into the depth where usable quantities of groundwater are typically encountered, and provides insight into the degree of connection with the surface (i.e. the deeper the casing depth, the less connectivity to the surface).
- ***Casing diameter*** - is used to determine the maximum size of pumps that can be installed and the potential yield the bore can support.

The intended use of the bores is also an important consideration if the Project is likely to have a dewatering effect. The bores in the area were typically stated as being used as Production bores, Geotechnical bores, Monitoring bores or Investigation bores. Table 12 to Table 14 (**Appendix A**) provide a summary of bores from cuts in the main road corridor, cuts in interchanges, and bridges, respectively.

The two bores nearest to any of the proposed cuts (SH29_Cut 6 and SH29_Cut 4) are BOPRC bore IDs BN-4130 and BN-4170, located approximately 65 m and 79 m away, respectively (Table 12). Construction details for bore BN-4130 are unavailable. Bore BN-4170, which is 49 m deep and located at an elevation of 44.1 mAMSL, has a recorded static water level of about 39 mBGL (5.1 mAMSL).

BN-2007 is located 57 m to Kaweroa Drive Shared Path and Underpass. The bore is 90 m deep and cased to a depth of 39 mBGL (**Table 13**).

Across the wider area of interest, bore records indicate an average total depth of approximately 141 m, an average casing depth of about 61 mBGL, and an average static water level of approximately 23 mBGL.

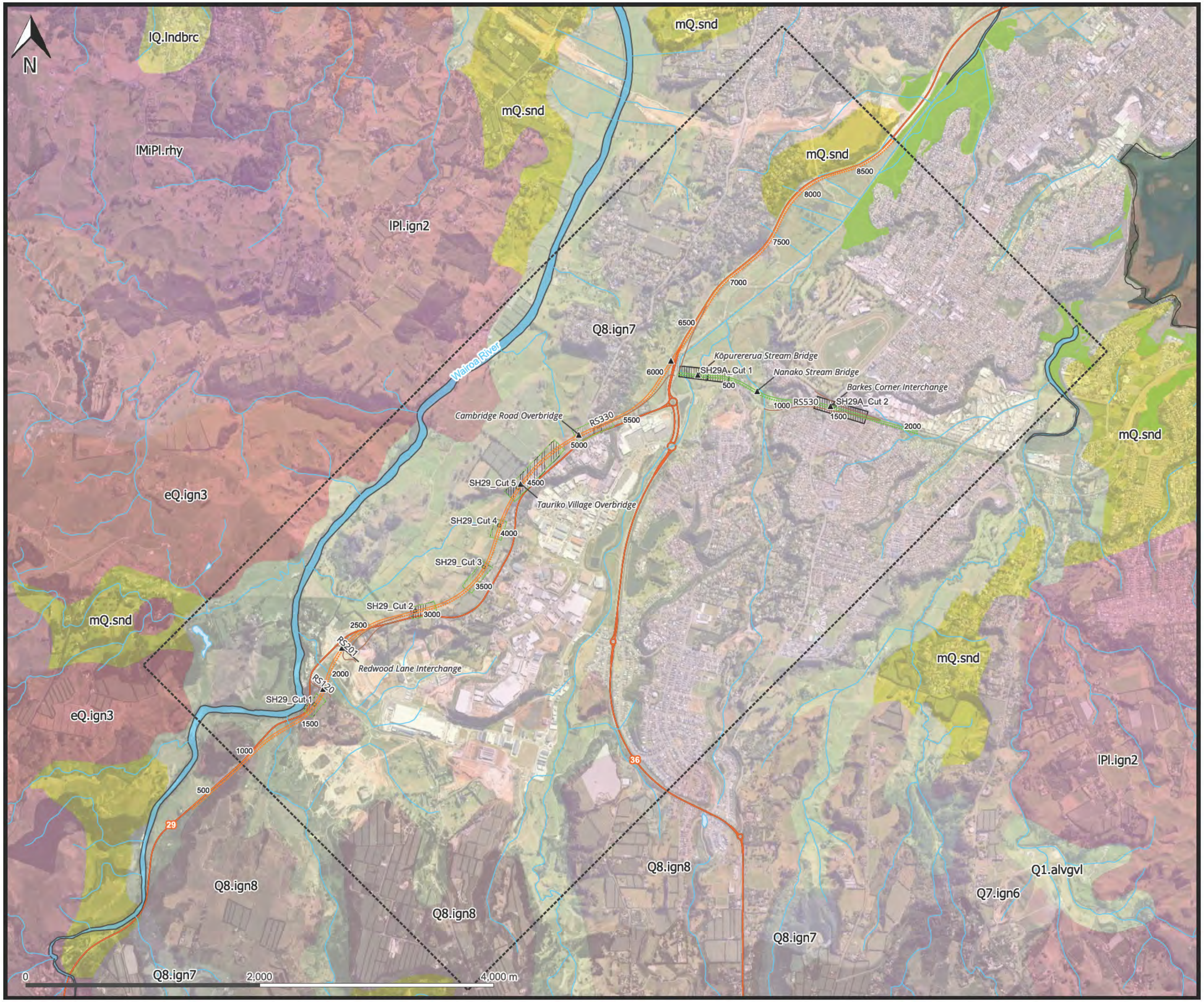
3.3.1 Recent Piezometers

Beca has installed 17 piezometers along the main road corridor, to inform geotechnical investigations for the Project, and has recently provided groundwater level (dip) data for 12 of them. A summary of the groundwater level data collected in the piezometers is presented in **Table 6**, noting that data obtained during drilling is considered less reliable.

Table 6. Summary of installed piezometers

Bore ID	Measured water level during Drilling (mAMSL)	Dipped water level (16 and 19 March) (mAMSL)
BH1001	Not Available	Not Measured
BH1002	11.0	26.3
BH1003	7.2	17.35
BH1004	-1.4	0.66
BH1006	5.6	5.73
BH1007	7.3	4.81
BH1009	39.6	33.7
BH1010	30.9	dry
BH1012	24.6	24.54
BH1014	18.5	29.7
BH1015	38.6	24.7
BH1018	3.3	1.76

Bore ID	Measured water level during Drilling (mAMSL)	Dipped water level (16 and 19 March) (mAMSL)
BH1019	Not Available	Not Measured
BH1022	31.7	23.02
BH2003	Not Available	Not Measured
BH2004	1.0	Not Measured
BH2007	4.3	Not Measured



Map Title:
Local Geology

Project:
Tauriko West Groundwater Assessment

Client:
CMW Geosciences

Legend

Centerline SH9
Centerline SH29A
Chainage SH29
Chainage SH29A
Bridges
Interchanges
Area of Interest

Top Level Basemap Data
State Highway
Rivers/Streams
Lake/Pond
Wetlands

Slope Cuts
SH29
SH29A

Geological Units within Are of Interest
Q1.alvgvl (gravel)
Q8.ign7 (ignimbrite)
Q8.ign8 (ignimbrite)
eQ.ign3 (ignimbrite)
IPl.ign2 (ignimbrite)
mQ.snd (gravel)

Data Provenance
Aerial Imagery from Land Information New Zealand

Drawn by: Asanka Thilakerathne
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Figure 4

Map Title:
Location Map of Registered Bores

Project:
Tauriko West Groundwater Assessment

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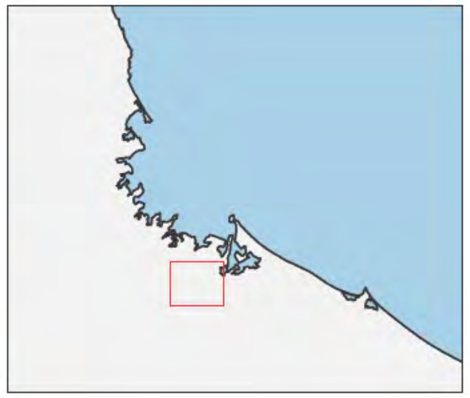
CMW Geosciences



Legend

- Registered Bores
- Centerline SH29
- Centerline SH29A
- Chainage SH29
- Chainage SH29A
- Bridges
- Interchanges
- Area of Interest
- 500 m buffer from Slope cuts and Bridges

Slope Cuts
- SH29
- SH29A

Top Level Basemap Data
- Roads
- State Highway
- Rivers/Streams
- Lake/Pond
- Wetlands

Data Provenance
Aerial Imagery from Land Information New Zealand

Drawn by: Asanka Thilakerathne
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Figure 5

4. Groundwater Effects Analysis

4.1 Methodology

Groundwater controls will be required where the design subgrade or invert level is lower than a groundwater table, whether that be a regional groundwater table or a localised perched groundwater table. The methodology focuses on developing a piezometric surface along the Project alignment, and comparing that to the Project's control levels in order to determine whether such controls are merited for the Project.

The preliminary assessment was undertaken by superimposing Tauriko West Consent Level Designs supplied by BBO (CMW, 2026), onto 1 m resolution LiDAR data obtained from LINZ.

A piezometric surface (groundwater level contour plan) was developed using two methods:

4.1.1 Geospatial Interpolation

Static groundwater level (SWL) data were interpolated using the minimum curvature geospatial interpolation method. SWL's were obtained from multiple sources, including:

- BOPRC[2] bore records;
- borehole and cone penetration test (CPT) data from the WSP geotechnical report (WSP, 2023);
- borehole, and CPT data from the BECA geotechnical report (BECA, 2025) ;
- BECA recent drilling data (dipped piezometers) (BECA, Personal communication, 2026);
- borehole and test pit data from the CMW geotechnical report (CMW, 2019), and
- streambed elevation data, which constrains groundwater levels.

To ensure the dataset is representative of regional shallow groundwater conditions that have the potential to impact the project, BOPRC records were filtered to exclude bores deeper than 100 m and bores with casing depths greater than 30 mBGL.

Inferred sub-soil drainage water (rather than true groundwater) observed in many shallow bores and auger holes were excluded from the interpolation.

In one location perched groundwater that is significantly higher than the inferred regional groundwater table was observed. This occurred at Bore BH07 (WSP,2023), located near SH29 Cut 5. Consequently, BH07 is assumed to be monitoring a perched groundwater system.

Accordingly, the resulting contour map (**Figure 6**) represents the regional groundwater table or piezometric surface. Static water level data are limited to streambed elevation along the SH29A corridor, assuming the stream is groundwater supported.

4.1.2 Numerical Groundwater Model

Groundwater monitoring data at the time of capture can be influenced by several variables, including seasonality, post-drilling recovery, perched water tables, and sub-soil drainage in shallow holes. To account for this variability and verify regional levels, a low-complexity three-dimensional groundwater model was developed. Literature (CMW, 2025) values for hydraulic conductivity of the alluvial sediments, tephra and non-welded ignimbrite units were used as a guide, and adjusted iteratively to achieve a reasonable match to the observed groundwater levels, with recharge fixed at 50% of mean annual rainfall to represent higher groundwater levels as expected during winter conditions.

While not subject to formal calibration, the model was designed as a diagnostic tool to produce a representative simulation of the anticipated and observed groundwater level distribution. In areas where there is a

