Report

Water Take and Supply Plan for the Green Steel Project:
Groundwater, Surface Water and Harvesting Rainfall Runoff

Green Steel Project

61 Hampton Downs Road, Hampton Downs, Waikato

Prepared for National Green Steel Limited

Prepared by Earthtech Consulting Limited

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Water Take and Supply Plan for the Green Steel Project: Groundwater, Surface Water and Harvesting Rainfall Runoff

Green Steel Project

Client:	National Green Steel Limited
Authors:	Lindsay Strachan, Senior Engineer, CMEngNZ, CPEng Philip Kelsey, Principal Hydrogeologist
Reviewer:	Aidan Nelson, Principal Geotechnical Engineer, CMEngNZ, CPEng

Earthtech Consulting Limited
47 West Street, PO Box 721, Pukekohe 2340
+64 9 238 3669
admin@earthtech.co.nz
www.earthtech.co.nz

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Green Steel Project

1. Introduction

1.1 Project Scope

National Green Steel Limited proposes to develop an integrated metals resource recovery and steel manufacturing plant at 61 Hampton Downs Road, Hampton Downs, Waikato. The development is named "The Green Steel Project" and has been selected as one of the several fast-track projects for New Zealand. The following description reference is provided for the project by the National Government (https://www.beehive.govt.nz/release/fast-track-projects-released) under *Waikato Region (Housing and Land Development), National Green Steel Limited*: "*The Green Steel project is to construct and operate a structural steel manufacturing plant on 53- hectares of land. The plant will use recycled scrap steel, sourced from across New Zealand and shredded on-site.*".

The overall project, comprising several industrial and manufacturing components, i.e. shredding of raw resource materials, steel smelting and steel manufacturing, requires water for key operational requirements of the utility and auxiliary facilities – primarily for cooling. A sustainable daily water supply is required to make up a nett difference for the manufacturing processes which amounts to 2,800m^3/day. Thus, a total water demand of 2,800m^3/d and 840,000m^3/yr is applicable to this Water Take and Supply Plan.

The Green Steel property (as a beef farm) is currently entitled to a rural raw water supply of some 30m^3/d (Mike Peters, 2024). Rural raw supply is available through a Daily Supply Entitlement (DSE) from the existing Whangamarino Rural Water Supply Scheme (WRWSS), which is operated through the Te Kauwhata Water Association (TKWA). TKWA is also referred to as "Te Kauwater". The TKWA is a community-owned and operated water business, and charity organisation. Technically, Green Steel's owner is a member of the scheme, with a current DSE entitlement of 30m^3/d.

2. Project Location and Site Description

2.1 Site Location and Access

The site is located at 61 Hampton Downs Road, Hampton Downs, Waikato. Access is via State Highway 1 (SH1), turning west into Hampton Downs Road and entering the property from the northern side via a section of Harness Road and an existing tar-sealed road (turning south).

The Hampton Downs Motorsport Park is located immediately north of the property, and the operational Hampton Downs Landfill site is situated to the west – both are accessed from Hampton Downs Road. The Hampton Downs Landfill site (Figure A below) serves the solid waste disposal needs of the cities of Auckland and Hamilton, as well as several other areas of North Island. The Spring Hill Corrections Facility is situated to the south, as shown in Figure A below.

Figure A: The site at 61 Hampton Downs Road, Hampton Downs, Waikato, viewing southwards from the hillside on the northern side of Harness Road.

2.2 Site Description

The property comprises five (5) lots: Lot 1 of DPS45893 and Lots 1 to 4 of DP310030. None of the five lots have been developed as rural living lots.

The northern portion of the site is defined by lower-lying flat ground at approximately RL3.5*m*, stepping up to higher ground in the central area varying in elevation from approximately RL7.5*m* to RL10*m*, then stepping up to an area of gently sloping ground varying in elevation from approximately RL12*m* to RL18*m*. The ground then rises moderately to the south, southeast and southwest at an approximate overall grade of 16° to 20°, forming a peripheral *horseshoe* ridge around the proposed development, as shown in Figure PD3.

An existing farm race (horse track) is situated in the western portion of Lot 1, at an elevation of approximately RL3.5*m*. The proposed development area is located within an area on the northern and western side of the peripheral *horseshoe*-shaped ridge line (Figure PD3). A historical aircraft landing strip is situated on the northwest-facing spur line, on the boundary between Lots 4 and 5, in

the southern portion of the site. High ground forming the southern perimeter of the *horseshoe* varies in elevation from approximately RL42*m* to RL51*m*.

Several existing flow paths originate from the ridgeline around the property, draining in a northerly direction. Additionally, several existing man-made farm drains transect the lower-lying ground in Lot 1. Outward-facing slopes from the property, i.e. southeast-facing in Lot 5 and south-facing in Lot 4, are steep with notable slip movement in parts.

3. Outline of the Water Take and Supply Outline

3.1 Project Water Requirement

The overall project comprising several industrial and manufacturing components, i.e. shredding of raw resource materials (ELVs, whiteware waste), steel smelting and steel manufacture, requires water for key requirements of the utility and auxiliary facilities, listed in Table 1 below. A sustainable daily water supply is required to make up a nett difference for the manufacturing processes which amounts to 2,800m^3/day. Thus, a total water demand of 2,800m^3/d and 840,000m^3/yr is used in this Water Take and Supply Plan.

3.2 Water Supply Options

Local water supply options are threefold, including an on-site groundwater supply, a piped supply from the Waikato River, and intensive harvesting of rainfall runoff and stormwater. Waikato Regional Council (WRC) confirmed with Earthtech on 1 November 2024[1] that there is current water availability for both groundwater and river water options.

3.2.1. Groundwater Supply

The site is located above the Waitemata sandstone aquifer. Bore yield conditions are variable and dependent on fractured aquifer conditions being encountered. There are no known high-yielding Waitemata aquifer bores in the wider site area.

Geophysical surveying was conducted in early December 2024, identifying potential fractured aquifer conditions between 100*m* and 300*m* depth at two locations along the traverse. Further geophysical investigation was conducted at these locations (at traverse chainages 42 and 54), and boreholes were drilled at the BH42 and BH54 locations, as shown in Figure 1, which is attached.

Explanatory drilling and bore yield testing have been completed in January and February 2025 for 100*mm* diameter test bores at 300*m* deep BH42 and 250*m* deep BH54 locations. The assessment of production bore yield and groundwater quality is presented in Section 6.

[1] Air Lift Yield Results for BH54 Test Bore, Earthtech, Ref PIK/L3660-1/cam, 22 January 2025

Table 1: Green Steel Plant Water Use Requirements

Plant Item Description	Water Type	Flow (Q)	Est. Volume
		(m^3/hr)	(m^3/ day)*
Closed Cooling Water Circuit			
CCM Mould	Soft Water	220	3,520
Meltshop			
Consteel	Soft Water	800	12,800
EAF	Soft Water	450	7,200
LF	Soft Water	140	2,240
FES	Soft Water	400	6,400
CCM Tertiary	Clear Water	200	3,200
Bar Mill			
Section cum Bar Mill	Clear Water	1,375	22,000
Cooling Water Circuits			
CCM Secondary	Clear Water	150	2,400
CCM tertiary open	Clear Water	30	480
Section Mill	Clear Water	600	9,600
Bar Mill Line	Clear Water	500	8,000
Total Water Requirement:		**4,865**	**77,840**
Industrial Make up Water Requirement			
Indirect Cooling Water Circuit	Clear Water	102	1,632
Direct Cooling Water Circuit	Clear Water	64	1,024
Soft Cooling Water Circuit	Clear Water	7	112
Total Make-up Water Requirement (Estimated):		**173**	**2,768**

3.2.2. River Water Supply

WRC confirmed that surface water take is available from the Waikato River for the volumes required by this project. Options include the construction of an independent pumping scheme and pipeline from the Waikato River and, alternatively, the use of the existing Whangamarino Rural Water Supply Scheme (WRWSS) which is operated through the Te Kauwhata Water Association (TKWA). TKWA is also referred to as "Te Kauwater".

The WRWSS has well-established infrastructure with a pumping station located on Churchill East Road, where the road runs south along the eastern flank of the Waikato River, as shown

in Figure 2. Water abstraction inlets are located on a purpose-built jetty alongside the pump station, as shown in Figure B below.

Figure B: The Whangamarino Rural Water Supply Scheme (WRWSS), operated by the Te Kauwhata Water Association (TKWA). Above left shows the water abstraction inlets attached to a purpose-built jetty, and water pumps inside the pumphouse are shown above right.

The closest link to the existing TKWA pipeline network is a 150*mmØ* pipeline located along the western side of the service road (often referred to as Harness Road) to the Spring Hill Corrections Facility, shown in Figure C below and Figure 2 attached. A 100*mmØ* pipeline runs east from the intersection with Hampton Downs Road for approximately 200*m*, crossing Hampton Downs Road, providing a potential connection point on the southern side, illustrated in Figure D below. This is in close proximity to the northwestern corner of the Green Steel site boundary.

An upgrade of the 100*mmØ* would most likely be required to a minimum of 150*mmØ* to supply the Green Steel Project. The distance to the PRV (pressure-reducing valve) is some 2,000*m*, the distance from the intersection distance from the connection point to the main reservoir on the Green Steel project site would be approximately 800*m*. Therefore, an infrastructure upgrade involving from 1*km* to 3*km* of 150*mmØ* water pipeline may be required.

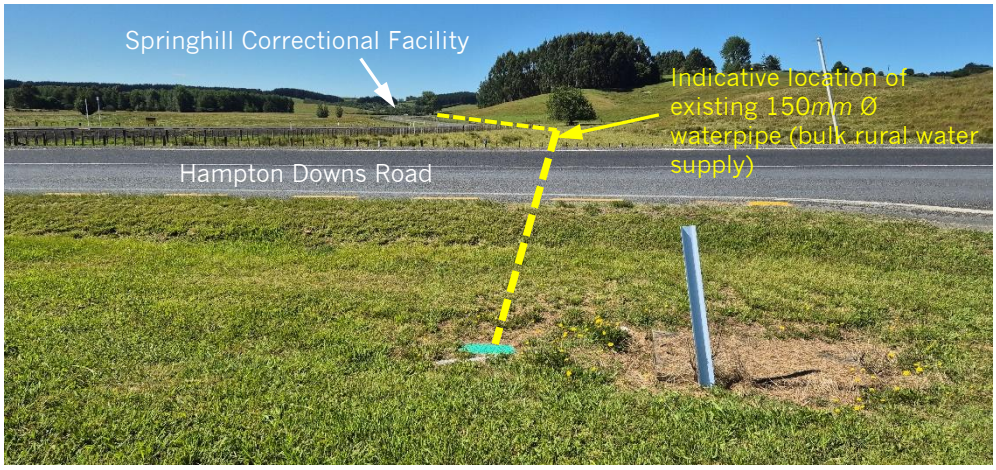


Figure C: Existing TKWA pipeline network showing a 150*mm*Ø pipeline located along the western side of the service road (often referred to as Harness Road) to the Spring Hill Corrections Facility, crossing Hampton Downs Road (in the foreground)

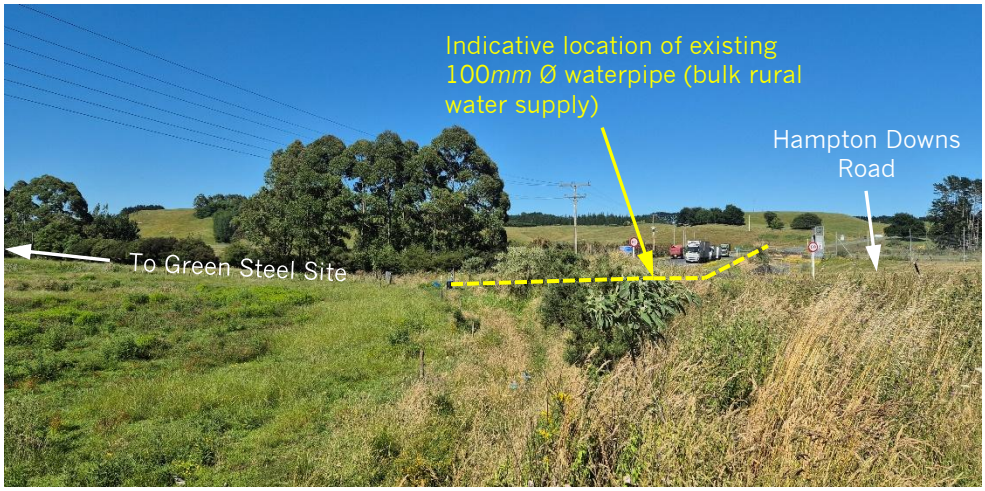


Figure D: Phots illustrates the TKWA 100*mm*Ø pipeline that runs east from the intersection with Hampton Downs Road, crossing Hampton Downs Road, providing a potential connection point on the southern side of the Green Steel site.

An alternative river supply option would be to establish a duplicate take at the current location of the WRWSS's raw water supply on Churchill East Road. Required works would involve:

- Run an additional supply pipeline within the easement (would need to be confirmed) between the river, alongside Hall Road and Spring Hill Prison, and extend the pipeline to the site.
- For the river take independent option, meetings with potential stakeholders to identify feasible options are recommended, including:

  i. Waikato District Council
  ii. The Department of Corrections

iii. TKWA
iv. Other land owners

3.2.3. Rainwater Runoff and Stormwater Harvesting

Rainwater and/or stormwater runoff is anticipated to be harvested, stored and used by Green Steel Project (following treatment). Whilst rooftop rainfall runoff is arguably the most common and easiest, various harvesting areas can be identified in the 3D image illustration of Figure E below and shown in Figure PD3 attached, are as follows:

1. Main Building Platform (RL14*m*), including:
   1.1. Roofed areas
   1.2. Road surfaces
   1.3. Parking and paved hardstand areas
   1.4. Processing areas (slag, shredder)
   1.5. Rain gardens
   1.6. Other areas, e.g. grassed slopes.
2. MRSS Platform (RL19*m*)
3. Northeast (NE) Platform (RL35*m*)
4. East (E) Platform (RL45*m*)
5. South (S) Platform (RL35*m*)
6. Southwest (SW) Platform (RL14*m*)
7. Stormwater catchment storage ponds (permanently remaining following earthworks)

Indicative runoff volume calculations and estimated daily and annual water volumes are enclosed in Appendix A of this report.