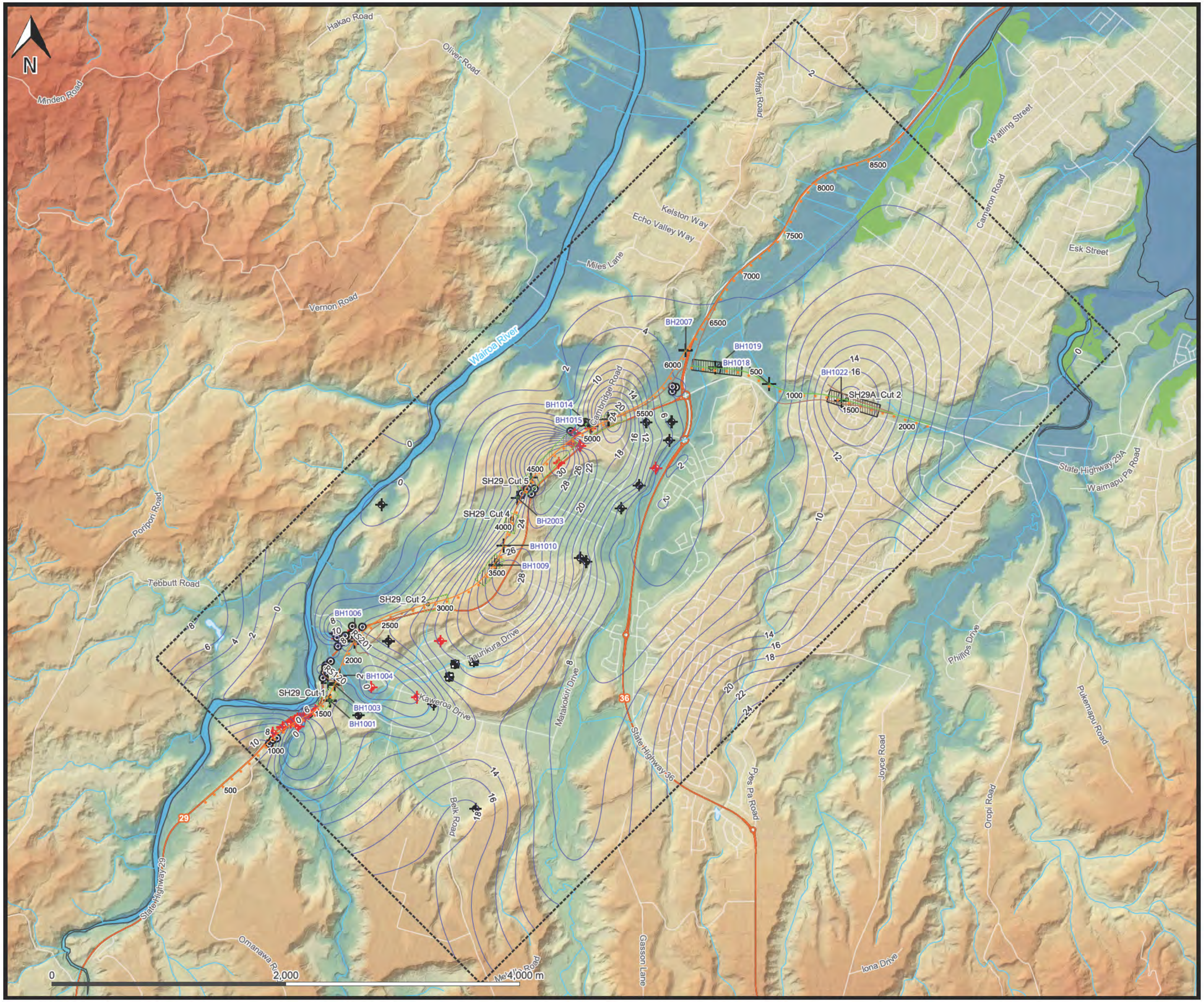
[2] https://maps.boprc.govt.nz/datasets/BOPRC::well-bore-locations-in-the-bay-of-plenty/explore

concentration of piezometers and therefore measured groundwater levels, the interpolated piezometric surface should be considered more accurate than the modelled. The resulting piezometric surface derived from the model is presented in **Figure 7**.

Two versions of the model were prepared, representative of:

a) pre-construction or current day ground surface; and

b) a post construction surface with groundwater sub-drains assigned 1.3 m below the Control Level within the carriageway.



Map Title:
Groundwater Piezometric Surface (Interpolated)

Project:
Tauriko West Groundwater Assessment

Client:
CMW Geosciences

Legend

Sources of Groundwater Levels
- BOP bore
- Borehole
- Cone Penetrometer Test
- Test pit
- Piezometer
- 2m Groundwater Contours (mAMSL)
- Centerline SH29
- Centerline SH29A
- Chainage SH29
- Chainage SH29A
- Interchanges
- Area of Interest

Slope Cuts
- SH29
- SH29A

Top Level Basemap Data
- Roads
- State Highway
- Rivers/Streams
- Lake/Pond
- Wetlands

Data Provenance
Aerial Imagery from Land Information New Zealand

Drawn by: Asanka Thilakerathne
25/03/2026

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Surface Water

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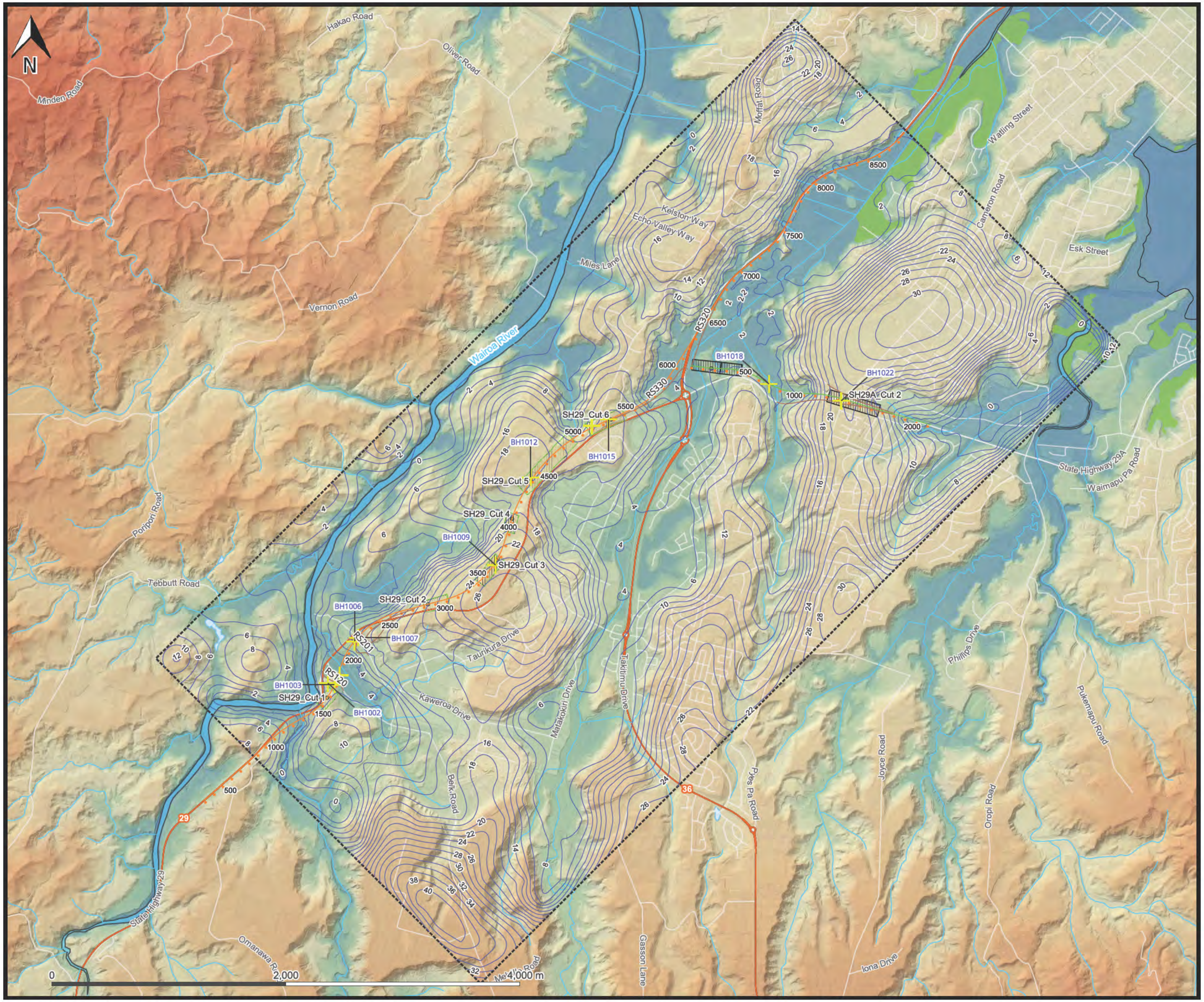
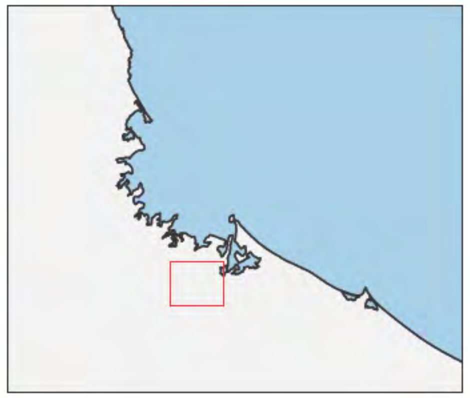
Figure 6





Map Title:
Groundwater Piezometric Surface (Modelled)

Project:
Tauriko West Groundwater Assessment

Client:
CMW Geosciences

Legend

- Dipped Piezometers
- 2 m Groundwater Contours (mAMSL)
- Centerline SH29
- Centerline SH29A
- Chainage SH29
- Chainage SH29A
- Interchanges
- Area of Interest

Slope Cuts

- SH29
- SH29A

Top Level Basemap Data

- Roads
- State Highway
- Rivers/Streams
- Lake/Pond
- Wetlands

Data Provenance
Aerial Imagery from Land Information New Zealand

Drawn by: Asanka Thilakerathne
25/03/2026

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Figure 7

4.2 Analysis

The interpolated and modelled groundwater elevations, together with topography along the entire road alignment of the Project are presented as hydrogeological long-sections in **Figure 8** and **Figure 9.** These show that depth to groundwater ranges from approximately 0 mBGL in stream-adjacent areas to about 35 mBGL beneath the highest ground elevations.

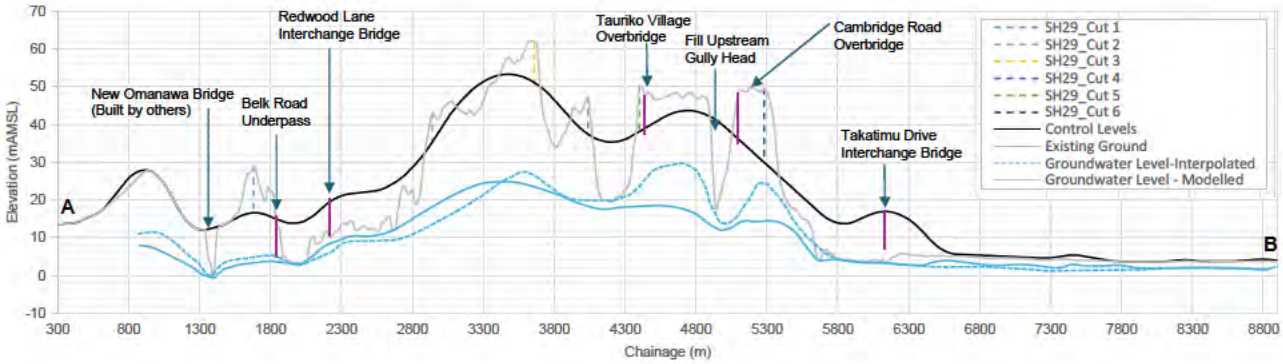

Figure 8. Hydrogeological long section along SH29.

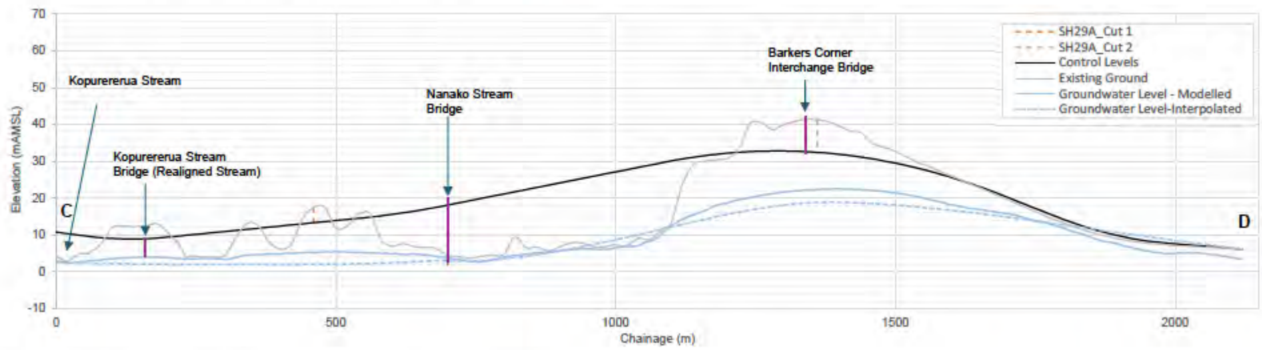

Figure 9. Hydrogeological long section along SH29A.

Figure 10 and **Figure 11** show the same long sections along the SH29 and SH29A road corridors with the locations of the piezometers marked. BH07 is marked on the long section in **Figure 10** and appears to indicate the presence of perched groundwater (Refer **Section 4.1**).

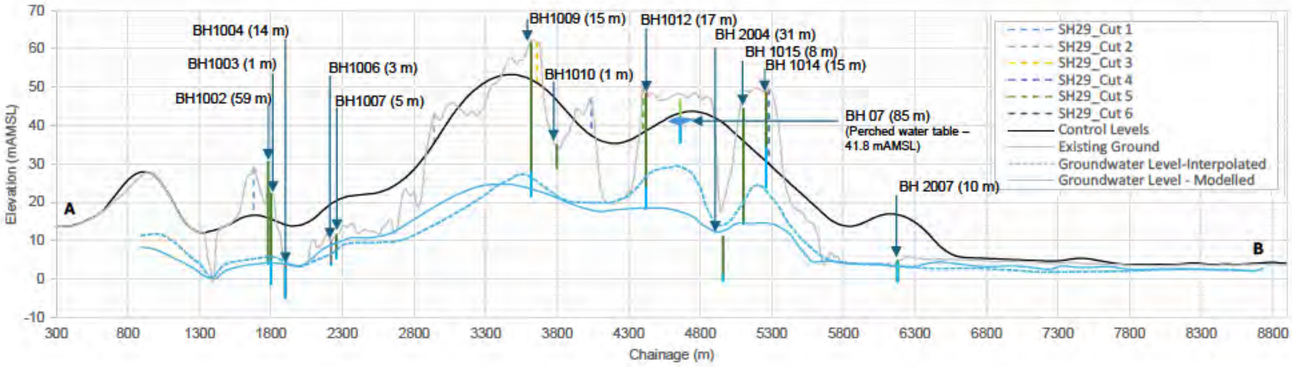

Figure 10. Piezometers along long section of SH29.

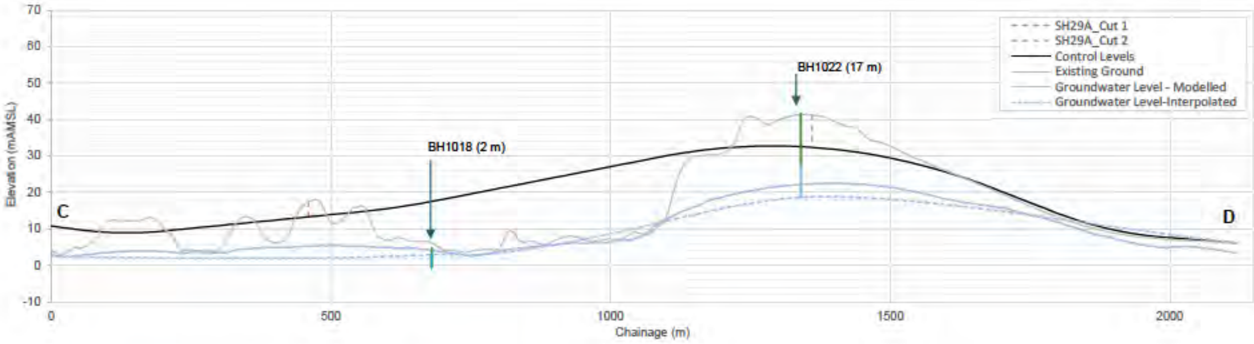

Figure 11. Piezometers along long section of SH29A.

Figure 15 to **Figure 33** (provided in **Appendix B**) show more detailed "close-up" hydrogeological long sections for the proposed cuts and interchanges along SH29, SH29A, using the same viewport as the engineering long-sections (CMW, 2026). **Appendix C** and **Appendix D** provide detailed plans of the cross-section locations, while **Table 8** summarises the groundwater and control levels at each cut site along the Project.

4.3 Summary of Groundwater Effects

The overall conclusion from the review of **Figure 15** to **Figure 33 (Appendix B)** and **Table 8** is that the majority of cuts will not intersect the regional (true) groundwater table. There are three locations where modelled groundwater levels are close to the surface, whilst measured groundwater levels are lower but within 5 m of the surface (close), as identified in **Table 7**. The modelled groundwater levels signal that minor groundwater inundation is possible without underdrainage at the Redwood Lane Interchange (RS250) and at the Kaweroa Drive Shared Path Underpass (RS201) of approximately 0.17 m and 0.16 m, respectively.

However, a detailed review of the area confirms that significant construction activities have been undertaken in the recent past, resulting in a noticeable lowering of ground levels (**Figure 12**). These recent topographical changes have not been incorporated into the groundwater model. Accordingly, the interpolated groundwater surface is considered to provide a more representative estimate of actual groundwater conditions in this area, as it incorporates data from recently installed piezometers and CPT investigations. On this basis, the groundwater depths are estimated to be approximately 4.2 mBGL at RS250 and 3.3 mBGL at RS240, respectively (**Table 8**).

The base level of the Kōpūrererua Stream Bridge is expected to intersect the modelled groundwater table. However, as the depth of construction does not extend below the groundwater table, dewatering is not anticipated to be required.

Table 7. Interchange and bridge with potentially shallow groundwater.

Interchange	Chainage where Maximum Groundwater Level Occurs	Maximum Inferred Groundwater Level - Modelled	Control Level	Inundation Depth*	
				Interpolated	Modelled
	(m)	(mAMSL)	(mAMSL)	(m)	(m)
Redwood Lane Interchange (Existing SH29 Extension (RS250))	120	12.85	12.68	0 (4.2)	0.17 (-0.17)
Kaweroa Drive Shared Path Underpass (RS201)	130	7.61	7.45	0 (5.6)	0.16 (-0.16)
Kōpūrererua Stream Bridge	160	3.9	3.9	0 (1.8)	0 (0)
Note: *Values in brackets are the depth to groundwater from the base of cut.					

Map Title:
Construction Activities at RS250 and RS201

Project:
Tauriko West Groundwater Assessment

Client:
CMW Geosciences

Legend

- **Dipped Piezometers**
- **Centerline Interchanges**
- **Centerline SH29**
- **Bridges**

Slope Cuts

- **SH29**

Data Provenance
Aeria Imagery from Land Information New Zea and

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11/05/2026

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Figure 12

Detailed analysis of shallow auger hole and CPT data indicates that, in isolated locations, seepages from sub-soil drainage and perched groundwater may be encountered at shallow depths. This perched water typically occurs within moderately permeable sand layers overlying lower-permeability clay or silt confining units. While such perched groundwater may cause short-term nuisance during construction (e.g. wet soil conditions for the Contractor to manage), it generally dissipates rapidly where the perched systems are lensoidal (such as in cross-bedded strata as this), and where the upgradient contributing catchment area is limited.

Table 8. Inferred Groundwater Level at Cuts.

Cut / Bridge	Chainage	Base Elevation of Maximum Cut	Inferred Groundwater Level		Depth To Groundwater*	
			Interpolated	Modelled	Interpolated	Modelled
	(m)	(mAMSL)	(mAMSL)	(mAMSL)	(m)	(m)
SH29_Cut 1	1,680	16.6	4.3	3.16	12.3	13.4
SH29_Cut 2	2,940	35.3	12.7	17.9	22.6	17.4
SH29_Cut 3	3,660	51.1	26.5	23.6	24.6	27.5
SH29_Cut 4	4,040	37.4	20.2	18.5	17.2	18.9
SH29_Cut 5	4,400	38.1	22.3	18.3	15.8	19.8
SH29_Cut 6	5,280	29.9	24.1	14.6	5.8	15.3
SH29A_Cut 1	460	13.3	2.1	3.9	11.2	9.4
SH29A_Cut 2	1,360	32.4	18.9	22.5	13.5	9.5
Belk Road (RS120)	120	6.3	4.4	3.3	2.0	3
Redwood Lane Interchange Existing SH29 Extension (RS250)	120	12.7	8.5	12.8	4.2	-0.1
Redwood Lane Interchange Westbound Exit Ramp (RS240)	440	11.7	8.4	11.6	3.3	0.1
Takitimu Drive Interchange Westbound Entry Ramp (RS330)	800	29.3	24.1	14.6	5.2	14.7
Takitimu Drive Interchange Westbound Exit ramp (RS320)	180	6.0	2.2	3.5	3.8	2.5
Barkes Corner Interchange Westbound Exit Ramp (RS530)	1280	27.4	16.7	18.5	10.7	8.9
Barkes Corner Interchange Eastbound Entry Ramp (RS520)	260	38.3	18.7	22.5	19.6	15.8
Kaweroa Drive Shared Path Underpass (RS201)	80	8.9	3.3	8	5.6	0.9

Note: *Values in brackets are the depth to groundwater from the base of cut.

Table 9. Inferred Groundwater Level at Structures.

Cut / Bridge	Chainage	Base Elevation of Maximum Cut	Inferred Groundwater Level		Depth To Groundwater*	
			Interpolated	Modelled	Interpolated*	Modelled*
	(m)	(mAMSL)	(mAMSL)	(mAMSL)	(m)	(m)
Belk Road Underpass	1840	5	4.4	3.4	0.6	1.6

Cut / Bridge	Chainage	Base Elevation of Maximum Cut	Inferred Groundwater Level		Depth To Groundwater*	
			Interpolated	Modelled	Interpolated*	Modelled*
	(m)	(mAMSL)	(mAMSL)	(mAMSL)	(m)	(m)
Redwood Lane Interchange	2220	10.4	4.3	8.6	6.1	1.8
Tauriko Village Overbridge	4440	38	24.8	18.4	13.2	19.6
Cambridge Road Overbridge	5100	35.4	15.0	13.5	20.4	21.9
Takitimu Drive Interchange	6140	7.8	2.9	2.8	4.9	5.0
Barkes Corner Interchange	1340	32.1	18.7	22.2	13.4	9.9
Kōpūrererua Stream Bridge	160	3.9	2.1	3.9	1.8	0
Nanako Stream Bridge	700	Not specified	3.0	3.7	-	-
Note: *Values in brackets are the depth to groundwater from the base of cut.						

4.3.1 Perched Groundwater

Figure 13 indicates a probable perched groundwater table between chainages 4700 m and 4900 m along SH29, which is also illustrated in **Figure 10** and **Figure 13**. According to WSP (2023), BH07 was drilled to a depth of 11 m, encountering a fine to coarse grained sand layer overlying silty clay at approximately 42.5 m AMSL (4 m BGL). A 5 m deep piezometer was installed in the bore. The thin sand layer overlying the silty clay is likely responsible for the development of the perched groundwater table at this location.

At this location, the base of the proposed cut is at 43 m AMSL, while the perched groundwater level is recorded at approximately 41.8 m AMSL. This indicates that the perched groundwater table is about 1.2 m below the control level. Therefore, dewatering is not expected to be required at this location or any other location due to perched groundwater.

4.3.2 Groundwater Inundation

Natural groundwater inundation occurs where groundwater levels are predicted to be at or above the original ground surface in low lying areas (as opposed to cuts). Groundwater inundation whilst not measured, was modelled as having potential to occur during winter conditions at several low-lying locations, as shown in **Figure 13** and as follows:

- Belk Road intersection (chainage 0 to 50 m-RS120)[3].
- SH29A (chainage 1700 to 2000 m)[4].

The inundation analysis used the groundwater model to generate groundwater levels as described above, with comparison against ground levels from LiDAR.

During the Project construction, these low lying areas will experience fill emplacement and sub-drains are installed beneath the entire road carriage way to control both sub-soil drainage and groundwater.

A groundwater model scenario was run that incorporated the post construction ground surface and subsoil drains at 1.3 mBGL under the carriageway in inundation prone areas. The modelling result for the winter

[3] **Figure 23** in **Appendix B** provides a hydrogeological long section of the site.
[4] **Figure 11** provides a hydrogeological long section of the site.

recharge scenario indicate that the sub-drains will intercept groundwater rise to effectively prevent groundwater inundation along the carriageway. Consequently, passive dewatering of groundwater is predicted at a number of localised low lying locations, as discussed in the following section.

Groundwater from the drainage system will be diverted to the nearest downgradient surface drainage network, which is ultimately where groundwater seeps to naturally. The implication is that there will not be a significant difference in groundwater flow path or flow rate as a result of the construction work.

4.3.3 Active Dewatering (Cuts)

The invert level of all cut faces remains above the regional groundwater table, hence no active dewatering is required.

It is likely that bridge piles will intersect the groundwater table. It is anticipated that piles will be advanced using steel caissons, and excavated internally, which will mitigate any dewatering requirements. Accordingly, any dewatering during pile construction (if any) will be of short duration and not of significant volume, given the internal excavation construction method.

4.3.4 Passive Dewatering (Potential Inundation Areas)

Analysis of drawdown and mounding due to the 1.3 m deep sub-drains beneath the surface of the carriageway and fill emplacement in low lying areas, was undertaken using the model. Where drawdown occurred, the model calculated rates of passive dewatering, and where mounding occurred, the model calculated the change in water balance immediately under the mounding area in the local stream network.