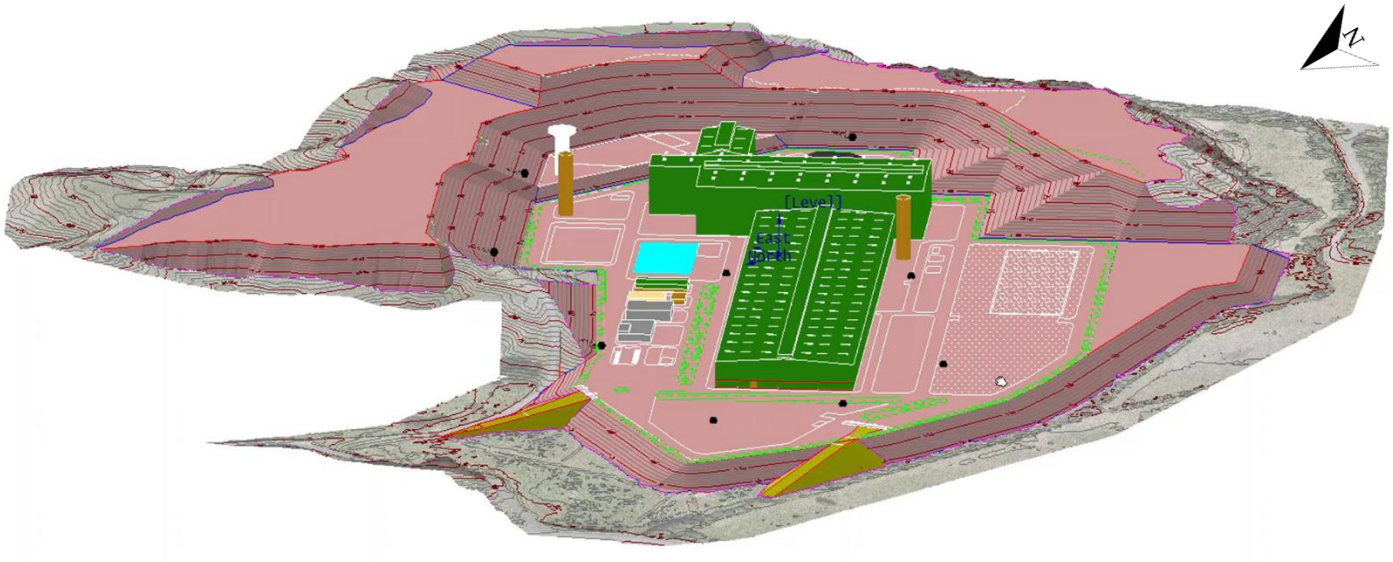


Figure E: 3D illustrative image of the site illustrating the proposed steel manufacturing plant and associated buildings, shredder plant and peripheral platform areas.

4. River Water Take and Supply Options

4.1 The Te Kauwater Option

An initial river take option could be to utilise the existing Whangamarino Rural Water Supply Scheme (WRWSS) which incorporates the townships of Te Kauwhata, Rangiriri and Meremere, and 700 hectares of horticultural development. The scheme involves significant installed infrastructure comprising water abstraction pumps from the Waikato River located on Churchill East Road (Figure 2). As mentioned, the WRWSS is operated through the Te Kauwhata Water Association (TKWA). TKWA is also referred to as "Te Kauwater". The scheme owns the current consent to abstract surface water from the Waikato River. An easement through the land owned by the Springhill Correctional Facility is established, and could be available for a possible additional pipeline (if necessary).

The scheme currently has consent for the abstraction of some 22,000m^3/day (Mike Peters, December 2024) and is currently being reviewed (by the Waikato Regional Council – WRC). The Waikato District Council (WDC) is one of TKWA's largest customers. Earthtech's communication with WRC highlighted that the TKWA has a large amount of water allocated that is not currently used. There is adequate available capacity to supply the Green Steel's needs. WRC considers that the project water supply could be very helpful for the TKWA in terms of growing into their allocation.

The Green Steel property currently has two water supplies, i.e.:

- Potable water supply – a trickle feed via a ~20$mmØ$ delivery pipe.
- Irrigation supply on demand – noting that the Green Steel property (as a beef farm) is currently entitled to a rural raw water supply of some 30m^3 per day (Mike Peters, 2024). Note: to potential avoid algae build-ups and clogging concerns, the rural raw water is chlorinated (to a dissolved Chlorine level of approximately 19$\mu g/\ell$). This does not render it potable.

Technically, Green Steel's owner is a member of the existing water supply scheme, with a current DSE entitlement of 30m^3/d.

The following information is presented on the existing water supply scheme, based on Earthtech's research and personal interviews with key stakeholders:

- Surface water supply, from the Waikato River, can be provided to the proposed Green Steel project, through the Te Kauwhata Water Association (Inc.) (TKWA).
    - TKWA is a private entity, a community owned organisation and registered charity.
    - Established initially in the late 70s to early 80s by the Ministry of Works.
    - Contact: email water@tkwa.co.nz, and Mr Mike Peters is the Executive Officer. Earthtech made contact with Mike Peters over several days (Mike Peters, 2024 and 2025).

- Area plans in Figures F, G, H and I below, obtained from the TKWA's website[3], show the scheme covering:
  - Current TKWA reticulation area
  - TKWA Extensions (under implementation)
  - Future TKWA reticulation area

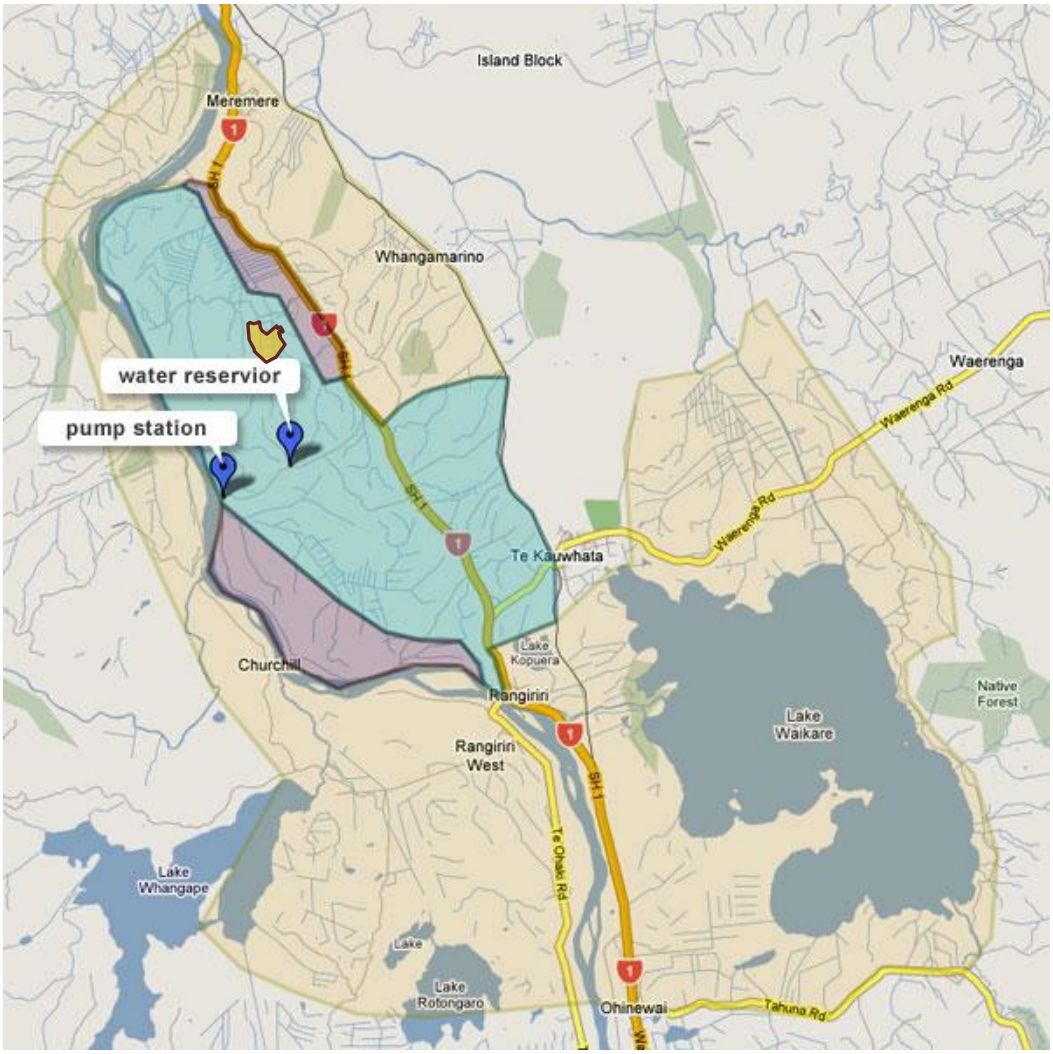
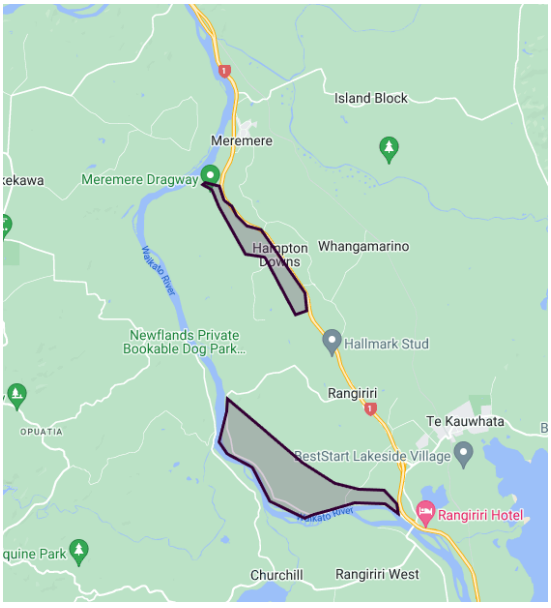


Figure F: Extent of the TKWA supply network

[3] https://www.tkwa.co.nz/reticulation.html

Figure G: Current TKWA reticulation area



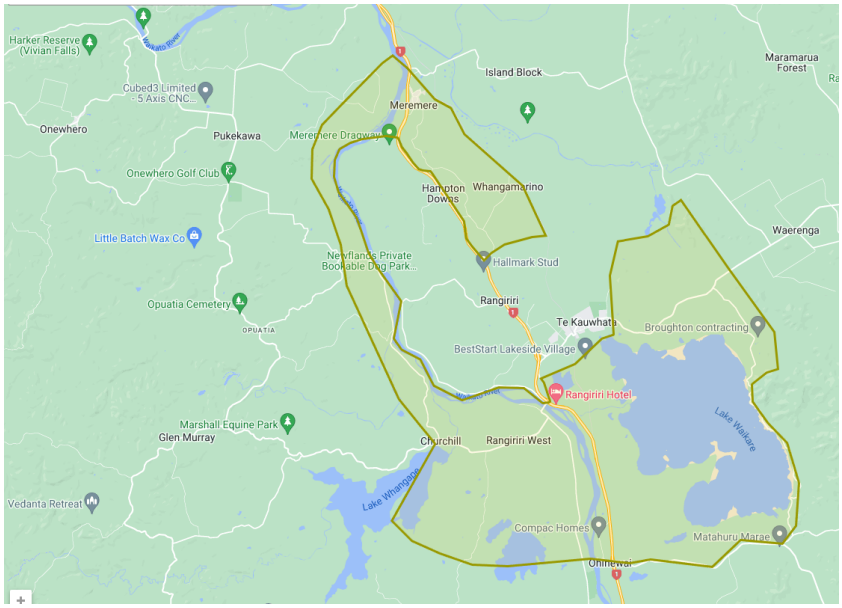


Figure H (above left): TKWA reticulation extension areas

Figure I (above right): Future TKWA development area

4.2 Independent River Take and Supply Option

As mentioned previously, an alternative option to Green Steel would be an independent take from the Waikato River for water supply. This could entail a duplicate take at the current location of the WRWSS's raw water supply on Churchill East Road. This option could involve a sharing arrangement of existing infrastructure or, alternatively, the development of a completely independent line. Consideration of the works would involve:

- Run an additional supply pipeline within the easement (would need to be confirmed) between the river, alongside Hall Road and Spring Hill Prison, and extend the pipeline to the site.

- For the river take independent option, meetings with potential stakeholders to identify feasible options are recommended, including:

    i. Waikato District Council
    ii. The Department of Corrections
    iii. TKWA
    iv. Other land owners

This option would involve an independent consent from the WRC and the high capital expenditure costs for the scheme overall. Whilst this option cannot be excluded, the likelihood of progressing this option at this stage is arguably slim.

4.3 Targeted Upgrades of Existing Scheme

A probable project sharing approach could be considered whereby Green Steel could opt to upgrade a specific section of infrastructure. For example, the existing 100*mm*Ø pipeline would require extending to a point of use within the Green Steel site, a distance of approximately 1,000*m*. Alternatively, an independent pipeline could be constructed to the existing pressure reducing valve (PRV) (Figure 2). Indicative pipe flows are provided below as information on such considerations. Pipeline pressures of 5 and 7 bar are provided below. We note, from a recent site visit and discussion with TKWA, that the pressure at the pumphouse was 6.9 bar.

Table 2: Indicative Pipe Water Flows

P (bar)	7			
	L = 1000m		**L = 2000m**	
	l/s	**m³/day**	**l/s**	**m³/day**
100*mm* Ø	13.0	1,126	9.2	798
150*mm* Ø	40.5	3,495	28.7	2,475
P (bar)	5			
	L = 1000m		**L = 2000m**	
	l/s	**m³/day**	**l/s**	**m³/day**
100*mm* Ø	11.0	952	7.8	674
150*mm* Ø	34.2	2,953	24.2	2,092

5. Rainfall Runoff and Stormwater Harvesting

5.1 Stormwater Catchment

The total proposed development is situated largely within a single catchment area, as an inner *horseshoe-like* shaped area situated on the northern side of a peripheral ridgeline, and stormwater flows can be suitably channelled around the site by strategically located contour drains. The final disposal and discharge of stormwater into and from the property will be determined at the detailed design stage. Attenuation ponds are likely to be required to reduce the impact of peak flows off roofs and paved areas.

The following is an assessment of the potential to use stormwater runoff as a viable source of water.

5.2 Stormwater Flows

Indicative stormwater flows have been provided Appendix A.

Applicable rainfall intensity and depth values are provided by the National Institute for Water and Atmospheric Research (NIWA) High Intensity Rainfall Design System (HIRDS) [use: HIRDS V4 (Oct. 2023), https://hirds.niwa.co.nz/]. The nearest rainfall gauging station is located at Meremere, which provides rainfall data dating back to the 1960s. Design rainfall is as follows:

- Allow: *Ten minutes duration rainfall intensity (in mm/hr) for New Zealand shall be determined for ARIs of 10 years (10% AEP) and 50 years (2% AEP) using rainfall frequency duration information available from HIRDS* V4 (HIRDS, Nov. 2024).
- Design rainstorm event (50 years): 24 hours 10% AEP storm = 99.7*mm*, i.e. **100*mm*** (depth in 24 hours).
- However, if allowance is required for climatic change of ≥2 degrees increase in global temperature effects threshold, then we would recommend that the RCP6.0 values be applied as follows:
    - 24 hours 10% AEP storm = **108*mm*** (depth in 24 hours)
- Design rainfall depths for considered Annual Exceedance Probabilities (AEPs) are provided in Table 3 below.

5.3 Storage Provision

Suitably sufficient storage should be provided to enable the capture of a 24 hours 10% AEP storm event. Based on the potential rainfall harvesting areas (Appendix A), a storage volume to accommodate some 420m^3 per day is recommended. The project has designed a large pond at the northern end of the site, designed by Airey Consultants Ltd in their Roading and Stormwater Management Report (Airey, 2025). Airey (2025) note in their report that *stormwater runoff collected from the impervious areas of the site can provide an average supply of 420m^3 of water per day, which is approximately 15% of the Steel Plant's daily water demand*. To suitably facilitate daily water consumption demand, a storage reservoir/lagoon of some 15,000m^3 is shown in Figure PD3 for

possible consideration for the project. Water from the proposed stormwater pond, groundwater extraction wells and river water supply can be reticulated to this proposed reservoir.