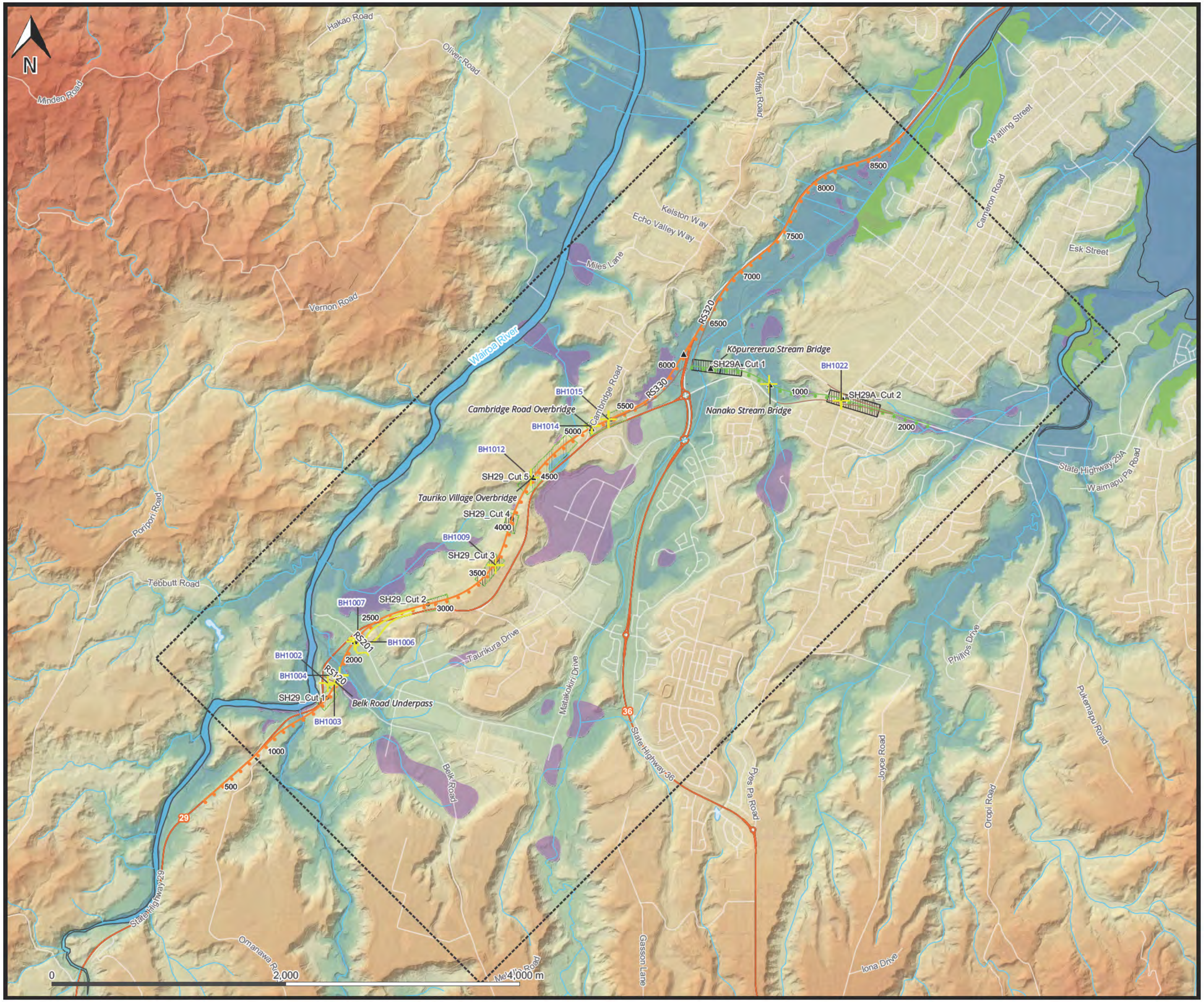
Groundwater drawdown and mounding (increased groundwater level) areas were determined by comparing piezometric surfaces generated from the pre-construction and post-construction groundwater models. **Figure 14** illustrates the identified drawdown and mounding areas.

A total of 18 groundwater drawdown zones and 19 mounding zones were identified (**Table 10** and **Table 11**). The maximum drawdown depth is approximately 2.6 m and maximum drawdown extent is 450 m (in locations where the post construction ground surface is lower than the pre-construction ground surface). The maximum mounding depth is approximately 0.5 m and extent is very localised (less than 230 m), hence the scale of groundwater level changes related to underdrainage coupled with emplaced fill (where relevant) is small.

Where groundwater drawdown occurs, this results in a theoretic loss in groundwater discharge to the local stream network through passive dewatering, although in practice, the intercepted groundwater discharges back to the local stream immediately downgradient of the road carriageway. The maximum passive dewatering rate in a drawdown area was estimated at 1.68 L/s (145 m^3/day) and occurred within Zone DD-15.

Where groundwater mounding occurs because of fill emplacement, there may be a localised reduction in groundwater discharge to the original stream bed at that location, but the groundwater remains in the aquifer as increased storage (mounding) and will continue to flow, manifesting in the stream slightly further downstream. The maximum change in groundwater discharge to streams was estimated at 1,2 L/s (100 m^3/day) Zone MD-11.

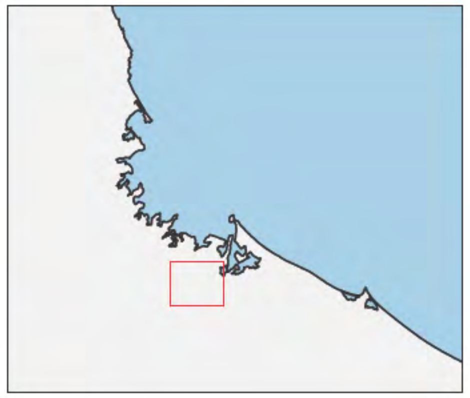
Therefore, under both the groundwater drawdown or mounding assessment, there is no net loss of stream baseflow and the effects of this are considered less than minor.



Map Title:
Probable Inundation Areas and Areas with Perched Groundwater

Project:
Tauriko West Groundwater Assessment

Client:
CMW Geosciences



Legend

- Dipped Piezometers
- Centerline SH29
- Centerline SH29A
- Chainage SH29
- Chainage SH29A
- Bridges
- Interchanges
- Area of Interest

Slope Cuts

- SH29
- SH29A

Top Level Basemap Data

- Roads
- State Highway
- Rivers/Streams
- Lake/Pond
- Wetlands
- Probable Inundation Areas
- Probable Perched Groundwater

Data Provenance
Aeria Imagery from Land Information New Zea and

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11/05/2026

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Figure 13

Table 10. Groundwater Drawdown Localised Passive Dewatering.

FID	Groundwater Model Status		Reduction in Flow	
	Pre Construction	Post Construction		
	(m^3/day)	(m^3/day)	(m^3/day)	(L/s)
DD-1	0	8.09	8.09	0.09
DD-2	0	7.33	7.33	0.08
DD-3	0	7.33	7.33	0.08
DD-4	0	4.57	4.57	0.05
DD-5	0	1.99	1.99	0.02
DD-6	8.92	30.10	21.18	0.25
DD-7	0	3.47	3.47	0.04
DD-8	0	14.00	14.00	0.16
DD-9	0	8.25	8.25	0.10
DD-10	0	2.75	2.75	0.03
DD-11	2.84	9.05	6.21	0.07
DD-12	0	3.25	3.25	0.04
DD-13	0	36.24	36.24	0.42
DD-14	3.79	39.94	36.15	0.42
DD-15	157.49	302.72	145.23	1.68
DD-16	11.94	66.11	54.17	0.63
DD-17	26.91	82.07	55.16	0.64
DD-18	0	15.93	15.93	0.18

Table 11. Groundwater Mounding Localised Flow Reduction.

FID	Groundwater Model Status		Reduction in Flow	
	Pre Construction	Post Construction		
	(m^3/day)	(m^3/day)	(m^3/day)	(L/s)
MD-1	8.92	3.90	5.03	0.06
MD-2	3.41	0.00	3.41	0.04
MD-3	35.57	1.80	33.77	0.39
MD-4	4.47	0.00	4.47	0.05
MD-5	16.31	0.00	16.31	0.19
MD-6	17.84	0.00	17.84	0.21
MD-7	10.48	0.00	10.48	0.12
MD-8	1.85	0.00	1.85	0.02
MD-9	8.83	0.00	8.83	0.10
MD-10	16.65	0.00	16.65	0.19
MD-11	100.75	0.00	100.75	1.17
MD-12	50.14	5.61	44.53	0.52
MD-13	10.02	0.87	9.15	0.11
MD-14	11.62	0.00	11.62	0.13

FID	Groundwater Model Status		Reduction in Flow	
	Pre Construction	Post Construction		
	(m³/day)	(m³/day)	(m³/day)	(L/s)
MD-15	13.46	0.00	13.46	0.16
MD-16	10.79	0.00	10.79	0.12
MD-17	13.28	0.00	13.28	0.15
MD-18	5.47	0.00	5.47	0.06
MD-19	11.40	0.00	11.40	0.13

Map Title:
Drawdown and Mounding Areas

Project:
Tauriko West Groundwater Assessment

Client:
CMW Geosciences

Legend

- Mounding Areas
- Drawdown Areas
- Drawdown Contours (m)
- Dipped Piezometers
- Centerline SH29
- Centerline SH29A
- Chainage SH29
- Chainage SH29A
- Interchanges
- Area of Interest

Slope Cuts

- SH29
- SH29A

Top Level Basemap Data

- Roads
- Rivers/Streams
- Lake/Pond
- Wetlands

Data Provenance
Aeria Imagery from Land Information New Zea and

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19/06/2026

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Figure 14

5. Hydrological Uncertainty and Integrated Management

While the assessment concludes that regional groundwater dewatering will not be required, the management of intermittent water ingress remains a key variable. During winter months, differentiating between surface runoff, sub-soil drainage, and perched water tables is often impractical, principally because surface runoff will overshadow the other components of the water balance. Consequently, all water encountered within the Project footprint should be managed through the established stormwater and erosion control systems.

Groundwater related effects from dewatering or diversion (inundation) are considered zero in areas where groundwater is not encountered. Where groundwater is encountered the effects are considered no more than minor. Nevertheless, a cautious approach is recommended to seek project wide consents to intercept, capture and discharge any intercepted groundwater flows (if encountered).

6. Conclusion

The Project traverses geology dominated by recent alluvial deposits comprising mainly sand, silt, and clay with localised peat in lower-lying areas and unwelded ignimbrite in higher-elevation areas. Permeability is expected to be moderately low to moderate (10^{-6} to 10^{-5} m/s) in the alluvial deposits, and moderate to high in the unwelded ignimbrite (10^{-6} to 10^{-4} m/s).

The regional groundwater level using the pre-construction model is estimated to lie approximately 0.1 to 27.5 m below the base of the deepest proposed cuts. In most areas groundwater remains significantly below the proposed Control Levels and no dewatering will be required.

There are 18 locations where the Project (either sub-surface structures or sub-drains) may intersect with groundwater, particularly during winter, and passive dewatering along with commensurate minor groundwater drawdown will occur.

The groundwater model with winter recharge conditions indicates that the proposed post-construction drainage measures, including subsoil drains installed at 1.3 mBGL, are effective in reducing groundwater levels within the designation area, such that no groundwater inundation is identified in low-lying areas.

Passive dewatering from the subsoil drains in the low-lying areas is localised, with of limited depth (<2.6 m) and extent (450 m) of drawdown. Mounding due to fill emplacement is even more localised, with maxim rise in groundwater level of 0.5 m and extent limited to 230 m.

Both the groundwater drawdown (passive dewatering) or mounding result in no net loss of stream baseflow because groundwater will; be discharge either passively or via natural throughflow effectively into the same surface water receptor immediately downstream of the affected area.

Therefore, because of the limited and localised drawdown, and no net losses in surface water flows, it is expected that there will be no effects on neighbouring bores, or wetlands and no land settlement.

A possible perched groundwater table was encountered at BH07 (**Section 4.1**), however the level was still 1.2 m below the base of the proposed cut. At no other sites were potential or possible perched groundwater encountered. Therefore, perched groundwater is not expected to affect this cut, nor any others.

Finally, as all the proposed cuts remain above both the regional water table and identified potential perched groundwater levels, year-round excavation is feasible without the need for seasonal scheduling or specialised dewatering measures. Proposed 1.3 m deep sub soil drains within low lying areas are adequate mitigate inundation in low lying areas. Data from the existing network of 13 continuous and 4 manual piezometers will be utilised to verify these separation distances are maintained throughout the construction period.

7. References

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Appendix A. Summary of Bores Within 500 m

Table 12. Summary of borewells within 500 m from slope cuts of Main Road Corridor (WRC data).

Well Number	Date of Construction	Bore Head Elevation (mAMSL)	Static Water Level (mBGL)	Bore Depth (m)	Casing Depth (mBGL	Distance to Nearest Slope Cut (m)	Slope Cut (Main Road Corridor)
BN-4130	4/10/1983	49.50	Not Available	Not Available	Not Available	65	SH29_Cut 6
BN-4170	6/10/1985	44.14	39.3	48.8	0	79	SH29_Cut 4
BN-10798	1/08/2009	58.59	53.7	237.7	91	139	SH29_Cut 3
BN-83	10/07/1985	56.63	47.2	253	118.3	171	SH29_Cut 3
BN-4357	9/07/1984	9.75	Not Available	Not Available	Not Available	174	SH29_Cut 1
BN-11657	22/01/2009	3.19	4	73	32.5	188	SH29_Cut 1
BN-4434	16/07/1983	44.81	42.7	75	0	211	SH29_Cut 2
BN24-0062	24/06/2024	37.52	37.25	144	89.4	214	SH29_Cut 1
BN-2670	27/03/2003	58.65	49.3	585	125	235	SH29_Cut 3
BN-80	19/06/1985	41.68	39	234.7	135.9	301	SH29A_Cut 2
BN-1001279	23/09/2013	13.44	3.2	18	0	304	SH29_Cut 6
BN-10793	14/08/2007	10.60	3.9	25.5	19.5	307	SH29_Cut 1
BN-2389	11/10/1983	27.50	25.91	189	104.24	339	SH29_Cut 3
BN-403	25/08/1979	46.09	10.67	100	12.19	341	SH29_Cut 5
BN-2043	11/02/1988	42.83	46	305	133	363	SH29A_Cut 2
BN-2007	11/01/1986	13.49	3.6	90	39	439	SH29_Cut 1
BN20-0069	26/05/2020	24.98	15.9	28	22.5	463	SH29_Cut 2
BN-11653	16/12/2008	15.43	13.7	82	39	482	SH29_Cut 1

Table 13. Summary of borewells within 500 m form slope cuts of Interchanges (WRC data).