Table 3: Design Rainfall Depths vs Annual Exceedance Probability (AEP)

AEP Storm %	Return Period (1:years)	>50-year Design Life (2081 to 2100)	Allow 2.3° Climatic Temp Increase, i.e. HIRDS V4 RCP6.0 (2081-2100)
20%	5	84.2	90.7
10%	10	99.7	108
2%	50	140	151
1%	100	159	172

Suitably sufficient storage should be provided to enable the capture of a given storm event. Detailed assessment is to be conducted by others to verify the storage volume suitable for the Green Steel project for rainfall runoff-derived waters. Indicative volumes are presented in Table 4 below. Based on the potential rainfall harvesting areas (Appendix A), we recommend a storage volume for roof runoff of, say, 3,000m^3 to 4,000m^3 be provided for total rainfall runoff. A storage lagoon/pond of up to some 9,000m^3 to 15,000m^3, illustrated in Figure PD3, could be possibly considered for the project, allowing for total storage (groundwater balancing, rainwater harvesting). Determination of such total storage volume would require further assessment by other specialists.

Table 4: Indicative High-Level Estimated Storage Volumes for Rainfall-Runoff Waters

Av (Storm) Recurrence Interval (ARI):	1:10	1:5	1:2
AEP:	10%	20%	50%
24hr Storm (*mm*):	95.2	80.5	61.4
Storage requirement to be considered (m^3):	6,337	5,358	4,087
Indicative max storage requirement (m^3):	13,455	11,377	8,678

Note: Standard / unfactored rainfall depths provided above.

6. Groundwater Supply Bores

6.1 Test Bores

Site geophysics identified two target bore locations for higher-yielding fractured aquifer conditions at BH42 and BH54 locations (Figure 1). Based on geophysics, 300*m* and 250*m* deep 100*mm*Ø test bores were drilled at BH42 and BH54 respectively. Temporary casing to 65*m* depth was installed in each bore.

The following drilling circulation losses were encountered during test bore drilling, confirming the presence of fractured aquifer conditions at depth (See Figure D1 in Appendix D):

i. BH42 100% drill water loss at 185*m*, water loss of 75% from 185*m* to 300*m* (note that casing was not extended below 65*m*).
ii. BH54 40% to 50% drill water loss between 108*m* and 130*m*.

Details of the air lift yield and SDT (Step Drawdown Test) testing are presented in Appendix D.

Maximum specific capacities of 0.34$m^3/hr/m$ and 0.38$m^3/hr/m$ were measured in BH42 and BH54 respectively, indicating similar yielding conditions. The BH42, the SDT also returned near constant specific capacity conditions with an average of 0.32$m^3/hr/m$ and range of 0.28$m^3/hr/m$ and 0.34$m^3/hr/m$. This indicates confined aquifer conditions (yield proportioned to drawdown) and only limited turbulent head losses for fracture flow for the pump test range up to 12m^3/hr.

6.2 Production Bores

6.2.1. Bore Yield

The proposed production bores are to be 150*mmØ*. From the test bore results final casing depths have been increased from 65*m* to 100*m* for BH42 and from 65*m* to 80*m* for BH54 to optimise submersible pump submergence.

The production bore yield assessment is provided in Appendix D. The assessment uses equilibrium well equations to determine the long-term bore yield. Drawdown interference effects between the bores are also included. The estimated yields are as follows:

i. BH42 Yield = 14m^3/hr and 336m^3/d
ii. BH54 Yield = 18m^3/hr and 432m^3/d
iii. Combined Yield = 32m^3/hr and 768m^3/d

6.2.2. Water Quality

Water quality samples were taken at the end of each air lift yield test and at the completion of the SDT and tested by R J Hill Laboratories.

Test results are compiled in Table 5 and provided in Appendix E2.

Table 5: Test Bores BH42 and BH54 Water Quality Testing

Parameter	Bore ID	BH42	BH42	BH54	BH54
	Test Number	Test 1	Test 2	Test 1	Test 2
	Depths	65m – 155m	65m – 300m	65m – 185m	65m – 250m
Turbidity	NTU	114	111	57	8.4
pH	Unit	9.1	9.2	8.8	8.9
Total Alkalinity	g/m^3 as $CaCO_3$	210	220	184	210
Free Carbon Dioxide	g/m^3 at 25°C	<1.0	<1.0	<1.0	<1.0
Total Hardness	g/m^3 as $CaCO_3$	33	21	40	20
Electrical Conductivity	mS/m	44.1	49.6	43.7	71.4
Electrical Conductivity	$\mu S/cm$	441	496	437	714
Approx Total Dissolved Salts	g/m^3	300	330	290	480
Total Arsenic	g/m^3	0.0016	0.0038	0.0016	0.0015
Total Boron	g/m^3	0.072	0.24	0.070	0.34
Total Calcium	g/m^3	9.0	4.9	12.2	6.6
Total Copper	g/m^3	0.0052	0.0045	0.0035	0.00078
Total Iron	g/m^3	6.2	5.0	4.0	0.58
Total Lead	g/m^3	0.0024	0.00170	0.00142	0.00043
Total Magnesium	g/m^3	2.5	2.1	2.3	0.89
Total Manganese	g/m^3	0.090	0.059	0.061	0.0132
Total Potassium	g/m^3	1.55	1.21	1.65	1.24
Total Sodium	g/m^3	107	110	96	141
Total Zinc	g/m^3	0.111	0.077	0.140	0.029
Chloride	g/m^3	26	27	33	101
Nitrate-N	g/m^3	<0.05	<0.05	<0.05	<0.05
Sulphate	g/m^3	4.5	3.4	3.9	2.5

Table 6 shows a comparison of the deeper BH42 and BH54 water quality signatures against typical Waitemata aquifer groundwater. This shows that on the basis of TH/TA, pH and sodium, the site groundwater is typical for deep confined Waitemata aquifers.

Table 6: Waitemata Aquifer Water Quality Signatures

Parameter[1]		High TH/TA Ratio Shallow Groundwater[2]	High TH/TA Ratio Deep Groundwater[3]	BH42	BH54
Test Number				Test 2	Test 2
Depths				65m – 300m	65m – 250m
TH/TA Ratio	%	>50	<12	<9	<9
pH	Unit	<8.3	>8.4	9.2	8.9
Silica	g/m^3	>50	<35	Not tested	Not tested
Total Iron	g/m^3	>0.7	<0.1	5.0	0.58
Sodium	g/m^3	<40	>75	110	141

The total Fe results are influenced by bore development. The test bores had limited development, as indicated by turbidity at 111 NTU in BH42. The low nitrate at <0.05g/m^3 confirms a deeper groundwater source unaffected by agriculture.

The slightly elevated boron in BH42 and BH54 at 0.24g/m^3 and 0.34g/m^3 also indicates deep groundwater with some thermal influence.

National Green Steel Limited has provided some water quality requirements associated with the various cooling systems proposed. For both BH42 and BH54 deep samples, these have been assessed as follows:

i. pH
- Site at 8.9 and 9.2
- Suitable for QW cooling
- Too high for CW and KW cooling

ii. Total Hardness ($CaCO_3$)
- Site at 20g/m^3 and 21g/m^3
- Too high for QW cooling
- Too low for CW and KW cooling

iii. Total Alkalinity
- Site at 210g/m^3 and 220g/m^3
- Too high for QW and CW cooling
- Suitable for KW cooling

iv. Chloride
- Site at 27g/m^3 and 101g/m^3
- Too high for QW cooling
- Suitable for CW and KW cooling

v. Sulphate
- Site at 2.5g/m^3 and 3.4g/m^3
- Suitable for QW, CW and KW cooling

vi. Total Iron
- Site at 0.58g/m^3 and 5.0g/m^3

- Too high for QW, CW and KW cooling

vii. TDS
- Site at 330g/m^3 and 480g/m^3
- Suitable for QW, CW and KW cooling

The above shows that water treatment or mixing with another water source will be needed to improve water quality requirements for the plant process use. Production bore development is expected to reduce the above total metals testing results.

6.3 Groundwater Resource

The BH42 and BH54 test bores indicate a combined yield of 32m^3/hr and 768m^3/d from two 150$mmØ$ production bores at these locations. 100$mmØ$ slotted screens are recommended over the two open production zones to provide hole stability for the proposed 50m pumping heads. Water quality testing indicates either treatment or mixing with another source as required to meet site requirements. The yield and water quality assessment is subject to pump testing on the production bores.

For the assessment of groundwater supply, the following is recommended:

- Project water demand planning — Yield of 32m^3/hr and 768m^3/d, say 770m^3/d
- Resource consent application for BH42 and BH54 production bores: — Yield of 42m^3/hr and 1,000m^3/d

A 30% increase is recommended for resource consenting as previous experience indicates that increasing the bore size from the 100$mmØ$ test bores to 150$mmØ$ production bores can result in yields higher than calculated by theoretical well equations.

Further geophysics and test bore drilling would be required to identify further bore sites. The aquifer fracturing is poorly developed, with only two targets identified (BH42 and BH54) along a 1.4km long geophysics survey line.

The BH42 and BH54 test bores indicate that the aquifer is characterised by low transmissivity at around 12m^2/d, and therefore, groundwater level drawdowns, including pumping interference effects between bores, are significant. This requires bores to have a separation distance of at least 300m.

On the basis of the scarcity of aquifer fractures and low aquifer transmissivity resulting in large groundwater drawdowns, it is expected that only two other bore locations may be present on the project site. The feasibility of these two bore locations needs to be determined with further geophysics and test bore drilling.

Hence, the total potential groundwater resource based on four production bores is estimated at 64m^3/hr and 1,540m^3/d.

7. Water Take and Supply Options

Local water supply options are threefold, including an on-site groundwater supply, a piped supply from the Waikato River, and intensive harvesting of rainfall runoff and stormwater.

Use of the existing Whangamarino Rural Water Supply Scheme (WRWSS) which is operated through the Te Kauwhata Water Association (TKWA), presents an indicative cost comparator. TKWA is also referred to as "Te Kauwater". The WRWSS has a well-established infrastructure with a pumping station located on Churchill East Road, which runs south along the eastern flank of the Waikato River. An upgrade of this pipeline would most likely be required to meet total water demand by the Green Steel Project.

Cost estimating is still to be conducted on the water take options for financial planning.

8. Heavy Rainfall Response and Contingency Measures

It is important to note that high-intensity rainfall events in the area can occur (e.g. early 2023). Available storage volume should be managed to exploit storm events to maximise harvesting volumes as much as is practicable. Appropriate disposal of stormwater will be required within the site for excessive rain events – possibly to an area (still to be identified) in the northern portion of the site.

9. Water Take and Supply Plan Review Procedures

The water take and supply plan should be reviewed after the first year of operation. Information gleaned from storm events (levels reached over areas, etc.) will be crucial to informing the plan.

10. Drawings Disclaimer

The are two drawings attached to this report, numbered as Figure 1 and Figure 2, which are referred to in the technical content of this Water Take and Supply Plan for the Green Steel Project: Groundwater, Surface Water and Harvesting Rainfall Runoff. Certain details may differ slightly from similar drawings (Figures) appearing in other technical reports we have authored for the Green Steel project. This is primarily due to revision updates which are specific to the report. The Green Steel Project Development Drawing (PDD), numbered PD3, is consistent throughout our reports and is current with the revision and date shown.

11. Conclusions and Recommendations

i. The proposed Green Steel project, comprising several industrial and manufacturing components, i.e. shredding of raw resource materials, steel smelting and steel manufacturing, requires water for key operational requirements of the utility and auxiliary facilities – primarily for cooling. A sustainable daily water supply is required to make up a net difference for the manufacturing processes which amounts to 2,800m^3/d. Thus, a total water demand of 2,800m^3/d and 840,000m^3/yr is applicable to this Water Take and Supply Plan.

ii. The Green Steel property (as a beef farm) is currently entitled to a rural raw water supply of some $30m^3/d$. Rural raw supply is available through a Daily Supply Entitlement (DSE) from the existing Whangamarino Rural Water Supply Scheme (WRWSS), which is operated through the Te Kauwhata Water Association (TKWA). TKWA is also referred to as "Te Kauwater".

The TKWA is a community-owned and operated water business and charity organisation. Technically, Green Steel's owner is a member of the scheme, with a current DSE entitlement of $30m^3/d$.

iii. Three water take options for the potential supply of water to the Green Steel Project include groundwater abstraction, river water from the Waikato River, and rainwater harvesting.

iv. A high-level plan is provided in this report based on current findings and calculations. Groundwater yields are promising, and further geophysics may identify additional bore locations for test bore drilling and yield assessment. It is possible that a cluster of groundwater bores could provide a suitable water supply for use by the Green Steel Project.

v. Rainwater harvesting would require development works to provide suitable conveyance of rainfall runoff from all or most rooftops and possibly from roads, hardstand areas and other open areas. Capture of runoff from any processing areas would require site-specific pre-treatment prior to recirculation into the plant storage and supply system. Further stormwater assessment is to be undertaken by specialist others to confirm possible capture volumes that could be practicably used as process water supply. We have estimated that a daily water supply of some $420m^3$ per day is viable from stormwater water harvesting from areas of the site, and consent should thus be applied for this water volume.

vi. The BH42 and BH54 test bores indicate a combined yield of $32m^3/hr$ and $768m^3/d$ from two $150mmØ$ production bores at these locations.

For the assessment of groundwater supply, the following is recommended:

- Project water demand planning — Yield of $32m^3/hr$ and $768m^3/d$, say $770m^3/d$
- Resource consent application for BH42 and BH54 production bores: — Yield of $64m^3/hr$ and $1{,}540m^3/d$

On the basis of the scarcity of aquifer fractures and low aquifer transmissivity resulting in large groundwater drawdowns, it is expected that only two other bore locations may be present on the project site. The feasibility of these two bore locations needs to be determined with further geophysics and test bore drilling.

On-site aquifer permeability testing carried out to date indicates $12m$ of groundwater level interference for the two BH42 and BH54 production bore locations separated about $300m$ apart. Such interference is not uncommon for deep confined Waitemata aquifer bores. Bore interference effects have been allowed for in the estimated total groundwater resource yield at $1{,}540m^3/d$ from four on-site bores. Further assessment is required of interference effects on neighbouring bores.

Groundwater yield is dependent on production bores intercepting fractured aquifer conditions, hence the need for site geophysics which allowed targeted drilling in fractured conditions for BH42 and BH54. The total resource assessment based on two additional bores requires further geophysics and test bore drilling at these locations. Sufficient site investigations have, however, been carried out for the resource consent assessment that is yet to be completed.

We recommend an application for the total potential groundwater resource based on four production bores, i.e. estimated at 64m^3/hr and 1,540m^3/d.

vii. Combined water supply from stormwater harvesting and groundwater take is some 1,420m^3/d to 1,960m^3/d. The balance of the required water supply should be sourced from river water supply.

12. References

Airey Consultants Ltd (2025) — *Roading and Stormwater Management Report to Support A Resource Consent Application for a New Steel Processing Plant and Associated Activities for National Green Steel Ltd, at 61 Hampton Downs Road, Hampton Downs.* Ref Job No. 85675-01, 28 April 2025.

Earthtech (2024) — *Preliminary Geotechnical Assessment Report. 61 Hampton Downs Road, Hampton Downs.* Prepared for National Green Steel Limited. Ref R4392-2 dated 3 May 2024.

Peters, Mike (2024 & 2025) — *Personal interview between Earthtech's Lindsay Strachan and Mike Peters, and personal inspection of pipeline and associated infrastructure installations from Churchill East Road, Hall Road, Springhill Prison Service Road, and Hampton Downs Road*. 10 and 18 December 2024. Follow-up checks of information during January 2025.

Waikato Regional Council (2020) — Waikato Regional Council Technical Report 2020/07. Updated version May 2020: *Waikato stormwater management guideline*. Erosion and sediment control guidelines for soil disturbing activities (TR2009/02).

BH Ref	Mt Eden 2000 Easting	Mt Eden 2000 Northing
BH42	428021.11	745972.98
BH54	427882.2	746233.96

LEGEND

- Boreholes
- Site Boundary

Notes:
1. Aerial and contours from RavSurvey, dated 25 March 2024.
2. Background aerial from Google.

0m 50 100 150 200 250m

Scale 1:5000

FOR INFORMATION

Note: All drawings are to be approved (initialled) before final issue.

EARTHTECH

Earthtech Consulting Ltd.
P.O. Box 721, Pukekohe
Phone: 64 9 238 3669
Email: admin@earthtech.co.nz

61 HAMPTON DOWNS ROAD

National Green Steel Limited

Groundwater Investigation Site Plan

DRAWING NO.: FIG. 1

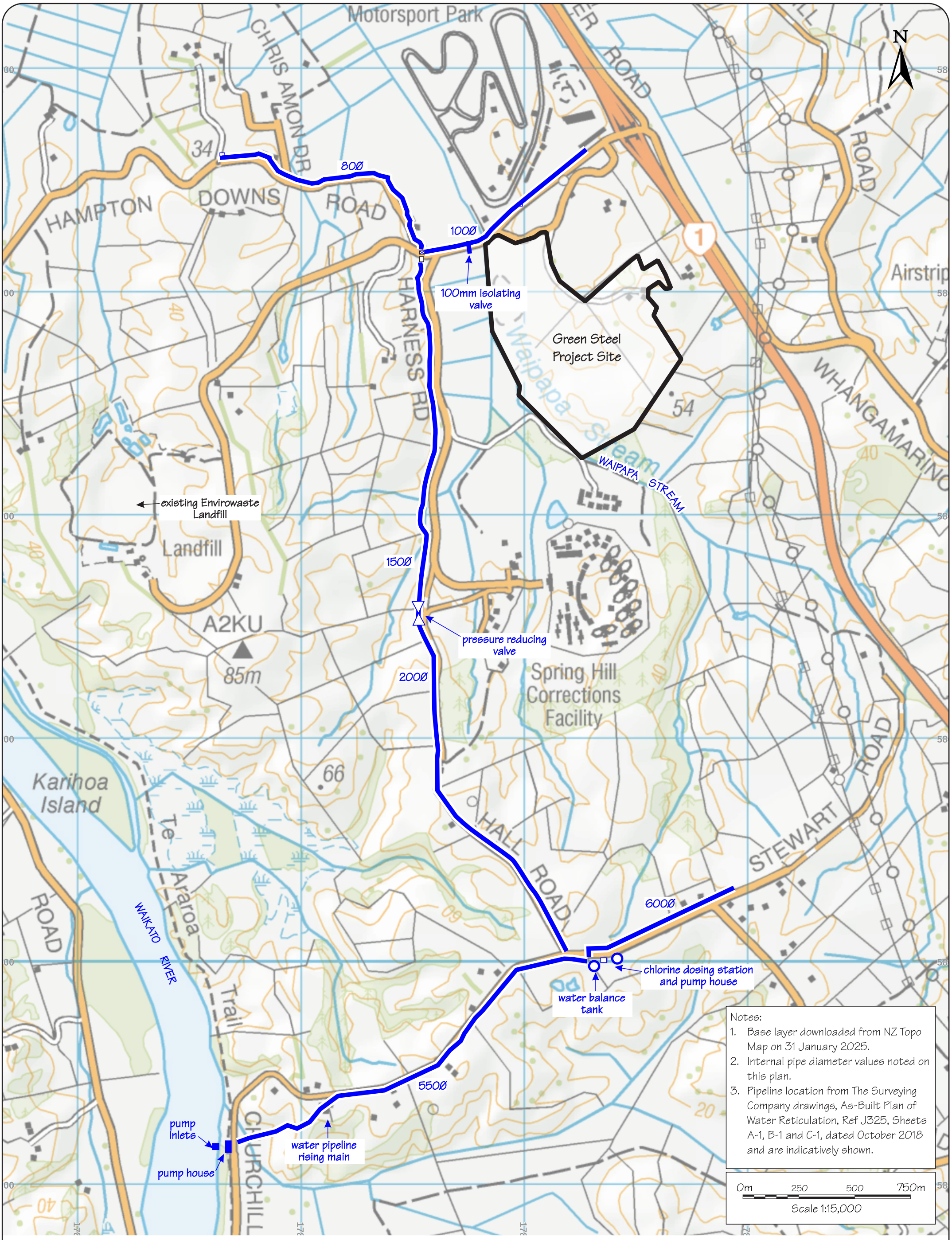
REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	07-02-25	DRAFT FOR COMMENT	P.K	P.K	S.SW	
B	14-03-25	FINAL FOR R3660-1	P.K	P.K	S.SW	

REF: 3660

SCALE: 1:5000

CRS: Mt Eden 2000

DATUM: AVD46



FOR INFORMATION

Note: All drawings are to be approved (initialled) before final issue.

EARTHTECH

Earthtech Consulting Ltd.
P.O. Box 721, Pukekohe
Phone: 64 9 238 3669
Email: admin@earthtech.co.nz

61 HAMPTON DOWNS ROAD

National Green Steel Limited

Te Kauwhata Water Association Water Reticulation Layout Plan

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	03-02-25	DRAFT FOR COMMENT	L.S	L.S	S.SW	
B	14-03-25	FINAL FOR R3660-1	L.S	L.S	S.SW	

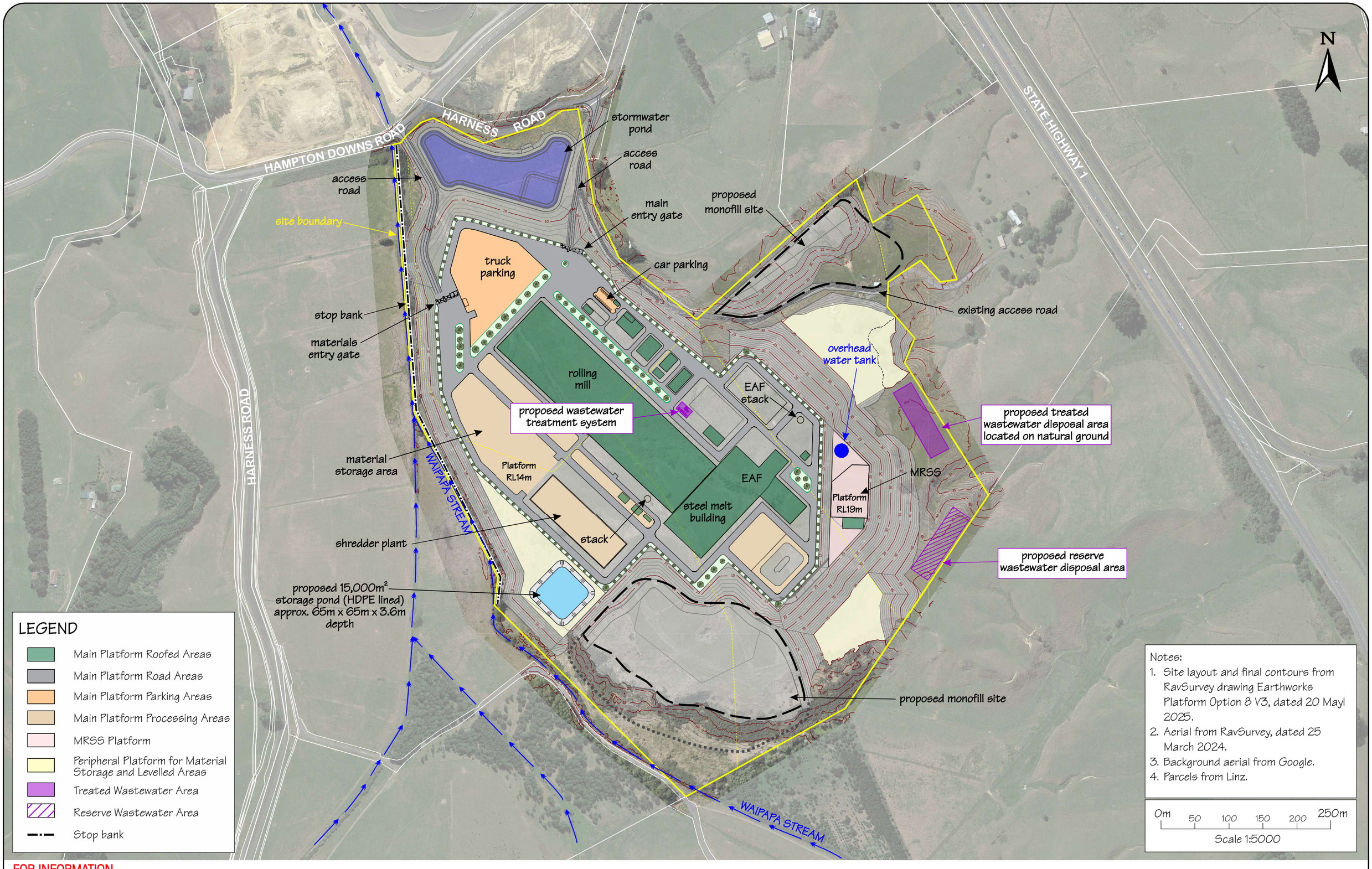
DRAWING NO.: FIG. 2

REF: 3660

SCALE: approx. 1:15000

CRS: NZTM

DATUM:



FOR INFORMATION

Note: All drawings are to be approved (initialled) before final issue.

EARTHTECH

Earthtech Consulting Ltd.

P.O. Box 721, Pukekohe
Phone: 64 9 238 3669
Email: admin@earthtech.co.nz

61 HAMPTON DOWNS ROAD

National Green Steel Limited

Site Plan

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	05-12-24	DRAFT FOR DISCUSSION	L.S	A.N	S.SW	
B	18-02-25	UPDATE PLATFORMS AND CONTOURS	L.S	A.N	S.SW	
C	16-04-25	UPDATE STORMWATER POND	L.S	A.N	S.SW	
D	20-05-25	UPDATE WASTEWATER AREA	L.S	A.N	S.SW	

DRAWING NO.: FIG. PD3

REF: 4392

SCALE: 1:5000

CRS: Mt Eden 2000

DATUM: AVD46

Water Take and Supply Plan for the Green Steel Project:
Groundwater, Surface Water and Harvesting Rainfall Runoff

Green Steel Project

Appendix A

Rainfall Runoff Harvesting Calculation Summary

Green Steel Project

Surface Water Take: Rainfall Runoff

Area No.	Area Description	Finished GL (RL*m*)	Area (m^2)	Area (ha)	Viable Catchment Area %	Nett Catchment Area (m^2)	Nett Catchment Area (ha)	Runoff Coefficient (C)	Rainfall (Av mm/day)	Rainfall Volume (m^3/day)	Rainfall Volume (m^3/yr)	Notes
1	**Main Platform**	14	212,000	21.2	100%	212,000	21.2					
1.1	Main Platform Roofed Areas	14	66,560	6.7	100%	66,560	6.7	0.90	2.9	175	63,733	EAF, Mill, Shredder Plant - refer roofed areas on plan
1.2	Main Platform Roads Areas	14	40,000	4.0	80%	32,000	3.2	0.85	2.9	79	28,939	Refer plan for roads areas
1.3	Main Platform Parking Areas	14	23,340	2.3	90%	21,006	2.1	0.85	2.9	52	18,996	Refer plan for parking areas
1.4	Main Platform Processing Areas	14	60,000	6.0	70%	42,000	4.2	0.60	2.9	73	26,811	Treatment of runoff waters from these areas possreqd to area use
1.5	Rain Gardens	14	10,000	1.0	50%	5,000	0.5	0.40	2.9	6	2,128	Areas shown on plan
1.6	Main Platform Other Areas	14	12,100	1.2	50%	6,050	0.6	0.40	2.9	7	2,575	Estimate 50% of areas available
	Subtotal Check:		**212,000**	**21.2**		**172,616**	**17.3**			**392**	**143,181**	
2	**MRSS Platform**	19	7,970	0.8	20%	1,594	0.2	0.35	2.9	2	594	Crushed stone or aggregate material base
3	**NE Platform**	35	26,682	2.7	20%	5,336	0.5	0.40	2.9	6	2,271	Allowance for 2 x 3,334m^2 (6,668m^2) treated wastewater irrigation areas.
4	**East Platform**	45	6,620	0.7	20%	1,324	0.1	0.40	2.9	2	563	Refer plan showing E. platform
5	**South Platform**	35	12,235	1.2	20%	2,447	0.2	0.40	2.9	3	1,041	Refer plan showing S. platform
6	**SW Platform**	14	15,950	1.6	20%	3,190	0.3	0.40	2.9	4	1,358	Refer plan showing SW platform
7	**Stormwater Catchment Ponds**	various	50,000	5.0	20%	10,000	1.0	0.35	2.9	10	3,724	Allow 5ha. Refer EMP & ESCP Ref: R4392-3, 29 Nov 2024. Probable location at southern most boundary (south of SW Monofill)
	Totals:		**281,457**	**28.1**		**186,507**	**18.7**			**418**	**152,732**	

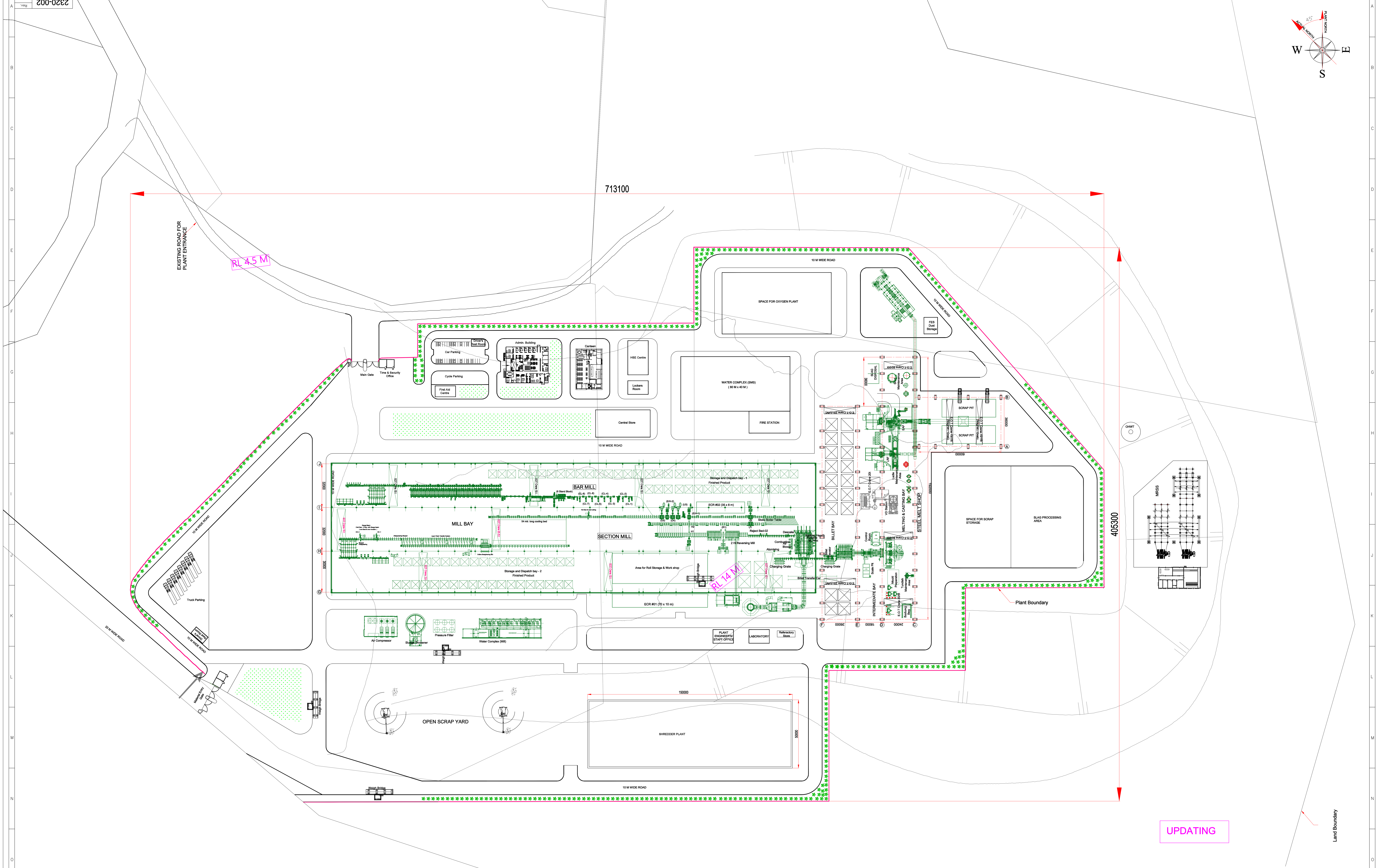
Water Take and Supply Plan for the Green Steel Project:
Groundwater, Surface Water and Harvesting Rainfall Runoff

Green Steel Project

Appendix B

Concept Plant Layout

Please Do Not Scale. If in Doubt, ASK.