Well Number	Date of Construction	Bore Head Elevation (mAMSL)	Static Water Level (mBGL)	Bore Depth (m)	Casing Depth (mBGL	Distance to Nearest Slope Cut (m)	Slope Cut (Main Road Corridor)
BN-2007	11/01/1986	13.49	3.6	90	39	57	Kaweroa Drive Shared Pathe and Underpass
BN-4130	4/10/1983	49.50	Not Available	Not Available	Not Available	81	Takitimu Drive Interchange
BN-1515	7/09/1983	11.07	10.4	134.1	45.7	97	Redwood Lane Interchange West Bound
BN20-0069	26/05/2020	24.98	15.9	28	22.5	99	Redwood Lane Interchange
BN24-0121	19/06/2024	9.16	8.7	186	48	113	Redwood Lane Interchange West Bound

Well Number	Date of Construction	Bore Head Elevation (mAMSL)	Static Water Level (mBGL)	Bore Depth (m)	Casing Depth (mBGL	Distance to Nearest Slope Cut (m)	Slope Cut (Main Road Corridor)
BN-11657	22/01/2009	3.19	4	73	32.5	158	Belk Road Underpass
BN-4357	9/07/1984	9.75	Not Available	Not Available	Not Available	222	Belk Road Underpass
BN-10519	6/06/2003	11.33	1.5	48	30	276	Kaweroa Drive Shared Pathe and Underpass
BN-1001279	23/09/2013	13.44	3.2	18	0	288	Takitimu Drive Interchange
BN-80	19/06/1985	41.68	39	234.7	135.9	323	Barkes Corner On Ramp
BN24-0062	24/06/2024	37.52	37.25	144	89.4	341	Belk Road Underpass
BN-2571	18/04/1991	9.18	11	73	32.5	351	Redwood Lane Interchange West Bound
BN-10793	14/08/2007	10.60	3.9	25.5	19.5	362	Belk Road Underpass
BN-2043	11/02/1988	42.83	46	305	133	399	Barkes Corner On Ramp
BN-11585	29/07/2005	26.47	38	146	32.5	420	Barkes Corner Off Ramp
BN-10461	10/11/2002	0.44	3.4	21	13	496	Kaweroa Drive Shared Path and Underpass

Table 14. Summary of borewells within 500 m from Bridges (WRC data).

Well Number	Date of Construction	Bore Head Elevation (mAMSL)	Static Water Level (mBGL)	Bore Depth (m)	Casing Depth (mBGL	Distance to Nearest Slope Cut (m)	Bridges
BN-4130	4/10/1983	49.50	Not Available	Not Available	Not Available	114	Cambridge Road Overbridge
BN-1515	7/09/1983	11.07	10.4	134.1	45.7	123	Redwood Lane Interchange
BN-2007	11/01/1986	13.49	3.6	90	39	170	Redwood Lane Interchange
BN24-0121	19/06/2024	9.16	8.7	186	48	177	Redwood Lane Interchange
BN-11657	22/01/2009	3.19	4	73	32.5	178	Belk Road Underpass
BN-10519	6/06/2003	11.33	1.5	48	30	181	Redwood Lane Interchange
BN-4357	9/07/1984	9.75	Not Available	Not Available	Not Available	207	Belk Road Underpass
BN20-0069	26/05/2020	24.98	15.9	28	22.5	288	Redwood Lane Interchange
BN-80	19/06/1985	41.68	39	234.7	135.9	297	Barkes Corner Interchange
BN-403	25/08/1979	46.09	10.67	100	12.19	309	Tauriko Village Overbridge
BN-2571	18/04/1991	9.18	11	73	32.5	313	Redwood Lane Interchange
BN24-0062	24/06/2024	37.52	37.25	144	89.4	332	Belk Road Underpass
BN-10793	14/08/2007	10.60	3.9	25.5	19.5	345	Belk Road Underpass
BN-2043	11/02/1988	42.83	46	305	133	351	Barkes Corner Interchange
BN-10461	10/11/2002	0.44	3.4	21	13	402	Redwood Lane Interchange
BN-1001279	23/09/2013	13.44	3.2	18	0	470	Cambridge Road Overbridge

Well Number	Date of Construction	Bore Head Elevation (mAMSL)	Static Water Level (mBGL)	Bore Depth (m)	Casing Depth (mBGL	Distance to Nearest Slope Cut (m)	Bridges
BN-4170	6/10/1985	44.14	39.3	48.8	0	477	Tauriko Village Overbridge

Appendix B. Results

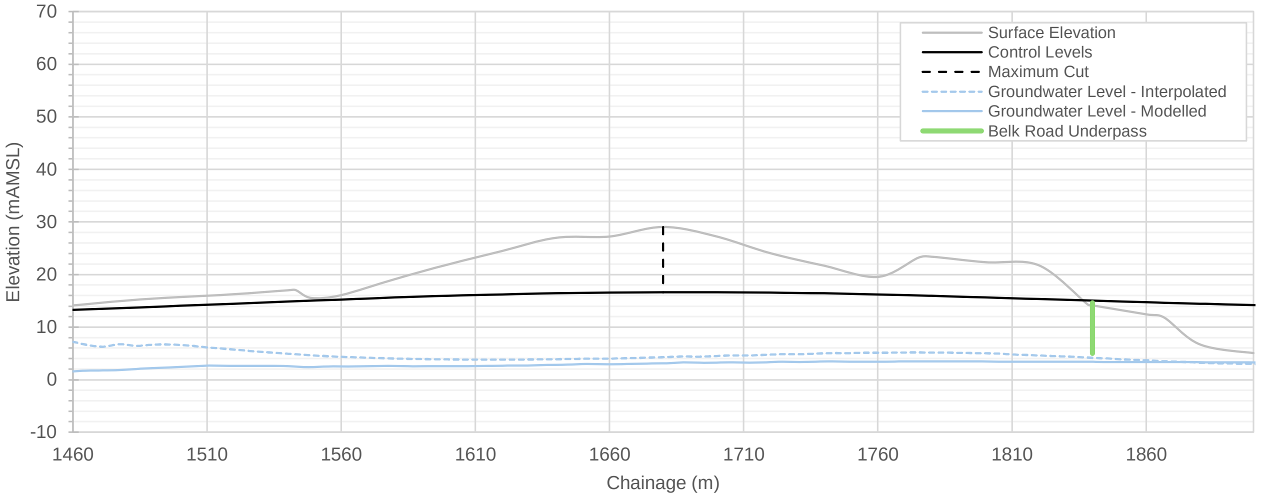

Figure 15. Long section along 1460 to 1860 m (SH29_Cut 1 and Belk Road Underpass).

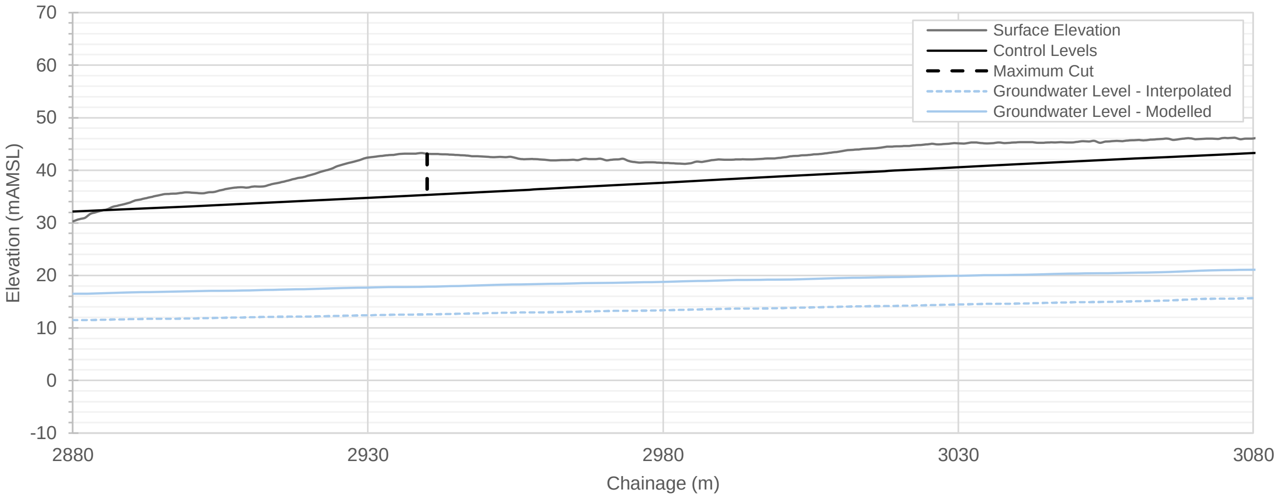

Figure 16. Long section along 2880 to 3080 m (SH29_Cut 2).

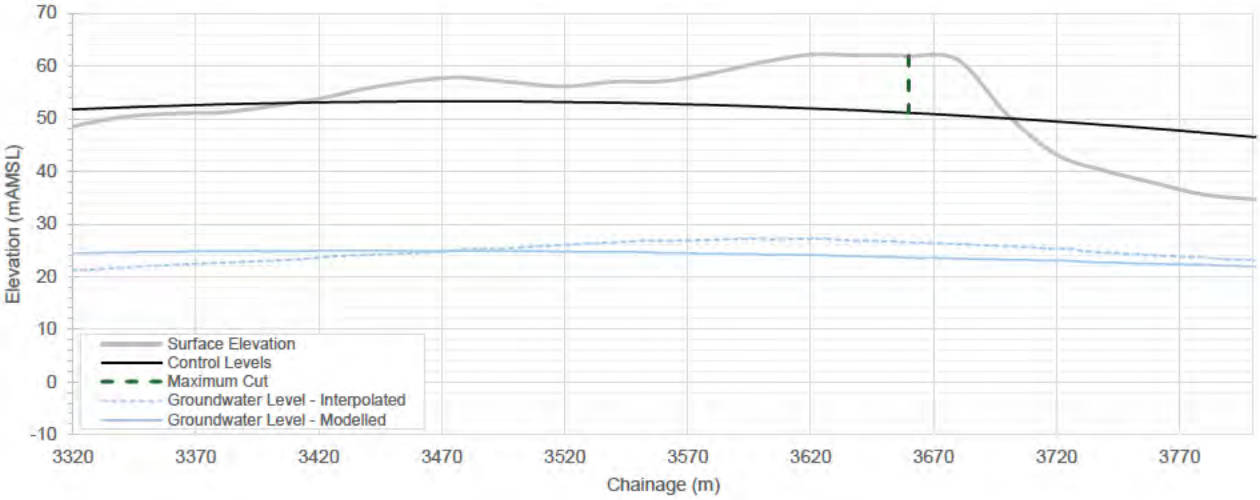

Figure 17. Long section along 3320 to 3800 m (SH29_Cut 3).

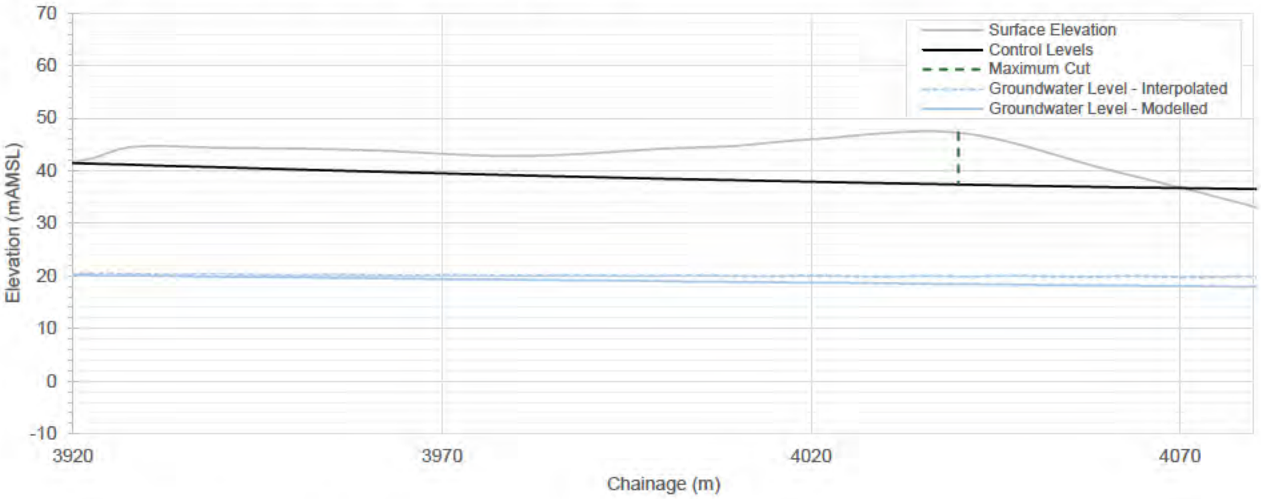

Figure 18. Long section along 3920 to 4080 m (SH29_Cut 4).