713100
405300
EXISTING ROAD FOR PLANT ENTRANCE
RL 4.5 M
RL 14 M
SPACE FOR OXYGEN PLANT
10 M WIDE ROAD
Main Gate
Time & Security Office
Car Parking
Cycle Parking
First Aid Centre
Admin. Building
Canteen
HSE Centre
Lockers Room
WATER COMPLEX (SMS)
FIRE STATION
Central Store
BAR MILL
MILL BAY
SECTION MILL
Storage and Dispatch bay - 1 Finished Product
Storage and Dispatch bay - 2 Finished Product
Area for Roll Storage & Work shop
ECR #01 (70 x 10 m)
ECR #02 (35 x 8 m)
BILLET BAY
INTERMEDIATE BAY
MELTING & CASTING BAY
STEEL MELT SHOP
SCRAP PIT
SPACE FOR SCRAP STORAGE
SLAG PROCESSING AREA
MRSS
Plant Boundary
Truck Parking
Air Compressor
Pressure Filter
Water Complex (Mill)
PLANT ENGINEER'S STAFF OFFICE
LABORATORY
Refractory Store
OPEN SCRAP YARD
SHREDDER PLANT
150000
20 M WIDE ROAD
Land Boundary
UPDATING
W
E
S

Rev. No.	Date	Revision Description	Design	Drawn	Chkd.	Appd.
06	30.04.24	updated as per client's email dtd. 22.04.24	S.D	S.D	J.N.S	S.K.G
05	26.03.24	updated as per client's email dtd. 20.03.24	S.D	S.D	J.N.S	S.K.G
04	01.03.24	updated as per client's email dtd. 27.02.24	S.D	S.D	J.N.S	S.K.G
03	15.02.24	updated as per client's email dtd. 14.02.24	S.D	S.D	J.N.S	S.K.G
02	13.02.24	updated as per client's email dtd. 09.02.24	S.D	S.D	J.N.S	S.K.G
01	08.02.24	Additional required land area marked.	S.D	S.D	J.N.S	S.K.G

STEEL MELT SHOP AND MEDIUM SECTION CUM REBAR MILL

CONCEPT PLANT LAYOUT

Scale 1:1200 | Design S.D | Drawn S.D | Chkd. J.N.S | Appd. S.K.G | Date 02.02.24

R. Singh & Associates Pvt. Ltd.

Size A1 | 2320-002 | Sh. 1 | Next __ | Rev. 06

Water Take and Supply Plan for the Green Steel Project:
Groundwater, Surface Water and Harvesting Rainfall Runoff

Green Steel Project

Appendix C

BH42 and BH54 100mmØ Test Bore Yield Assessment

Appendix C

BH42 and BH54 100mmØ Test Bore Yield Assessment

D1. Yield Testing

- **BH42**

Two air lift yield tests and a pump test (Step Drawdown Test -SDT) were completed in BH42. The Drill Force air lift yield test data is attached in Appendix E. The test data depth plot is presented in Figure D1. The SDT plots are shown in Figures D2 and D3. The summary test data and associated specific capacities are shown in Table D1.

The SDT returned a near-constant specific capacity with an average of $0.32m^3/hr/m$ and range of $0.28m^3/hr/m$ and $0.34m^3/hr/m$. This indicates confined conditions (with yield proportional to drawdown) and aquifer head losses from fracture flow not being significant for the $4m^3/hr$ to $12m^3/hr$ pumping range.

The increase in the specific capacities between the $0.24m^3/hr/m$ from air lift and $0.34m^3/hr/m$ from pumping testing at $5m^3/hr$ is considered to be due to lower turbulent head losses from the pumped SDT method.

Table D1: Yield Testing and Specific Capacities BH42

Test	Depth Interval	Static Water Level	Drawdown		Yield	Specific Capacity
	(m)	(m)	(PSI)	(m)	(m^3/hr)	(m^3/hr/m)
A. Air Lift Testing						
BH42 – Test 1	65 to 185	33.2	30	21.1	3	0.14
BH42 – Test 2	65 to 300	33.1	30	21.1	5	0.24
B. SDT Testing						
SDT @ 60-minute steps	65 to 300	34.0	-	11.7	4	0.34
			-	17.5	6	0.34
			-	23.5[1]	8	0.34
			-	39.4[1]	12	0.31
			-	36.0	10	0.28

Note: [1] Drawdown adjustment made due to changing pump rate within step.

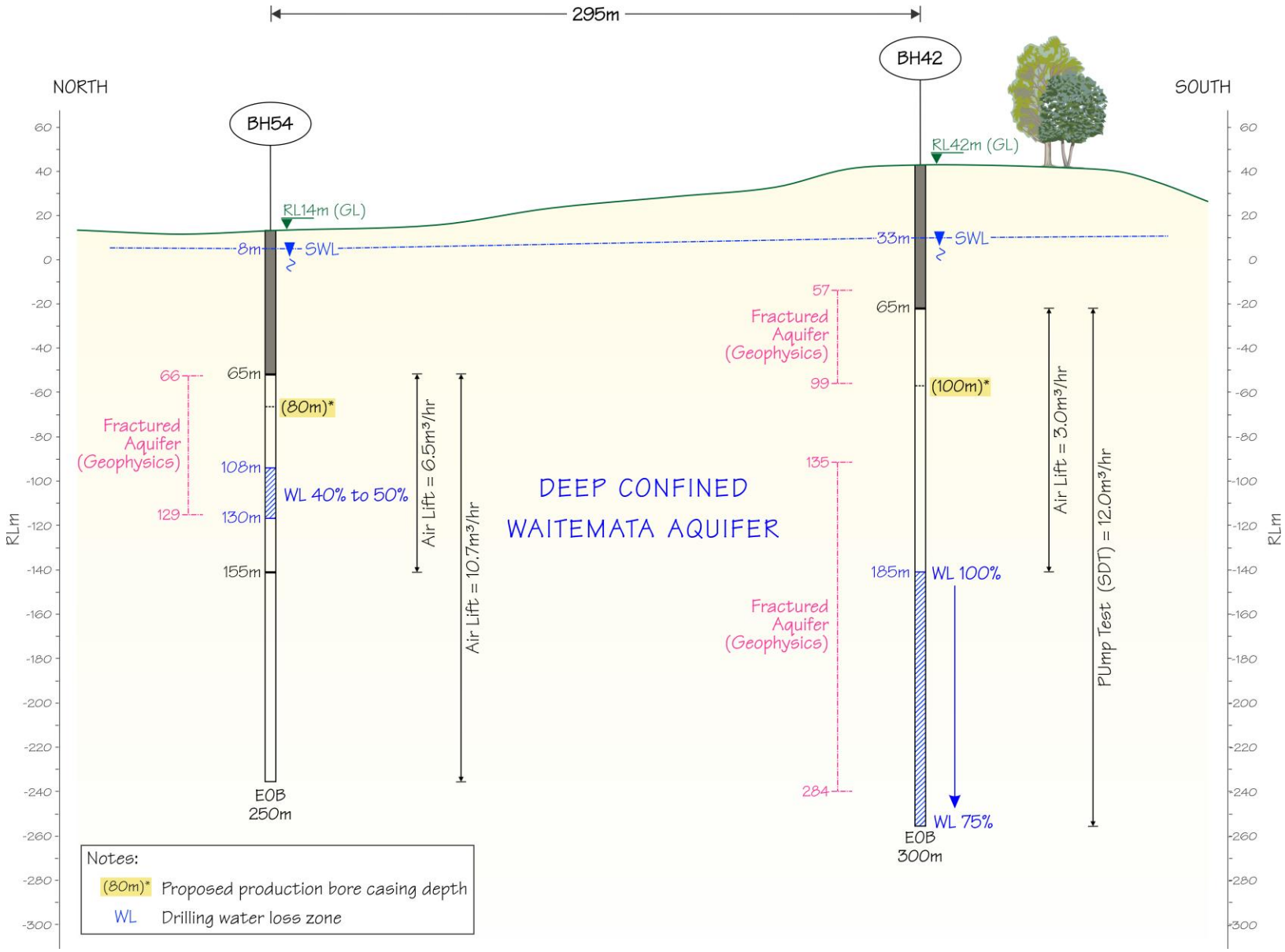


Figure D1: BH42 and BH54 Test Bore Results

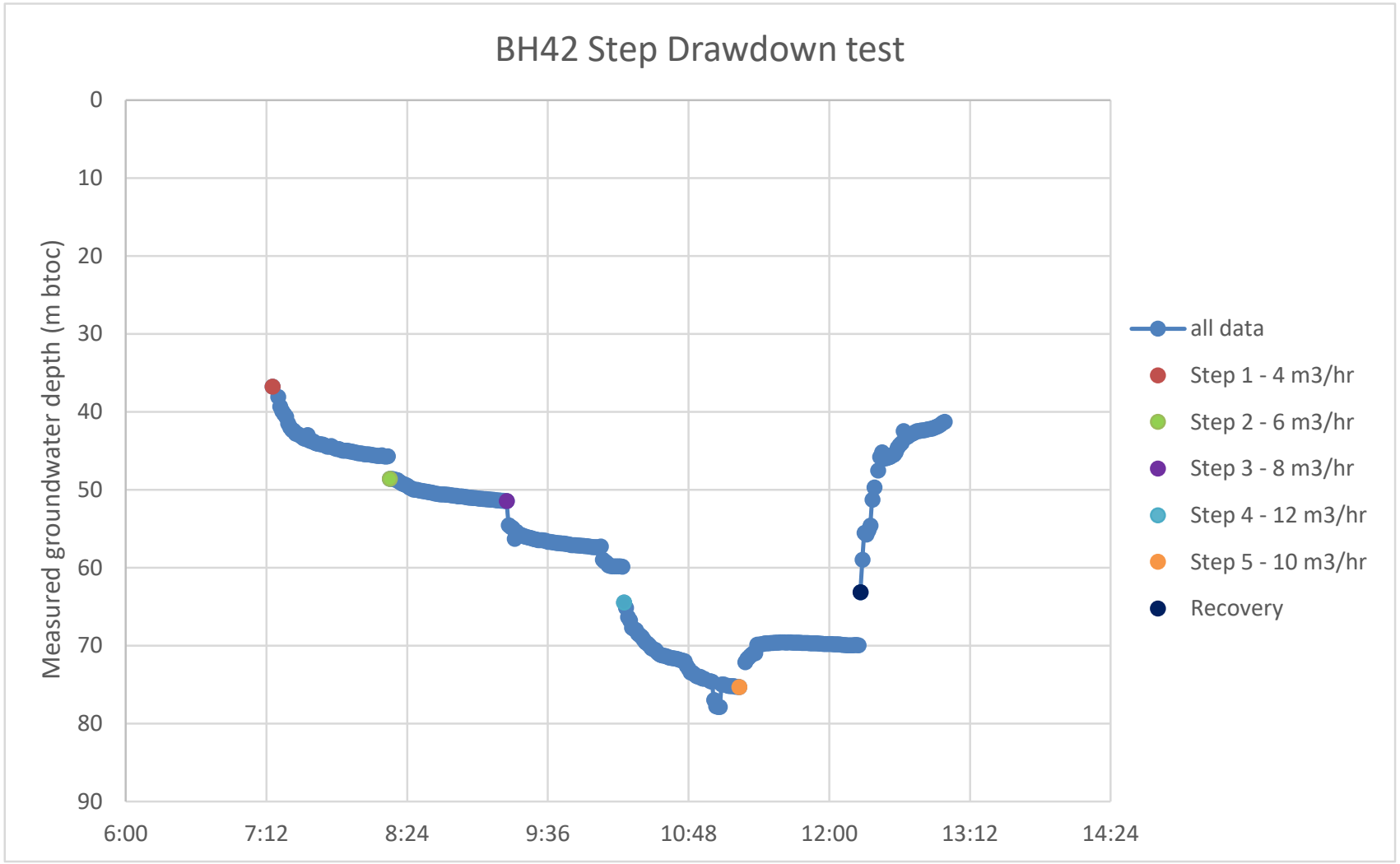


Figure D2: BH42 SDT Drawdown and Recovery Data

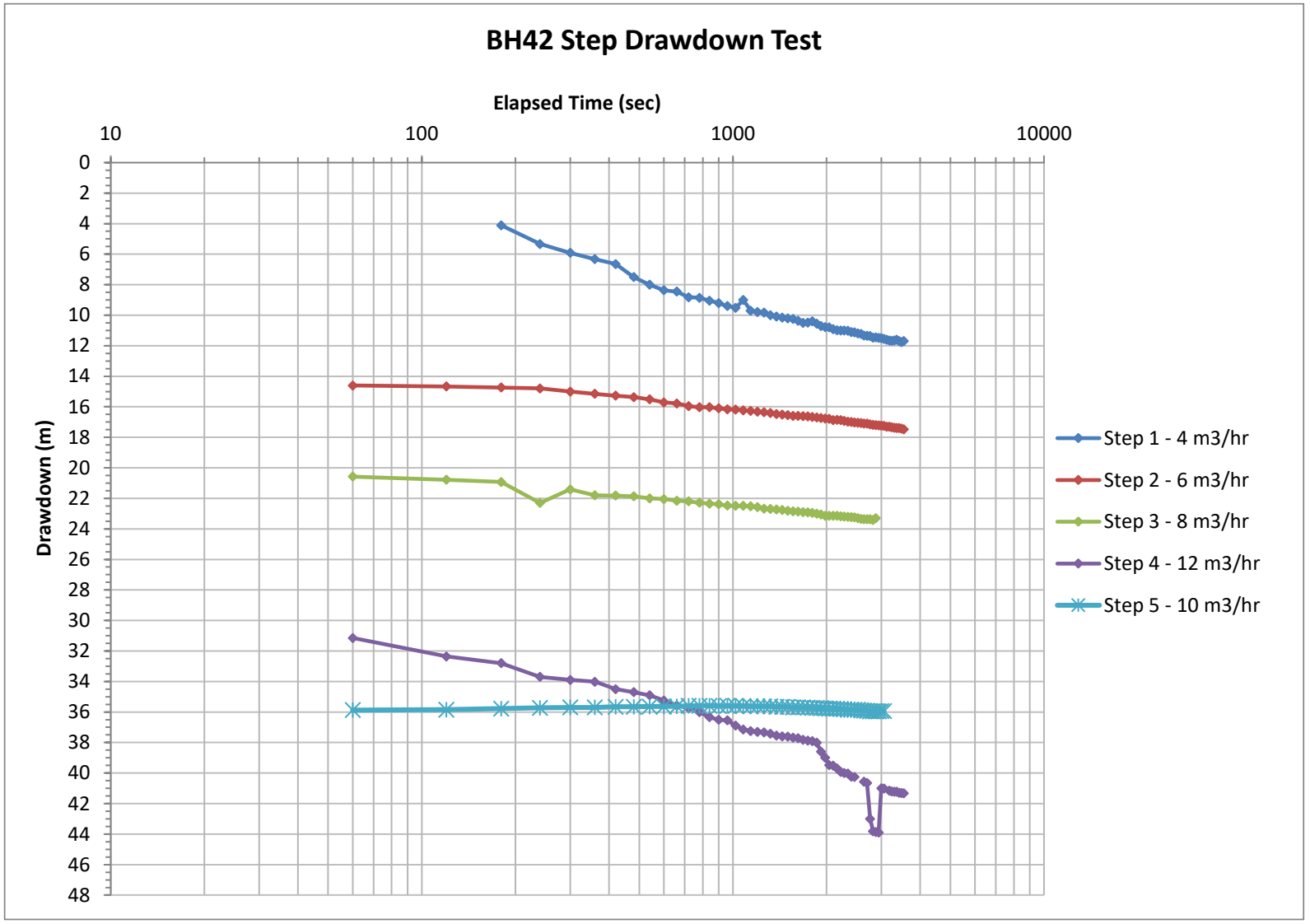


Figure D3: BH42 SDT Step Data

- **BH54**

For BH54, the air lift test data is attached in Appendix E, with calculated specific capacities presented in Table D2.

The specific capacities of the deeper portions of BH42 and BH54 at 0.32$m^3/hr/m$ (average) and 0.38$m^3/hr/m$ respectively are similar. Both bores encountered fractured Waitemata aquifer conditions as indicated by drill water circulation loss zones (Figure D1).

Table D2: Yield Testing and Specific Capacities BH54

Test	Depth Interval	Static Water Level	Drawdown		Yield	Specific Capacity
	(m)	(m)	(PSI)	(m)	(m^3/hr)	(m^3/hr/m)
A. Air Lift Testing						
BH54 – Test 1	65 to 185	7.1	50	35	6.5	0.19
BH54 – Test 2	65 to 250	8.0	40	28	10.7	0.38

D2. Aquifer Parameters

Hvorslev (1951)[6] calculations have been used to determine aquifer permeability and transmissivity. Associated results are presented in Table D3.

For the yield assessment, the following has been adopted:

i. BH42 Transmissivity $T = 11 m^2/d$ } SDT average
Permeability $k_h = 0.05 m/d$ }

ii. BH54 Transmissivity $T = 13 m^2/d$ } Air lift Test 2
Permeability $k_h = 0.09 m/d$ }

For aquifer storativity, s = 7 x 10^{-4} has been adopted from bulk average storativity data from the Franklin deep confined Waitemata aquifer (Table 5.1 of Earthtech, 2014[7]).

Table D3: Aquifer Permeability and Transmissivity

Test	Depth Interval	Horizontal Permeability	Transmissivity
	(m)	(k_h) (m/d)	(m^2/d)
A. BH42[1]			
Air Lift Test 2	65 to 300	0.04	8.3
SDT-1		0.05	11.9
SDT-2		0.05	12.0
SDT-3		0.05	11.9
SDT-4		0.05	10.6
SDT-5		0.04	9.7
B. BH54[1]			
Air Lift Test 2	65 to 250	0.09	12.7

Note: [1] Aquifer thickness of 235*m* and 142*m* have been adopted for BH42 and BH54 analysis respectively.

[6] Hvorslev, M. J. (1951). *Time Lag and Soil Permeability in Groundwater Observations.* US Army Corps Engrs. Waterways. Vicksburg, Miss. USA.
[7] Earthtech (2014). *Franklin Deep Waitemata Aquifer – Groundwater Availability Study. Stage I Data Compilation.* Report prepared for Auckland Council. Ref R3172-1 dated 30 June 2014.

D3. Bore Yield Assessment

The proposed production bores are to be 150*mm* in diameter. Final bore depths are to match the test bore depths. To maximise the groundwater submergence depths of submersible pumps, the following production bore casing depths are proposed (see Figure D1).

i. BH42 – 150*mm* casing to 100*m* depth.
ii. BH54 – 150*mm* casing to 80*m* depth.

Non-equilibrium well equations have been used to determine the pumping interference effects between BH42 and BH54 which are 295*m* apart. For 365 days of pumping and T_{av} = 12m^2/d and Q_{av} = 360m^3/d, the interference effect in each bore is 12*m*.

Equilibrium well equations for confined conditions have been used to determine bore yield (Equation 9.2 from Driscoll, 1986[8]), where:

$$Q = \frac{2.73\ Kb\ (H-h)}{\log {}^{R}/_{r}} \quad \text{.....(1)}$$

Where:
- Kb = Transmissivity
- H-h = Drawdown
- R = Radius of Influence
- r = Bore Diameter

A radius of influence of 1,000*m* has been adopted to match the stabilised ROI with an estimated deep aquifer recharge rate of about 40*mm*/*yr*.

For in-well pumping drawdown (s), the following has been adopted:

i. BH42
- *s* = 100*m* (casing) – 33*m* (SWL) – 10*m* (min. pump submergence) – 12*m* (BH54 interference).
- *s* = 45*m*

ii. BH54
- *s* = 80*m* (casing) – 8*m* (SWL) – 10*m* (min. pump submergence) – 12*m* (BH42 interference).
- *s* = 50*m*

The estimated yields of the BH42 and BH54 production bores are:

i. BH42

$$Q = \frac{2.73\ x\ 11m^3/d\ x\ 45m}{\log \frac{1{,}000m}{0.075m}} = 328m^3/d, \text{ and } 13.7m^3/hr, \text{ say } 14m^3/hr$$

[8] Driscoll, F.G. (1986). *Groundwater and Wells (2nd Ed)*. Published by Johnson Division, St. Paul, Minnesota 55112.

ii. BH54

$$Q = \frac{2.73\ x\ 13m^3/d\ x\ 50m}{\log \frac{1{,}000m}{0.075m}} = 430m^3/d, \text{ and } 17.9m^3/hr, \text{ say } 18m^3/hr$$

From the above, combined yield = $32m^3/hr$ and $768m^3/d$.

Note that the above yields are subject to pump testing in the constructed production bores.

Water Take and Supply Plan for the Green Steel Project:
Groundwater, Surface Water and Harvesting Rainfall Runoff

Green Steel Project

Appendix D

E1) Drilling: Drill Force Bore Logs and Air Lift Testing Sheets

E2) Water Quality: R J Hills Laboratories Water Quality Analyses

Water Take and Supply Plan for the Green Steel Project:
Groundwater, Surface Water and Harvesting Rainfall Runoff

Green Steel Project

Appendix D1

Drilling: Drill Force Bore Logs and Air Lift Testing Sheets

BORE SUMMARY/BORE LOG

PERMIT NUMBER :	AUTH147358.01.01	**DFNZ REFRENCE # :**	DF24WW104
BORE NUMBER/I.D :	72 _12576 (BH 42)	**COMPLETION DATE :**	4/02/2025
MAP REFRENCE :	1784236ME 5862473MN	**PURPOSE :**	100mm New Water Bore
CLIENT :	National Green Steel Limited		
SITE ADDRESS :	61 Hampton DownsRoad, Hampton Downs.		
DRILLER :	Keil Peterson		
DRILLING METHOD:	Mud Rotary		

WELL CONSTRUCTION DETAILS			**WELL DEVELOPMENT**	
DEPTH OF BORE :	300m		**METHOD :**	Airlift
BORE DIAMETER :	100m		**S.W.L :**	33.1m
DEPTH OF PRODUCTION CASING :	65.0m		**AIR LINE DEPTH :**	57m
CASING MATERIAL :	Galvanised Steel		**FLOW RATE :**	5,000L Per Hour
I.D OF CASING :	100mm		**START PRESSURE :**	95
WELL AQUIFER :	Mudstone / Sandstone		**RUNNING PRESSURE :**	40 PSI
AQUIFER ISOLATION MATERIAL :	Temporary 100mm casing.		We had total water loss in this bore at 180m and drilled with 75% loss to 300m.	
ISOLATION INSTALL METHOD :	Concrete Apron			
AQUIFER ISOLATION VOLUME :	WEIGHT	80kg		

BORE LOG :

DEPTH		**LITHOLOGY**
0	.300mm	Top soil
.300mm	5m	Brown / white clays
5m	10m	White / blue silts
10m	23m	Grey silts/ mudstone
23m	28m	Brown / grey silts
28m	35.1m	Brown sands
35.1m	37m	Grey sands
37m	40m	Pre sandstone
40m	300m	Sandstone / mudstone

BORE SUMMARY/BORE LOG

PERMIT NUMBER :	AUTH147358.01.01	**DFNZ REFRENCE # :**	DF24WW104
BORE NUMBER/I.D :	72 _12575 (BH 54)	**COMPLETION DATE :**	4/02/2025
MAP REFRENCE :	1784108ME 5862738MN	**PURPOSE :**	100mm New Water Bore
CLIENT :	National Green Steel Limited		
SITE ADDRESS :	61 Hampton DownsRoad, Hampton Downs.		
DRILLER :	Keil Peterson		
DRILLING METHOD:	Mud Rotary		

WELL CONSTRUCTION DETAILS			**WELL DEVELOPMENT**	
DEPTH OF BORE :	250m		**METHOD :**	Airlift
BORE DIAMETER :	100m		**S.W.L :**	8m
DEPTH OF PRODUCTION CASING :	65.0m		**AIR LINE DEPTH :**	44m
CASING MATERIAL :	Galvanised Steel		**FLOW RATE :**	10,700L Per Hour
I.D OF CASING :	100mm		**START PRESSURE :**	80 PSI
WELL AQUIFER :	Mudstone / Sandstone		**RUNNING PRESSURE :**	40 PSI
AQUIFER ISOLATION MATERIAL :	Temporary 100mm casing.			
ISOLATION INSTALL METHOD :	Concrete Apron			
AQUIFER ISOLATION VOLUME :	WEIGHT	80kg		

BORE LOG :

DEPTH		**LITHOLOGY**
0	.200mm	Top soil
.200mm	1m	Brown / white clays
1m	2m	Brown / orange / white clays
2m	9m	Orange sandy clays
9m	10m	Pre sanstone
10m	250m	Sandstone / mudstone

DRILLFORCE
THE DRILLING SPECIALISTS

BH42 Test one

WELL DEVELOPMENT

DATE: 23-1-25

SITE ADRESS/BORE I.D:	61 Hamton downs 72-12576	COMPRESSOR NUMBER/SIZE:	
STATIC WATER LEVEL:	33.2	BORE HOLE DIAMETER:	100m.m
STARTING PRESSURE :	70 psi	AIR LINE SIZE:	1¼
RUNNING PRESSURE:	40 psi	DELIVERY HOSE SIZE:	1"
AIR LINE DEPTH:	50.5	NUMBER OF DELIVERY HOSES:	2
MEASURED FLOW:		CASING SHOE DEPTH:	65.m
To obtain flow in litres/Hr = volume (litres) divided by time (in seconds) x 60 x 60 = liters/hr		TOP OF J LATCH:	
		BOTTOM OF SCREEN:	

TIME	FLOW (CUBE PER HOUR)	RUNNING PSI	AIR LINE DEPTH	NOTES (SAND/SILT CONTENT, WATER DISCLORATION, ODOR/SMELL COMING FROM WATER, TEMPRETURE OF WATER, TASTE) RECORD IF AIR LINE DEPTH CHANGES THROUGH OUT TESTING
8.45	4	40	50.5	
9.45	3	40	50.5	
10:45	3	40	50.5	
11:45	3	40	50.5	
12:45	3	40	50.5	
1:00	3	40	50.5	

WATER SAMPLE TAKEN	YES/NO

DRILLFORCE

NZDF

DRILLFORCE
THE DRILLING SPECIALISTS

BH 42 Test Twn

WELL DEVELOPMENT

DATE: 30-1-25

SITE ADRESS/BORE I.D:	61- Hamton Downs 72-12576	COMPRESSOR NUMBER/SIZE:	
STATIC WATER LEVEL:	after drilling 18.3	BORE HOLE DIAMETER:	100mm
STARTING PRESSURE :	95 PSI	AIR LINE SIZE:	1 1/4
RUNNING PRESSURE:	55 PSI	DELIVERY HOSE SIZE:	1"
AIR LINE DEPTH:	57	NUMBER OF DELIVERY HOSES:	2
MEASURED FLOW:	14.6m³ @ start of test	CASING SHOE DEPTH:	65
To obtain flow in litres/Hr = volume (litres) divided by time (in seconds) x 60 x 60 = liters/hr		TOP OF J LATCH:	
		BOTTOM OF SCREEN:	

TIME	FLOW (CUBE PER HOUR)	RUNNING PSI	AIR LINE DEPTH	NOTES (SAND/SILT CONTENT, WATER DISCLORATION, ODOR/SMELL COMING FROM WATER, TEMPRETURE OF WATER, TASTE) RECORD IF AIR LINE DEPTH CHANGES THROUGH OUT TESTING
12:00 Pm	14.6	50 PSI	57	
1:00 Pm	10.2	40 PSI	57	
2:00 Pm	8	40 PSI	57	
3:00 Pm	6	40 PSI	57	
4:00 Pm	5	40 PSI	57	
5:00 Pm	5	40 PSI	57	
6:00 Pm	5	40 PSI	55	
Next morning				
Swl 33.1m ✓				
Start Press 80psi				Flow @ 7:00am 7.8m³ and
Run Press 50psi				at 11:00am when returned to
				Site back at 5m³

WATER SAMPLE TAKEN	YES/NO

DRILLFORCE

NZDF

DRILLFORCE

THE DRILLING SPECIALISTS

BH54 Test one

WELL DEVELOPMENT

DATE: 14-1-25

SITE ADRESS/BORE I.D:	61 Hamton Downs Te Kauwhata	COMPRESSOR NUMBER/SIZE:	
STATIC WATER LEVEL:	7.1m	BORE HOLE DIAMETER:	100mm
STARTING PRESSURE :	30 PSI	AIR LINE SIZE:	1 1/4
RUNNING PRESSURE:	30 PSI	DELIVERY HOSE SIZE:	1"
AIR LINE DEPTH:	44m	NUMBER OF DELIVERY HOSES:	2
MEASURED FLOW:		CASING SHOE DEPTH:	65
To obtain flow in litres/Hr = volume (litres) divided by time (in seconds) x 60 x 60 = liters/hr		TOP OF J LATCH:	
		BOTTOM OF SCREEN:	

TIME	FLOW (CUBE PER HOUR)	RUNNING PSI	AIR LINE DEPTH	NOTES (SAND/SILT CONTENT, WATER DISCLORATION, ODOR/SMEL COMING FROM WATER, TEMPRETURE OF WATER, TASTE) RECORI IF AIR LINE DEPTH CHANGES THROUGH OUT TESTING
8 00	8.7	30	44	
900	8.7	30	44	
1000	8.7	30	44	
11 00	7	30	44	
12:00	6.5	30	44	
1:00	6.5	30	44	
2:00	6.5	30	44	