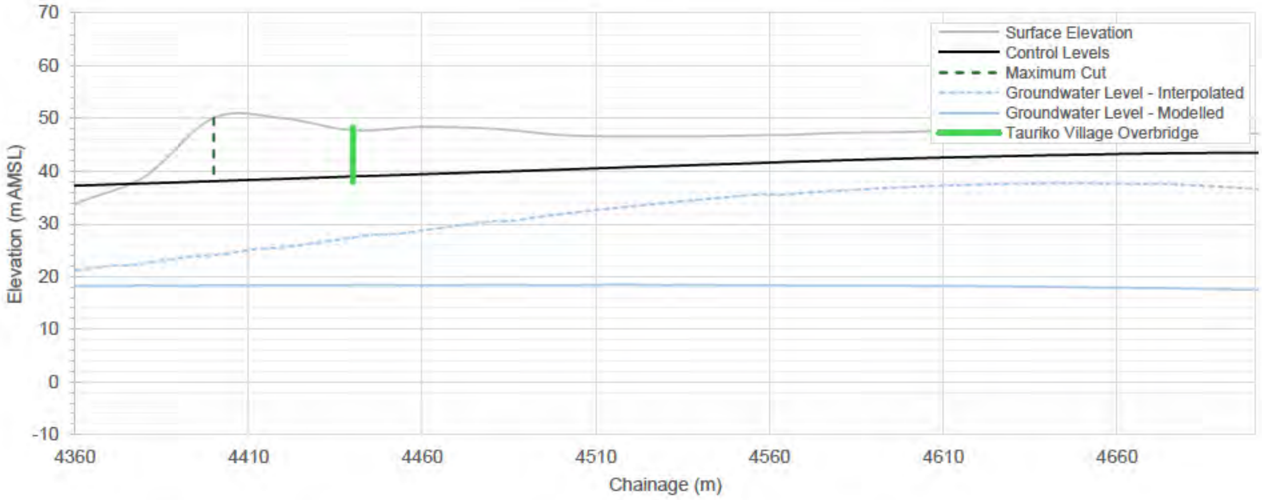

Figure 19. Long section along 4360 to 4700 m (SH29_Cut 5 and Tauriko Village Overbridge).

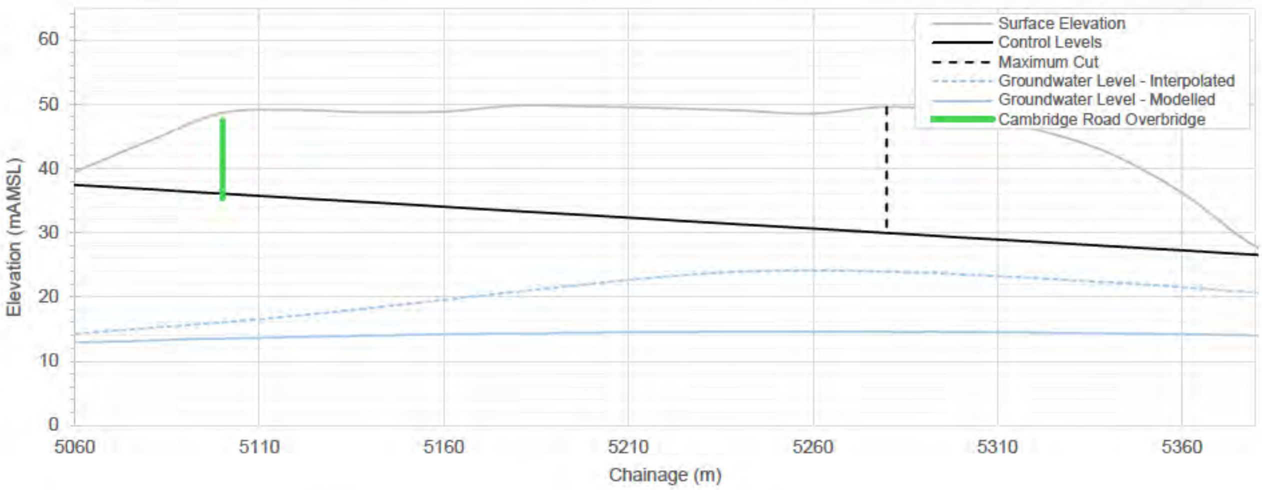

Figure 20. Long section along 5060 to 5380 m (SH29_Cut 6 and Cambridge Road Overbridge).

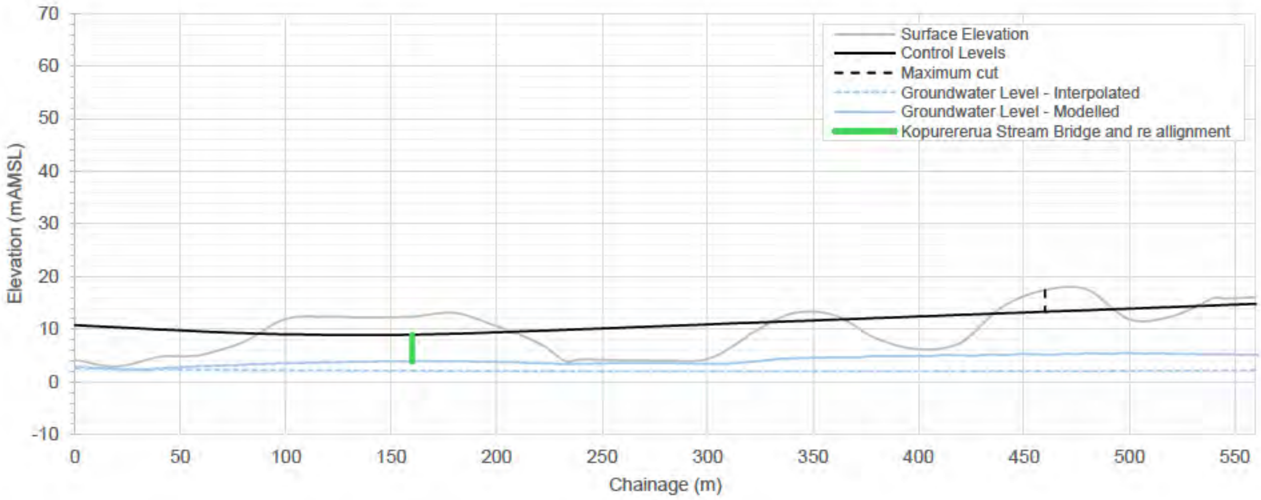

Figure 21. Long section along 0 to 550 m (SH29A_Cut 1 and Kōpurererua Stream Bridge).

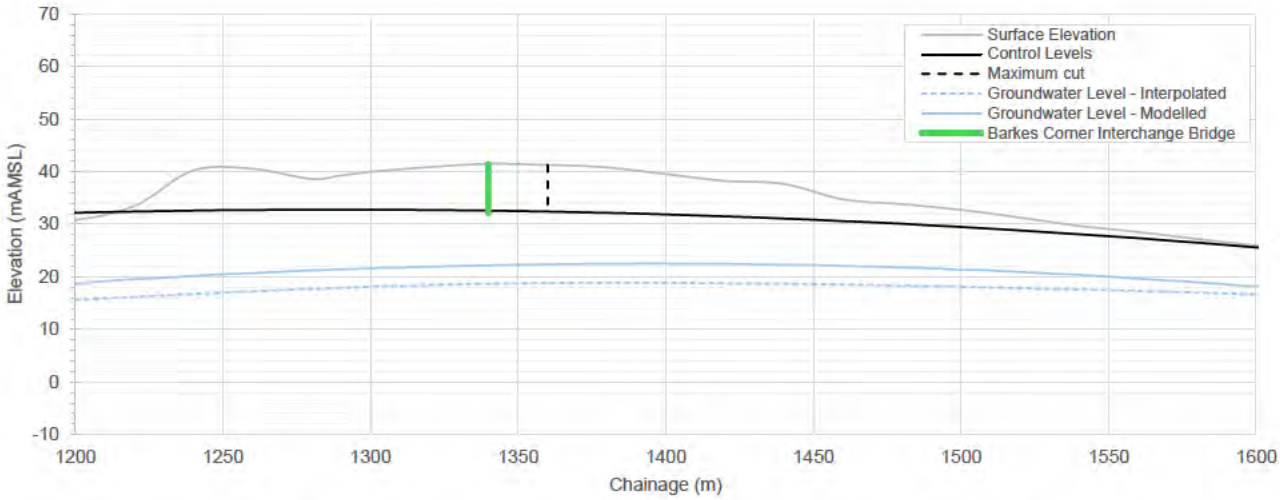

Figure 22. Long section along 1200 to 1600 m (SH29A_Cut 2 and Barkes Corner Interchange Bridge).

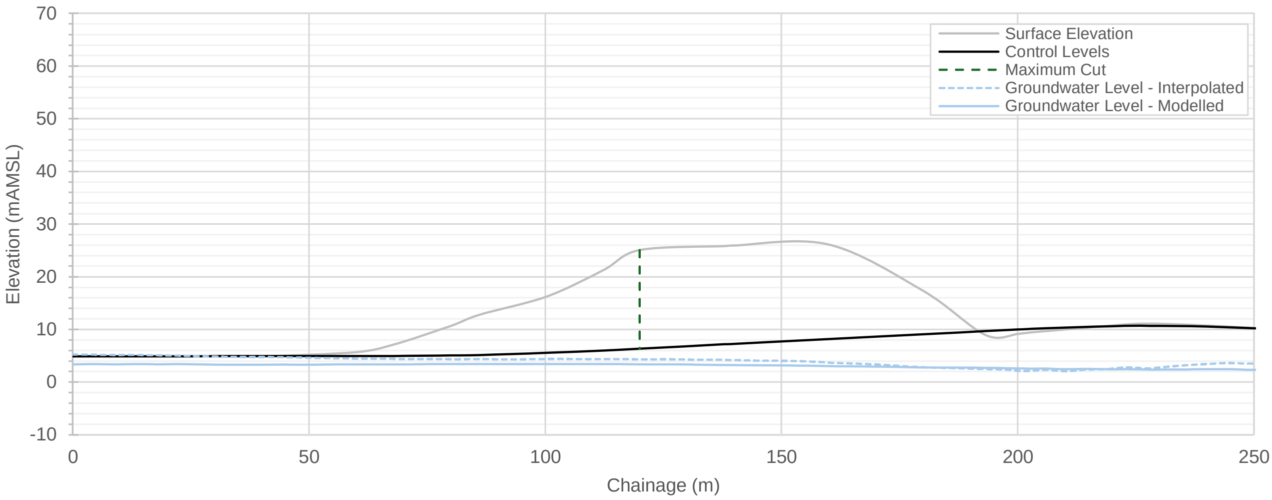

Figure 23. Long section along 0 to 250 m (Belk Road RS120)

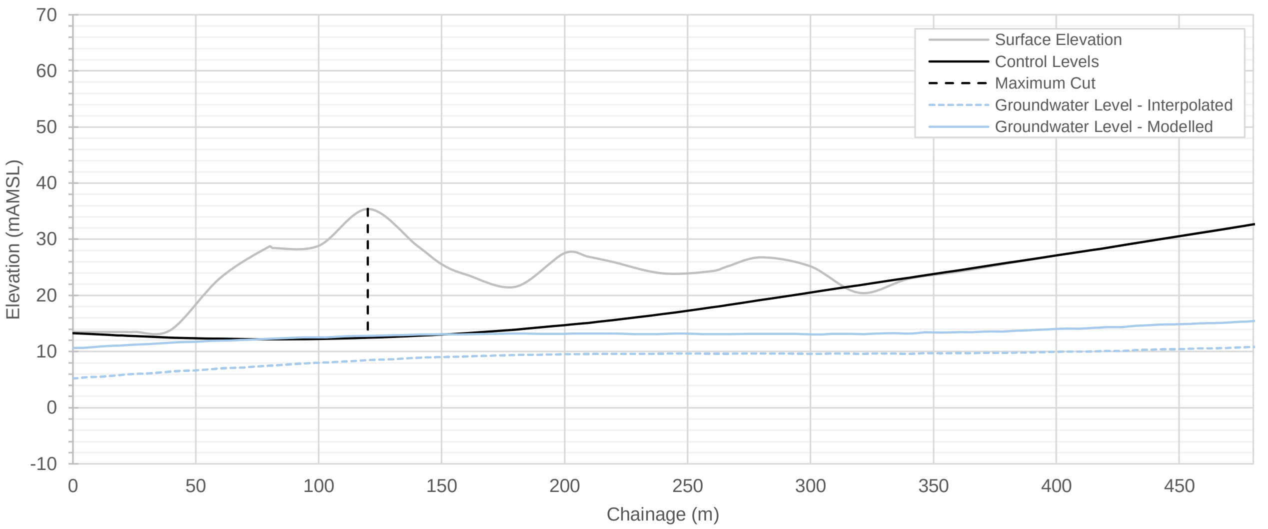

Figure 24. Long section along 0 to 480 m (Redwood Lane Interchange Existing SH29 Extension RS250)

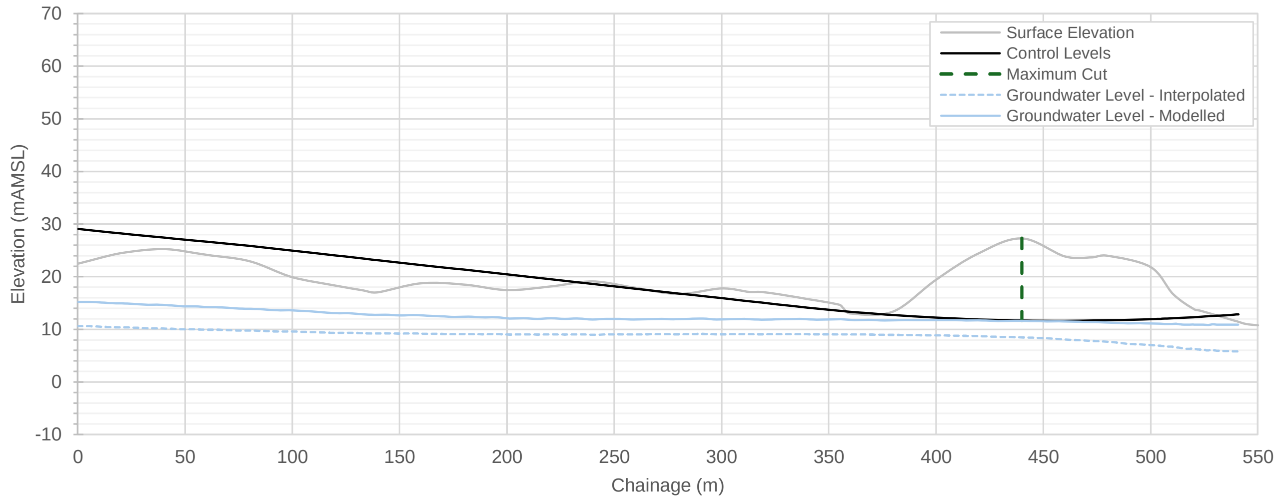

Figure 25. Long section along 0 to 550 m (Redwood Lane Interchange Westbound Exit Ramp RS240)

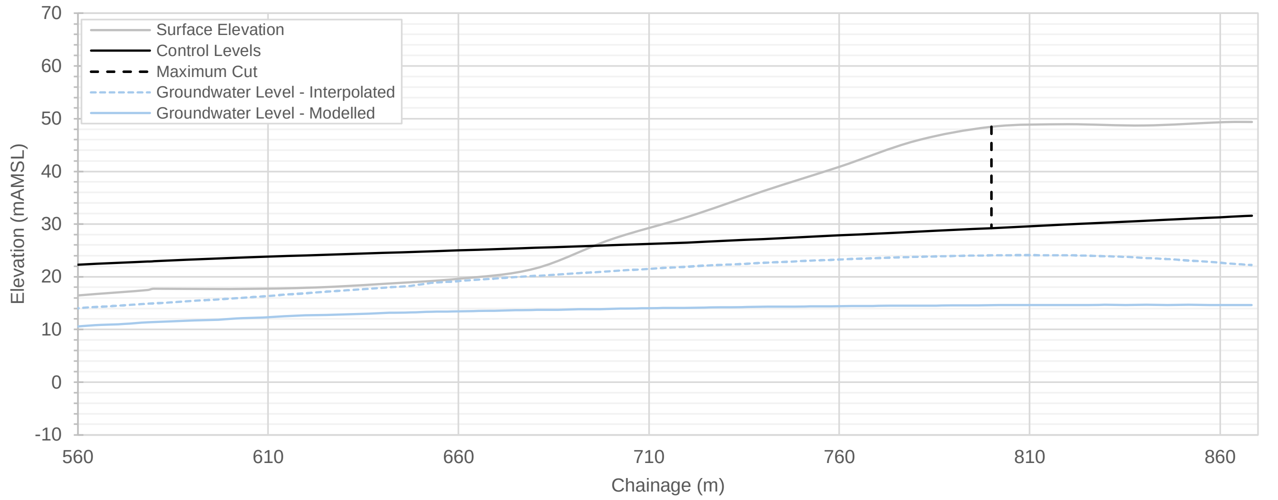

Figure 26. Long section along 560 to 900 m (Takitimu Drive Interchange Westbound Entry Ramp RS330)

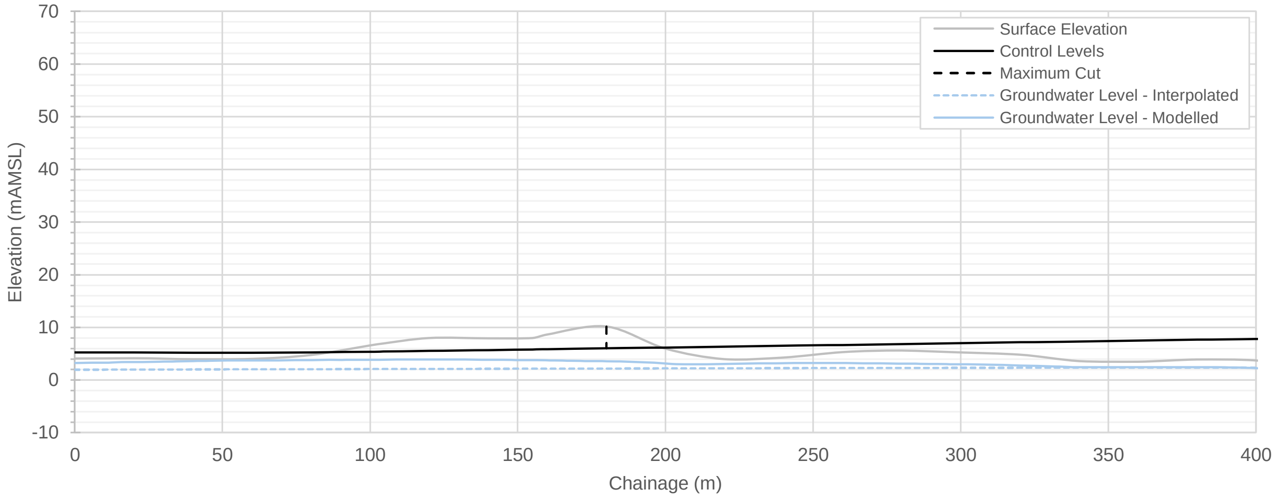

Figure 27. Long section along 0 to 400 m (Takitimu Drive Interchange Westbound Exit ramp RS320)

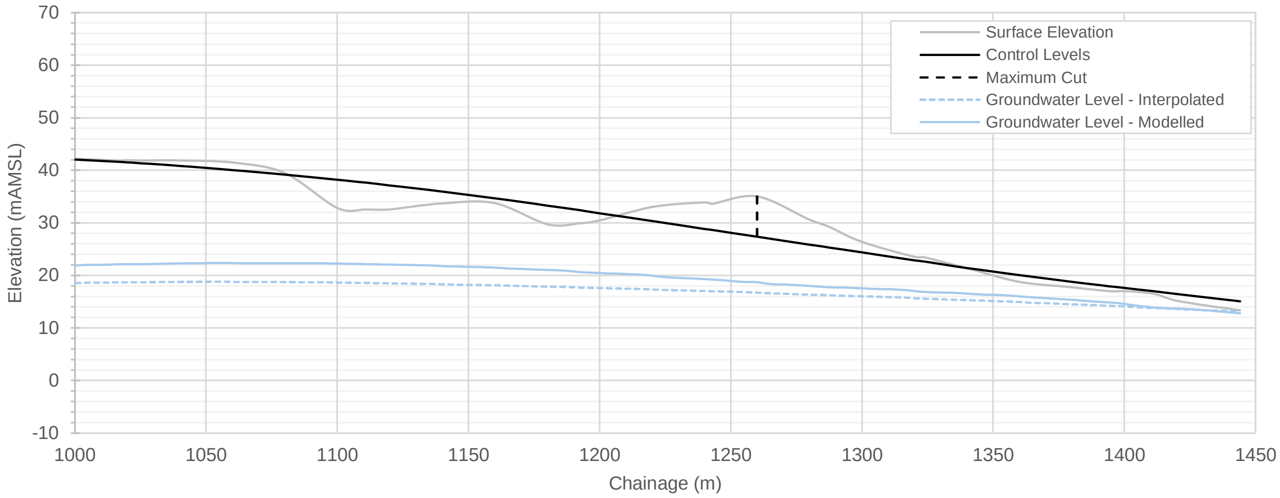

Figure 28. Long section along 1000 to 1450 m (Barkes Corner Interchange Westbound Exit Ramp RS530)

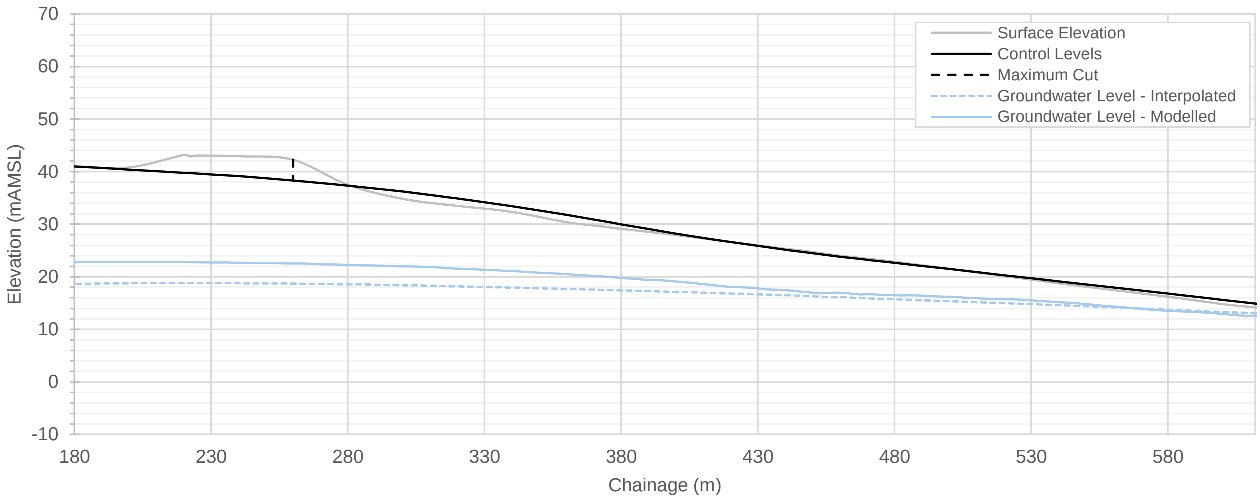

Figure 29. Long section along 180 to 580 m (Barkes Corner Interchange Eastbound Entry Ramp RS520)

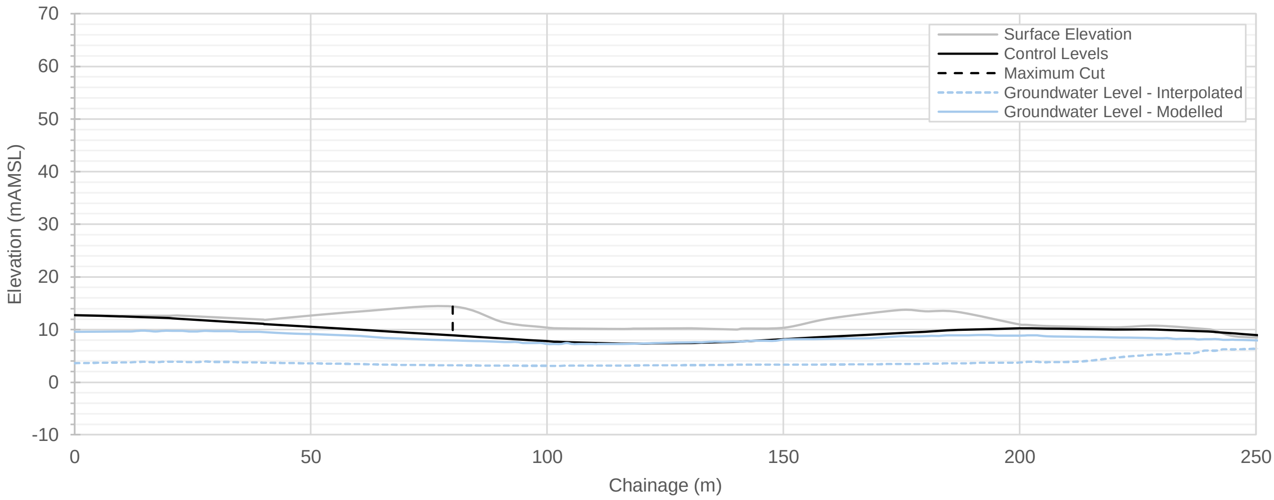

Figure 30. Long section along 0 to 250 m Kaweroa Drive Shared Path Underpass (RS201)