WATER SAMPLE TAKEN	(YES)/NO

DRILLFORCE
THE DRILLING SPECIALISTS

BH54 Test Two

WELL DEVELOPMENT

DATE: 16-1-25

SITE ADRESS/BORE I.D:	61 Hamton Downs	COMPRESSOR NUMBER/SIZE:	
STATIC WATER LEVEL:	8m	BORE HOLE DIAMETER:	100mm
STARTING PRESSURE :	80 PSI	AIR LINE SIZE:	1 1/4
RUNNING PRESSURE:	48 PSI	DELIVERY HOSE SIZE:	1"
AIR LINE DEPTH:	44	NUMBER OF DELIVERY HOSES:	2
MEASURED FLOW:	16.3 m^3	CASING SHOE DEPTH:	65m
To obtain flow in litres/Hr = volume (litres) divided by time (in seconds) x 60 x 60 = liters/hr		TOP OF J LATCH:	
		BOTTOM OF SCREEN:	

TIME	FLOW (CUBE PER HOUR)	RUNNING PSI	AIR LINE DEPTH	NOTES (SAND/SILT CONTENT, WATER DISCLORATION, ODOR/SMELL COMING FROM WATER, TEMPRETURE OF WATER, TASTE) RECORD IF AIR LINE DEPTH CHANGES THROUGH OUT TESTING
7:30am	16.3 m^3	48 PSi	44	
8:30am	14 m^3	40 PSi	44	
9:30am	12.6 m^3	40 PSi	44	
10:30am	12 m^3	40 PSi	44	
11:30am	10.7 m^3	40 PSi	44	
12:30pm	10.7 m^3	40 PSi	44	
1:30pm	10.7 m^3	40 PSi	44	
2:30pm	10.7 m^3	40 PSi	44	
3:30pm	10.7 m^3	40 PSi	44	

WATER SAMPLE TAKEN	(YES) / NO

DRILLFORCE

NZDF NEW ZEALAND DRILLERS FEDERATION INC

Water Take and Supply Plan for the Green Steel Project:
Groundwater, Surface Water and Harvesting Rainfall Runoff

Green Steel Project

Appendix D2

Water Quality: R J Hills Laboratories Water Quality Analyses

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

0508 HILL LAB (44 555 22)
+64 7 858 2000
mail@hill-labs.co.nz
www.hill-labs.co.nz

Certificate of Analysis

Client:	Drill Force New Zealand Limited	**Lab No:**	3761914	DWAPv1
Contact:	Manisha Patel	**Date Received:**	23-Jan-2025	
	C/- Drill Force New Zealand Limited	**Date Reported:**	30-Jan-2025	
	PO Box 72 335	**Quote No:**		
	Papakura 2244	**Order No:**	DF48509	
		Client Reference:	DF24WW104	
		Submitted By:	Manisha Patel	

Sample Type: Aqueous

		Sample Name:	BH42 Test One 23-Jan-2025 2:15 pm	**Aesthetic Values**	**Maximum Acceptable Values (MAV)**
		Lab Number:	3761914.1		
Routine Water + E.coli profile Kit					
Escherichia coli	MPN / 100mL		2 #1	-	< 1
Routine Water Profile					
Turbidity	NTU		114	≤ 5	-
pH	pH Units		9.1	7.0 - 8.5	-
Total Alkalinity	g/m³ as $CaCO_3$		210	-	-
Free Carbon Dioxide	g/m³ at 25°C		< 1.0	-	-
Total Hardness	g/m³ as $CaCO_3$		33	≤ 200	-
Electrical Conductivity (EC)	mS/m		44.1	-	-
Electrical Conductivity (EC)	µS/cm		441	-	-
Approx Total Dissolved Salts	g/m³		300	≤ 1000	-
Total Arsenic	g/m³		0.0016	-	0.01
Total Boron	g/m³		0.072	-	2.4
Total Calcium	g/m³		9.0	-	-
Total Copper	g/m³		0.0052	≤ 1	2
Total Iron	g/m³		6.2	≤ 0.3	-
Total Lead	g/m³		0.0024	-	0.01
Total Magnesium	g/m³		2.5	-	-
Total Manganese	g/m³		0.090	≤ 0.04 (Staining) ≤ 0.10 (Taste)	0.4
Total Potassium	g/m³		1.55	-	-
Total Sodium	g/m³		107	≤ 200	-
Total Zinc	g/m³		0.111	≤ 1.5	-
Chloride	g/m³		26	≤ 250	-
Nitrate-N	g/m³		< 0.05	-	11.3
Sulphate	g/m³		4.5	≤ 250	-

Note: The Maximum Acceptable Values (MAV) are taken from the 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022', published under the authority of the New Zealand Government-2022. Copies of this publication are available from: https://www.legislation.govt.nz/regulation/public/2022/0168/latest/whole.html

The standards set limits for the concentration of determinands in drinking water. The Maximum Acceptable Values (MAVs) for any determinand must not be exceeded at any time.

The Aesthetic Values are taken the publication, 'Aesthetic Values for Drinking Water Notice 2022' issued by the Water Services Regulator ("Taumata Arowai"). Aesthetic values specify or provide minimum or maximum values for substances and other characteristics that relate to the acceptability of drinking water to consumers (such as appearance, taste or odour).

Note that the units: g/m³ are the same as mg/L and ppm.

Analyst's Comments
#1 Please interpret this result with caution as the sample was > 10 °C on receipt at the lab. The sample temperature is recommended by the laboratory's reference methods to be less than 10 °C on receipt at the laboratory (but not frozen). However, it is acknowledged that samples that are transported quickly to the laboratory after sampling, may not have been cooled to this temperature.

Routine Water Assessment for Sample No 3761914.1 - BH42 Test One 23-Jan-2025 2:15

pH/Alkalinity and Corrosiveness Assessment
The pH of a water sample is a measure of its acidity or basicity. Waters with a low pH can be corrosive and those with a high pH can promote scale formation in pipes and hot water cylinders.
The guideline level for pH in drinking water is 7.0-8.5. Below this range the water will be corrosive and may cause problems with disinfection if such treatment is used.

The alkalinity of a water is a measure of its acid neutralising capacity and is usually related to the concentration of carbonate, bicarbonate and hydroxide. Low alkalinities (25 g/m^3) promote corrosion and high alkalinities can cause problems with scale formation in metal pipes and tanks.

With the pH and alkalinity levels found, it is unlikely this water will be corrosive towards metal piping and fixtures.
This water has an unusually high pH which could be indicative of contact with new concrete or cement or from alkaline cleaning agents. Water with such a high pH may have an unusual taste and a soapy feel.
The high alkalinity of this water may cause an increase in the pH in the root zones of plants which are irrigated using this water.

Hardness/Total Dissolved Salts Assessment
The water contains a moderate amount of dissolved solids and would be regarded as being soft.

Nitrate Assessment
Nitrate-nitrogen at elevated levels is considered undesirable in natural waters as this element can cause a health disorder called methaemaglobinaemia. Very young infants (less than six months old) are especially vulnerable. The 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022' sets a maximum permissible level of 11.3 g/m^3 as Nitrate-nitrogen (50 g/m^3 as Nitrate).

Nitrate-nitrogen was not found in this water.

Sodium and Chloride Assessment
The high levels of sodium may be detrimental to certain plants (eg Sandersonia).

Boron Assessment
Boron may be present in natural waters and if present at high concentrations can be toxic to plants.
Boron was found at a low level in this water but would not give any cause for concern.

Metals Assessment
Iron and manganese are two problem elements that commonly occur in natural waters. These elements may cause unsightly stains and produce a brown/black precipitate. Iron is not toxic but manganese, at concentrations above 0.5 g/m^3, may adversely affect health. At concentrations below this it may cause stains on clothing and sanitary ware.

Iron was found in this water at a very high level.
Manganese was found in this water at a significant level.
Treatment to remove iron and/or manganese will be required.

Bacteriological Tests
The Drinking Water Standards for NZ state that there should be no Escherichia coli (E coli) in water used for human consumption. The presence of these organisms would indicate that other pathogens of faecal origin may be present.

The E coli result indicates that this water should be checked again ensuring the sample is collected into a sterile container and, if still high, the water should not be used for drinking without filtration or disinfection

Final Assessment
The parameters Turbidity, pH, Total Iron, Total Manganese and Escherichia coli did NOT meet the guidelines laid down in the 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022' and the 'Aesthetic Values for Drinking Water Notice 2022' issued by the Water Services Regulator ("Taumata Arowai") for water which is suitable for drinking purposes.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Routine Water Profile		-	1
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1
pH	pH meter. APHA 4500-H^+ B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) : Online Edition.	1.0 g/m^3 as $CaCO_3$	1
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO_2 D : Online Edition.	1.0 g/m^3 at 25°C	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	1 µS/cm	1
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m^3	1
Total Arsenic	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.0011 g/m^3	1
Total Boron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0053 g/m^3	1
Total Calcium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.053 g/m^3	1
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.00053 g/m^3	1
Total Iron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.021 g/m^3	1
Total Lead	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.00011 g/m^3	1
Total Magnesium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.021 g/m^3	1
Total Manganese	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.00053 g/m^3	1
Total Potassium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.053 g/m^3	1
Total Sodium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.021 g/m^3	1
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.0011 g/m^3	1
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m^3	1
Nitrate-N	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.05 g/m^3	1
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m^3	1
Escherichia coli	MPN count using Colilert 18 (Incubated at 35°C for 18 hours) and 97 wells. APHA 9223 B : Online Edition.	1 MPN / 100mL	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 24-Jan-2025 and 30-Jan-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

0508 HILL LAB (44 555 22)
+64 7 858 2000
mail@hill-labs.co.nz
www.hill-labs.co.nz

Certificate of Analysis

Client:	Drill Force New Zealand Limited	**Lab No:**	3769355	DWAPv1
Contact:	Manisha Patel	**Date Received:**	03-Feb-2025	
	C/- Drill Force New Zealand Limited	**Date Reported:**	07-Feb-2025	
	PO Box 72 335	**Quote No:**		
	Papakura 2244	**Order No:**	DF48511	
		Client Reference:	DF24WW104	
		Submitted By:	Manisha Patel	

Sample Type: Aqueous

		Sample Name:	BH42 Test Two 03-Feb-2025 12:00 pm	Aesthetic Values	Maximum Acceptable Values (MAV)
		Lab Number:	3769355.1		
Routine Water + E.coli profile Kit					
Escherichia coli	MPN / 100mL		6	-	< 1
Routine Water Profile					
Turbidity	NTU		111	≤ 5	-
pH	pH Units		9.2	7.0 - 8.5	-
Total Alkalinity	g/m³ as $CaCO_3$		220	-	-
Free Carbon Dioxide	g/m³ at 25°C		< 1.0	-	-
Total Hardness	g/m³ as $CaCO_3$		21	≤ 200	-
Electrical Conductivity (EC)	mS/m		49.6	-	-
Electrical Conductivity (EC)	µS/cm		496	-	-
Approx Total Dissolved Salts	g/m³		330	≤ 1000	-
Total Arsenic	g/m³		0.0038	-	0.01
Total Boron	g/m³		0.24	-	2.4
Total Calcium	g/m³		4.9	-	-
Total Copper	g/m³		0.0045	≤ 1	2
Total Iron	g/m³		5.0	≤ 0.3	-
Total Lead	g/m³		0.00170	-	0.01
Total Magnesium	g/m³		2.1	-	-
Total Manganese	g/m³		0.059	≤ 0.04 (Staining) ≤ 0.10 (Taste)	0.4
Total Potassium	g/m³		1.21	-	-
Total Sodium	g/m³		110	≤ 200	-
Total Zinc	g/m³		0.077	≤ 1.5	-
Chloride	g/m³		27	≤ 250	-
Nitrate-N	g/m³		< 0.05	-	11.3
Sulphate	g/m³		3.4	≤ 250	-

Note: The Maximum Acceptable Values (MAV) are taken from the 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022', published under the authority of the New Zealand Government-2022. Copies of this publication are available from: https://www.legislation.govt.nz/regulation/public/2022/0168/latest/whole.html

The standards set limits for the concentration of determinands in drinking water. The Maximum Acceptable Values (MAVs) for any determinand must not be exceeded at any time.

The Aesthetic Values are taken the publication, 'Aesthetic Values for Drinking Water Notice 2022' issued by the Water Services Regulator ("Taumata Arowai"). Aesthetic values specify or provide minimum or maximum values for substances and other characteristics that relate to the acceptability of drinking water to consumers (such as appearance, taste or odour).

Note that the units: g/m³ are the same as mg/L and ppm.

Routine Water Assessment for Sample No 3769355.1 - BH42 Test Two 03-Feb-2025

pH/Alkalinity and Corrosiveness Assessment
The pH of a water sample is a measure of its acidity or basicity. Waters with a low pH can be corrosive and those with a high pH can promote scale formation in pipes and hot water cylinders.
The guideline level for pH in drinking water is 7.0-8.5. Below this range the water will be corrosive and may cause problems with disinfection if such treatment is used.

The alkalinity of a water is a measure of its acid neutralising capacity and is usually related to the concentration of carbonate, bicarbonate and hydroxide. Low alkalinities (25 g/m^3) promote corrosion and high alkalinities can cause problems with scale formation in metal pipes and tanks.

With the pH and alkalinity levels found, it is unlikely this water will be corrosive towards metal piping and fixtures.
This water has an unusually high pH which could be indicative of contact with new concrete or cement or from alkaline cleaning agents. Water with such a high pH may have an unusual taste and a soapy feel.
The high alkalinity of this water may cause an increase in the pH in the root zones of plants which are irrigated using this water.

Hardness/Total Dissolved Salts Assessment
The water contains a moderate amount of dissolved solids and would be regarded as being very soft.

Nitrate Assessment
Nitrate-nitrogen at elevated levels is considered undesirable in natural waters as this element can cause a health disorder called methaemaglobinaemia. Very young infants (less than six months old) are especially vulnerable. The 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022' sets a maximum permissible level of 11.3 g/m^3 as Nitrate-nitrogen (50 g/m^3 as Nitrate).

Nitrate-nitrogen was not found in this water.

Sodium and Chloride Assessment
The high levels of sodium may be detrimental to certain plants (eg Sandersonia).

Boron Assessment
Boron may be present in natural waters and if present at high concentrations can be toxic to plants.
Boron was found at a low level in this water but would not give any cause for concern.

Metals Assessment
Iron and manganese are two problem elements that commonly occur in natural waters. These elements may cause unsightly stains and produce a brown/black precipitate. Iron is not toxic but manganese, at concentrations above 0.5 g/m^3, may adversely affect health. At concentrations below this it may cause stains on clothing and sanitary ware.

Iron was found in this water at a high level.
Manganese was found in this water at a significant level.
Treatment to remove iron and/or manganese will be required.

Bacteriological Tests
The Drinking Water Standards for NZ state that there should be no Escherichia coli (E coli) in water used for human consumption. The presence of these organisms would indicate that other pathogens of faecal origin may be present.

The E coli result indicates that this water should be checked again ensuring the sample is collected into a sterile container and, if still high, the water should not be used for drinking without filtration or disinfection

Final Assessment
The parameters Turbidity, pH, Total Iron, Total Manganese and Escherichia coli did NOT meet the guidelines laid down in the 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022' and the 'Aesthetic Values for Drinking Water Notice 2022' issued by the Water Services Regulator ("Taumata Arowai") for water which is suitable for drinking purposes.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Routine Water Profile		-	1
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1
pH	pH meter. APHA 4500-H^+ B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) : Online Edition.	1.0 g/m^3 as $CaCO_3$	1
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO_2 D : Online Edition.	1.0 g/m^3 at 25°C	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	1 µS/cm	1
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m^3	1
Total Arsenic	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.0011 g/m^3	1
Total Boron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0053 g/m^3	1
Total Calcium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.053 g/m^3	1
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.00053 g/m^3	1
Total Iron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.021 g/m^3	1
Total Lead	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.00011 g/m^3	1
Total Magnesium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.021 g/m^3	1
Total Manganese	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.00053 g/m^3	1
Total Potassium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.053 g/m^3	1
Total Sodium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.021 g/m^3	1
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.0011 g/m^3	1
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m^3	1
Nitrate-N	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.05 g/m^3	1
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m^3	1
Escherichia coli	MPN count using Colilert 18 (Incubated at 35°C for 18 hours) and 97 wells. APHA 9223 B : Online Edition.	1 MPN / 100mL	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 04-Feb-2025 and 07-Feb-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Kim Harrison MSc
Client Services Manager - Environmental

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

0508 HILL LAB (44 555 22)
+64 7 858 2000
mail@hill-labs.co.nz
www.hill-labs.co.nz

Certificate of Analysis

Client:	Drill Force New Zealand Limited	**Lab No:**	3754821	DWAPv1
Contact:	Manisha Patel	**Date Received:**	14-Jan-2025	
	C/- Drill Force New Zealand Limited	**Date Reported:**	20-Jan-2025	
	PO Box 72 335	**Quote No:**		
	Papakura 2244	**Order No:**	DF48505	
		Client Reference:	DF24WW104	
		Submitted By:	Manisha Patel	

Sample Type: Aqueous

		Sample Name:	BH54 Test one 14-Jan-2025 2:00 pm	**Aesthetic Values**	**Maximum Acceptable Values (MAV)**
		Lab Number:	3754821.1		
Routine Water + E.coli profile Kit					
Escherichia coli	MPN / 100mL		36 #1	-	< 1
Routine Water Profile					
Turbidity	NTU		57	≤ 5	-
pH	pH Units		8.8	7.0 - 8.5	-
Total Alkalinity	g/m³ as $CaCO_3$		184	-	-
Free Carbon Dioxide	g/m³ at 25°C		< 1.0	-	-
Total Hardness	g/m³ as $CaCO_3$		40	≤ 200	-
Electrical Conductivity (EC)	mS/m		43.7	-	-
Electrical Conductivity (EC)	µS/cm		437	-	-
Approx Total Dissolved Salts	g/m³		290	≤ 1000	-
Total Arsenic	g/m³		0.0016	-	0.01
Total Boron	g/m³		0.070	-	2.4
Total Calcium	g/m³		12.2	-	-
Total Copper	g/m³		0.0035	≤ 1	2
Total Iron	g/m³		4.0	≤ 0.3	-
Total Lead	g/m³		0.00142	-	0.01
Total Magnesium	g/m³		2.3	-	-
Total Manganese	g/m³		0.061	≤ 0.04 (Staining) ≤ 0.10 (Taste)	0.4
Total Potassium	g/m³		1.65	-	-
Total Sodium	g/m³		96	≤ 200	-
Total Zinc	g/m³		0.140	≤ 1.5	-
Chloride	g/m³		33	≤ 250	-
Nitrate-N	g/m³		< 0.05	-	11.3
Sulphate	g/m³		3.9	≤ 250	-

Note: The Maximum Acceptable Values (MAV) are taken from the 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022', published under the authority of the New Zealand Government-2022. Copies of this publication are available from: https://www.legislation.govt.nz/regulation/public/2022/0168/latest/whole.html

The standards set limits for the concentration of determinands in drinking water. The Maximum Acceptable Values (MAVs) for any determinand must not be exceeded at any time.

The Aesthetic Values are taken the publication, 'Aesthetic Values for Drinking Water Notice 2022' issued by the Water Services Regulator ("Taumata Arowai"). Aesthetic values specify or provide minimum or maximum values for substances and other characteristics that relate to the acceptability of drinking water to consumers (such as appearance, taste or odour).

Note that the units: g/m³ are the same as mg/L and ppm.

Analyst's Comments

#1 Please interpret this result with caution as the sample was > 10 °C on receipt at the lab. The sample temperature is recommended by the laboratory's reference methods to be less than 10 °C on receipt at the laboratory (but not frozen). However, it is acknowledged that samples that are transported quickly to the laboratory after sampling, may not have been cooled to this temperature.

Routine Water Assessment for Sample No 3754821.1 - BH54 Test one 14-Jan-2025 2:00

pH/Alkalinity and Corrosiveness Assessment
The pH of a water sample is a measure of its acidity or basicity. Waters with a low pH can be corrosive and those with a high pH can promote scale formation in pipes and hot water cylinders.
The guideline level for pH in drinking water is 7.0-8.5. Below this range the water will be corrosive and may cause problems with disinfection if such treatment is used.

The alkalinity of a water is a measure of its acid neutralising capacity and is usually related to the concentration of carbonate, bicarbonate and hydroxide. Low alkalinities (25 g/m^3) promote corrosion and high alkalinities can cause problems with scale formation in metal pipes and tanks.

With the pH and alkalinity levels found, it is unlikely this water will be corrosive towards metal piping and fixtures.
This water has an unusually high pH which could be indicative of contact with new concrete or cement or from alkaline cleaning agents. Water with such a high pH may have an unusual taste and a soapy feel.
The high alkalinity of this water may cause an increase in the pH in the root zones of plants which are irrigated using this water.

Hardness/Total Dissolved Salts Assessment
The water contains a moderate amount of dissolved solids and would be regarded as being soft.

Nitrate Assessment
Nitrate-nitrogen at elevated levels is considered undesirable in natural waters as this element can cause a health disorder called methaemaglobinaemia. Very young infants (less than six months old) are especially vulnerable. The 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022' sets a maximum permissible level of 11.3 g/m^3 as Nitrate-nitrogen (50 g/m^3 as Nitrate).

Nitrate-nitrogen was not found in this water.

Boron Assessment
Boron may be present in natural waters and if present at high concentrations can be toxic to plants.
Boron was found at a low level in this water but would not give any cause for concern.

Metals Assessment
Iron and manganese are two problem elements that commonly occur in natural waters. These elements may cause unsightly stains and produce a brown/black precipitate. Iron is not toxic but manganese, at concentrations above 0.5 g/m^3, may adversely affect health. At concentrations below this it may cause stains on clothing and sanitary ware.

Iron was found in this water at a high level.
Manganese was found in this water at a significant level.
Treatment to remove iron and/or manganese will be required.

Bacteriological Tests
The Drinking Water Standards for NZ state that there should be no Escherichia coli (E coli) in water used for human consumption. The presence of these organisms would indicate that other pathogens of faecal origin may be present.

The E coli result indicates that this water should be checked again ensuring the sample is collected into a sterile container and, if still high, the water should not be used for drinking without filtration or disinfection

Final Assessment
The parameters Turbidity, pH, Total Iron, Total Manganese and Escherichia coli did NOT meet the guidelines laid down in the 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022' and the 'Aesthetic Values for Drinking Water Notice 2022' issued by the Water Services Regulator ("Taumata Arowai") for water which is suitable for drinking purposes.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Routine Water Profile		-	1
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1
pH	pH meter. APHA 4500-H^+ B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) : Online Edition.	1.0 g/m^3 as $CaCO_3$	1
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO_2 D : Online Edition.	1.0 g/m^3 at 25°C	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	1 µS/cm	1
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m^3	1
Total Arsenic	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.0011 g/m^3	1
Total Boron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0053 g/m^3	1
Total Calcium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.053 g/m^3	1
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.00053 g/m^3	1
Total Iron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.021 g/m^3	1
Total Lead	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.00011 g/m^3	1
Total Magnesium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.021 g/m^3	1
Total Manganese	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.00053 g/m^3	1
Total Potassium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.053 g/m^3	1
Total Sodium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.021 g/m^3	1
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.0011 g/m^3	1
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m^3	1
Nitrate-N	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.05 g/m^3	1
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m^3	1
Escherichia coli	MPN count using Colilert 18 (Incubated at 35°C for 18 hours) and 97 wells. APHA 9223 B : Online Edition.	1 MPN / 100mL	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 15-Jan-2025 and 20-Jan-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Ara Heron BSc (Tech)
Client Services Manager - Environmental

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

0508 HILL LAB (44 555 22)
+64 7 858 2000
mail@hill-labs.co.nz
www.hill-labs.co.nz

Certificate of Analysis

Client:	Drill Force New Zealand Limited	**Lab No:**	3756918	DWAPv1
Contact:	Manisha Patel	**Date Received:**	16-Jan-2025	
	C/- Drill Force New Zealand Limited	**Date Reported:**	23-Jan-2025	
	PO Box 72 335	**Quote No:**		
	Papakura 2244	**Order No:**	DF48506	
		Client Reference:	DF24WW104	
		Submitted By:	Manisha Patel	

Sample Type: Aqueous

		Sample Name:	BH54 Test Two 16-Jan-2025 3:30 pm	Aesthetic Values	Maximum Acceptable Values (MAV)
		Lab Number:	3756918.1		
Routine Water + E.coli profile Kit					
Escherichia coli	MPN / 100mL		6	-	< 1
Routine Water Profile					
Turbidity	NTU		8.4	≤ 5	-
pH	pH Units		8.9	7.0 - 8.5	-
Total Alkalinity	g/m³ as $CaCO_3$		210	-	-
Free Carbon Dioxide	g/m³ at 25°C		< 1.0	-	-
Total Hardness	g/m³ as $CaCO_3$		20	≤ 200	-
Electrical Conductivity (EC)	mS/m		71.4	-	-
Electrical Conductivity (EC)	µS/cm		714	-	-
Approx Total Dissolved Salts	g/m³		480	≤ 1000	-
Total Arsenic	g/m³		0.0015	-	0.01
Total Boron	g/m³		0.34	-	2.4
Total Calcium	g/m³		6.6	-	-
Total Copper	g/m³		0.00078	≤ 1	2
Total Iron	g/m³		0.58	≤ 0.3	-
Total Lead	g/m³		0.00043	-	0.01
Total Magnesium	g/m³		0.89	-	-
Total Manganese	g/m³		0.0132	≤ 0.04 (Staining) ≤ 0.10 (Taste)	0.4
Total Potassium	g/m³		1.24	-	-
Total Sodium	g/m³		141	≤ 200	-
Total Zinc	g/m³		0.029	≤ 1.5	-
Chloride	g/m³		101	≤ 250	-
Nitrate-N	g/m³		< 0.05	-	11.3
Sulphate	g/m³		2.5	≤ 250	-

Note: The Maximum Acceptable Values (MAV) are taken from the 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022', published under the authority of the New Zealand Government-2022. Copies of this publication are available from: https://www.legislation.govt.nz/regulation/public/2022/0168/latest/whole.html

The standards set limits for the concentration of determinands in drinking water. The Maximum Acceptable Values (MAVs) for any determinand must not be exceeded at any time.

The Aesthetic Values are taken the publication, 'Aesthetic Values for Drinking Water Notice 2022' issued by the Water Services Regulator ("Taumata Arowai"). Aesthetic values specify or provide minimum or maximum values for substances and other characteristics that relate to the acceptability of drinking water to consumers (such as appearance, taste or odour).

Note that the units: g/m³ are the same as mg/L and ppm.

Routine Water Assessment for Sample No 3756918.1 - BH54 Test Two 16-Jan-2025 3:30

pH/Alkalinity and Corrosiveness Assessment
The pH of a water sample is a measure of its acidity or basicity. Waters with a low pH can be corrosive and those with a high pH can promote scale formation in pipes and hot water cylinders.
The guideline level for pH in drinking water is 7.0-8.5. Below this range the water will be corrosive and may cause problems with disinfection if such treatment is used.

The alkalinity of a water is a measure of its acid neutralising capacity and is usually related to the concentration of carbonate, bicarbonate and hydroxide. Low alkalinities (25 g/m^3) promote corrosion and high alkalinities can cause problems with scale formation in metal pipes and tanks.

With the pH and alkalinity levels found, it is unlikely this water will be corrosive towards metal piping and fixtures.
This water has an unusually high pH which could be indicative of contact with new concrete or cement or from alkaline cleaning agents. Water with such a high pH may have an unusual taste and a soapy feel.
The high alkalinity of this water may cause an increase in the pH in the root zones of plants which are irrigated using this water.

Hardness/Total Dissolved Salts Assessment
The water contains a moderate amount of dissolved solids and would be regarded as being very soft.

Nitrate Assessment
Nitrate-nitrogen at elevated levels is considered undesirable in natural waters as this element can cause a health disorder called methaemaglobinaemia. Very young infants (less than six months old) are especially vulnerable. The 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022' sets a maximum permissible level of 11.3 g/m^3 as Nitrate-nitrogen (50 g/m^3 as Nitrate).

Nitrate-nitrogen was not found in this water.

Sodium and Chloride Assessment
The high levels of sodium may be detrimental to certain plants (eg Sandersonia).
Chloride levels above 100 may cause irrigation problems with sensitive plants, especially with overhead sprinkler systems.

Boron Assessment
Boron may be present in natural waters and if present at high concentrations can be toxic to plants.
Boron was found at a low level in this water but would not give any cause for concern.

Metals Assessment
Iron and manganese are two problem elements that commonly occur in natural waters. These elements may cause unsightly stains and produce a brown/black precipitate. Iron is not toxic but manganese, at concentrations above 0.5 g/m^3, may adversely affect health. At concentrations below this it may cause stains on clothing and sanitary ware.

Iron was found in this water at a significant level.
Manganese was found in this water at a low level.
Treatment to remove iron and/or manganese will be required.

Bacteriological Tests
The Drinking Water Standards for NZ state that there should be no Escherichia coli (E coli) in water used for human consumption. The presence of these organisms would indicate that other pathogens of faecal origin may be present.

The E coli result indicates that this water should be checked again ensuring the sample is collected into a sterile container and, if still high, the water should not be used for drinking without filtration or disinfection

Final Assessment
The parameters Turbidity, pH, Total Iron and Escherichia coli did NOT meet the guidelines laid down in the 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022' and the 'Aesthetic Values for Drinking Water Notice 2022' issued by the Water Services Regulator ("Taumata Arowai") for water which is suitable for drinking purposes.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Routine Water Profile		-	1
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1
pH	pH meter. APHA 4500-H^+ B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) : Online Edition.	1.0 g/m^3 as $CaCO_3$	1
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO_2 D : Online Edition.	1.0 g/m^3 at 25°C	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	1 µS/cm	1
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m^3	1
Total Arsenic	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.0011 g/m^3	1
Total Boron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0053 g/m^3	1
Total Calcium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.053 g/m^3	1
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.00053 g/m^3	1
Total Iron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.021 g/m^3	1
Total Lead	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.00011 g/m^3	1
Total Magnesium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.021 g/m^3	1
Total Manganese	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.00053 g/m^3	1
Total Potassium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.053 g/m^3	1
Total Sodium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.021 g/m^3	1
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition / US EPA 200.8.	0.0011 g/m^3	1
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m^3	1
Nitrate-N	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.05 g/m^3	1
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m^3	1
Escherichia coli	MPN count using Colilert 18 (Incubated at 35°C for 18 hours) and 97 wells. APHA 9223 B : Online Edition.	1 MPN / 100mL	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 17-Jan-2025 and 22-Jan-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Ara Heron BSc (Tech)
Client Services Manager - Environmental