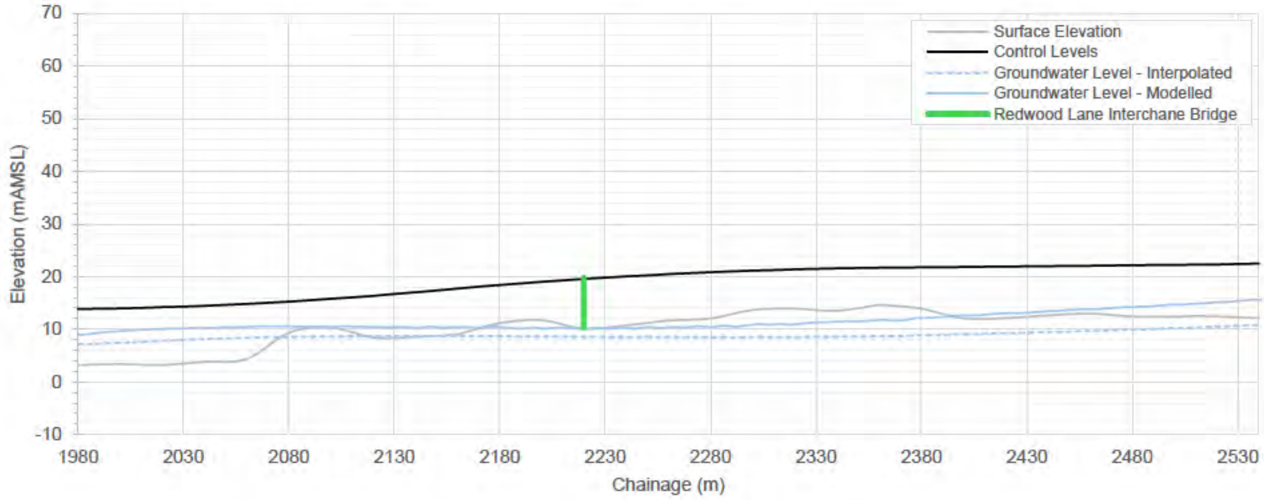

Figure 31. Long section along 1980to 2530 m (Redwood Lane Interchange)

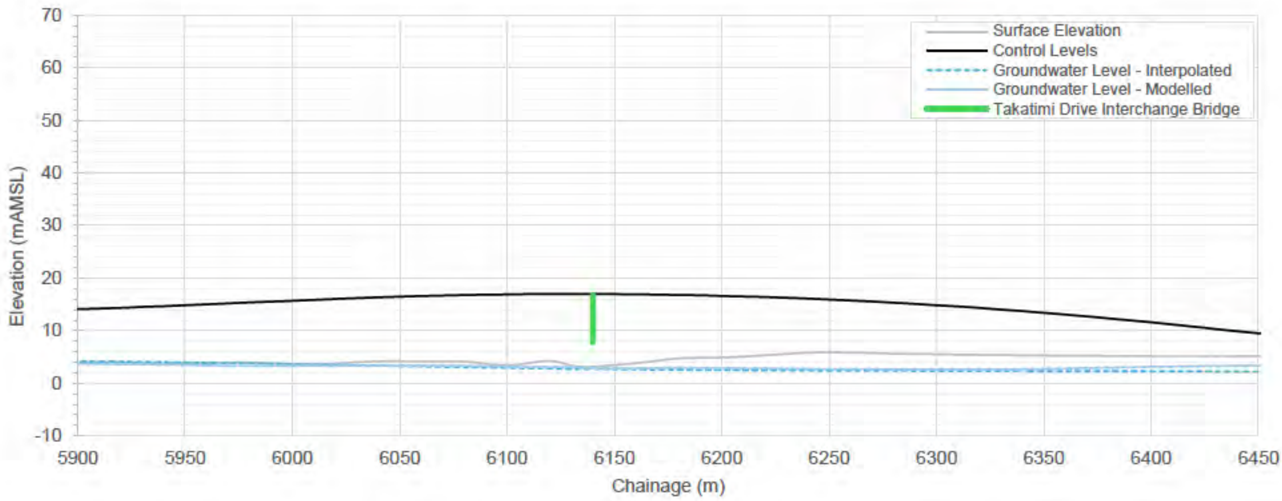

Figure 32. Long section along 5900 to 6450 m (Takitimu Drive Interchange)

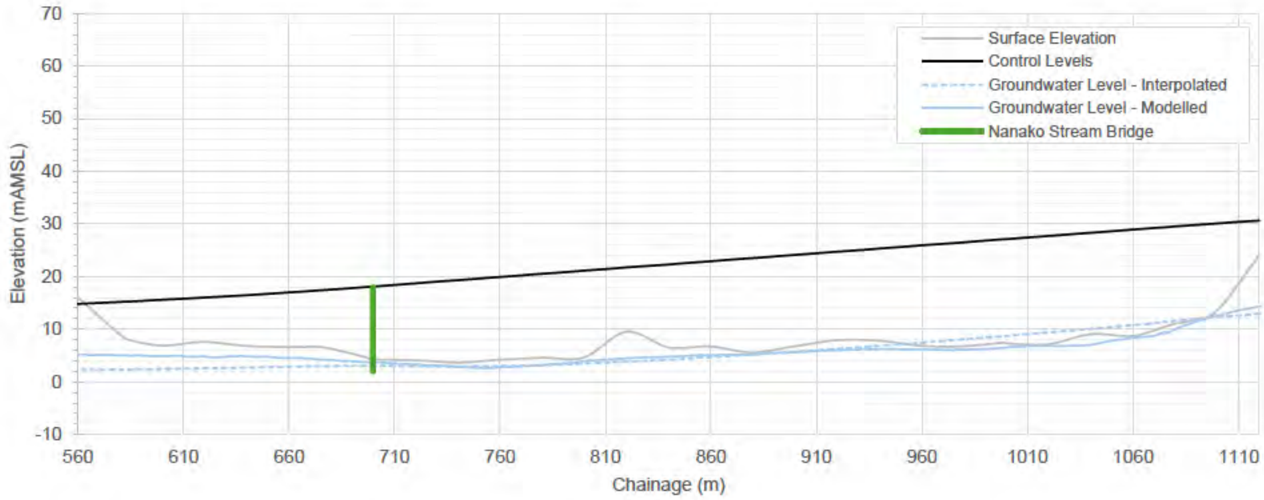

Figure 33. Long section along 560 to 1110 m (Nanako Stream Bridge).

Appendix C. Inferred Groundwater Level Map Along Cuts (Interpolated)

Map Title:
Groundwater Piezometric Surface (Interpolated) around SH29_Cut 1, RS120 and Bridges

Project:
Tauriko West Groundwater Assessment

Client:
CMW Geosciences

Legend

- Dipped Piezometers
- Bridges
- 1 m Groundwater Contours (mAMSL)
- Area of Interest
- Chainage SH29
- Centerline SH29
- Interchanges

Slope Cuts

- SH29

Top Level Basemap Data

- Roads
- Rivers/Streams

Sources of Groundwater Levels

- BOP bore
- Borehole
- Cone Penetrometer Test
- Piezometer

Data Provenance
Aerial Imagery from Land Information New Zealand

Drawn by: Asanka Thilakarathne
26/03/2026

Layout & Project File
Surface Water

WILLIAMSON WATER & LAND ADVISORY

Figure 34

Map Title:
Goundwater Piezometric Surface (Interpolated) around SH29_Cut 2,3,4, Interchanges and Bridges

Project:
Tauriko West Groundwater Assessment

Client:
CMW Geosciences

Legend

- Dipped Piezometers
- Bridges
- 1 m Groundwater Contours (mAMSL)
- Area of Interest
- Chainage SH29
- Centerline SH29
- Interchanges

Slope Cuts

- SH29

Top Level Basemap Data

- Roads
- Rivers/Streams

Sources of Groundwater Levels

- BOP bore
- Borehole
- Cone Penetrometer Test
- Test pit
- Piezometer

Data Provenance
Aerial Imagery from Land Information New Zealand

Drawn by: Asanka Thilakarathne
26/03/2026

Layout & Project File
Surface Water

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Figure 35

Map Title:
Goundwater Piezometric Surface (Interpolated) around SH29_Cut 5,6, Interchanges and Bridges

Project:
Tauriko West Groundwater Assessment

Client:
CMW Geosciences

Legend

- Dipped Piezometers
- Bridges
- 1 m Groundwater Contours (mAMSL)
- Area of Interest
- Chainage SH29A
- Chainage SH29
- Centerline SH29
- Centerline SH29A
- Interchanges

Slope Cuts
- SH29
- SH29A

Top Level Basemap Data
- Roads
- Rivers/Streams

Sources of Groundwater Levels
- BOP bore
- Borehole
- Cone Penetrometer Test
- Piezometer

Data Provenance
Aerial Imagery from Land Information New Zealand

Drawn by: Asanka Thilakerathne
26/03/2026

Layout & Project File
Surface Water

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Figure 36

Map Title:
Goundwater Piezometric Surface (Interpolated) around SH29A_Cut 1,2, Interchanges and Bridges

Project:
Tauriko West Groundwater Assessment

Client:
CMW Geosciences

Legend

- Dipped Piezometers
- Bridges
- 1 m Groundwater Contours (mAMSL)
- Area of Interest
- Chainage SH29A
- Chainage SH29
- Centerline SH29
- Centerline SH29A
- Interchanges

Slope Cuts
- SH29A

Top Level Basemap Data
- Roads
- Rivers/Streams
- Wetlands

Sources of Groundwater Levels
- BOP bore
- Cone Penetrometer Test
- Piezometer

Data Provenance
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26/03/2026

Layout & Project File
Surface Water

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Figure 37

Appendix D. Inferred Groundwater Level Map Along Cuts (Modelled)

Map Title:
Goundwater Piezometric Surface (Modelled) around SH29_Cut 1, Interchanges and Bridges

Project:
Tauriko West Groundwater Assessment

Client:
CMW Geosciences

Legend

- Dipped Piezometers
- Bridges
- Area of Interest
- Chainage SH29
- 1 m Groundwater Contours (mAMSL)
- Centerline SH29
- Interchanges

Slope Cuts

- SH29

Top Level Basemap Data

- Roads
- Rivers/Streams

Data Provenance
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Figure 38

Map Title:
Goundwater Piezometric Surface (Modelled) around SH29_Cut 2,3,4, Interchanges and Bridges

Project:
Tauriko West Groundwater Assessment

Client:
CMW Geosciences

Legend

- Dipped Piezometers
- Bridges
- Area of Interest
- 1 m Groundwater Contours (mAMSL)
- Chainage SH29
- Centerline SH29
- Interchanges

Slope Cuts
- SH29

Top Level Basemap Data
- Roads
- Rivers/Streams

Data Provenance
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Figure 39

Map Title:
Groundwater Piezometric Surface (Modelled) around SH29_Cut 5,6, Interchanges and Bridges

Project:
Tauriko West Groundwater Assessment

Client:
CMW Geosciences

Legend

- Dipped Piezometers
- Bridges
- Area of Interest
- 1 m Groundwater Contours (mAMSL)
- Chainage SH29
- Chainage SH29A
- Centerline SH29
- Centerline SH29A
- Interchanges

Slope Cuts

- SH29
- SH29A

Top Level Basemap Data

- Roads
- Rivers/Streams

Data Provenance
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Figure 40

Map Title:

Groundwater Piezometric Surface (Modelled) around SH29A_Cut 1,2, Interchanges and Bridges

Project:

Tauriko West Groundwater Assessment

Client:

CMW Geosciences

Legend

- Dipped Piezometers
- Bridges
- 1 m Groundwater Contours (mAMSL)
- Chainage SH29
- Chainage SH29A
- Centerline SH29
- Centerline SH29A
- Area of Interest
- Interchanges

Slope Cuts

- SH29A

Top Level Basemap Data

- Roads
- Rivers/Streams
- Wetlands

Data Provenance

Aerial Imagery from Land Information New Zealand

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Figure 41