Report

Monitoring Plan and Evaluation of Surface and Groundwater Effects

Green Steel Monofill, Hampton Downs

61 Hampton Downs Road, Hampton Downs, Waikato

Prepared for National Green Steel Limited

Prepared by Earthtech Consulting Limited

9 June 2025

Reference: R4424-6

EARTHTECH

Document Control

Monofill Monitoring Plan and Evaluation of Surface and Groundwater Effects

Green Steel Monofill

61 Hampton Downs Road, Hampton Downs, Waikato

Client: National Green Steel Limited

Author: Lindsay Strachan, Senior Engineer, CMEngNZ, CPEng
lindsay.strachan@earthtech.co.nz

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

Document Control			
Reference	Revision	Date	Status
R4424-6	0	14/03/2025	Draft - For Client Review
R4424-6	A	30/05/2025	Final
R4424-6	B	09/06/2025	Final

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Green Steel Monofill

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1. Introduction

This plan outlines the monitoring schedules for the sampling and testing regime for the proposed Green Steel Monofill sites known as the southwest (SW) and the northeast (NE) sites. The monofill sites are to receive a single waste type only, this being the residual floc material derived from the metals resource recovery process – referred to as "floc". No other waste type is to be disposed into the proposed monofills. Slag waste, derived from the steel smelting processes, is to be treated on site (recovered and recycled into aggregate) and excess slag will be disposed to landfill. The locations of the monofill sites are shown in Figures M1.2 and M2.1, which are attached. The proposed monitoring borehole locations are shown in Figure M1.3. This plan addresses only the SW site; however, similar circumstances and procedures are applicable for the NE site.

This plan also includes an evaluation of the effects for the monofill. The evaluation considers the SW site, which is sizably larger in area and volume and located closer to the property boundary and the Waipapa Stream (which runs along the site boundary). No leakage through the liner is anticipated with the Class 1 liner and engineering design approach applied. The subsoil drains will provide an effective precautionary leachate leakage detection system under the lining system.

It is noted that the potential liner leakage volume calculated and provided in this plan (i.e. 2.2*ℓ/day*) is a theoretical value applied to evaluate potential environmental effects. The calculation approach is adopted by most landfill design engineers in New Zealand and sourced from key available literature, i.e. Giroud and Bonaparte (1989), Giroud et al. (1994), Bonaparte et al. (1996), Rowe (1997) and Foose et al. (2002). The approach is based on assumptions that liner defects may occur during installation and construction. It is crucial that the Quality Control Plan (QCP) attached to the Engineering Report be strictly adopted to minimise the risk of any liner defects.

In summary, this plan addresses:

i. The Monofill physical characteristics and testing methodology
ii. The Monofill leachate characteristics
iii. Surface water effects and monitoring details
iv. Groundwater effects and monitoring details
v. Air discharge effects and monitoring details

2. Physical Characteristics of the Monofill

2.1 Characteristics of the Monofill Floc

Monofill floc material is derived largely from the processing of end-of-life vehicles (ELVs), as shown in Figure A, together with minor amounts of whiteware metals such as fridges, stoves and washing machines. All fuels, coolants and oils are drained prior to processing through a heavy-duty hammermill, resulting in a finely shredded mix of metals, plastics, rubber and leather. This mix is passed along a conveyor system which systematically removes the different metals into separate bins for recycling. What is left is a lightweight "floc". This builds up into a pile of floc on top of a concrete slab at the discharge end of the conveyor, illustrated in Figure B. The floc is loaded into trucks and delivered to a Municipal Solid Waste Landfill (Hampton Downs and/or other selected landfill), where it is mixed in with the general waste.

The floc is recognised as a potentially valuable energy source and could be reused and recycled as a fuel source to produce thermal or electrical energy. Economic circularity of this floc resource is an opportunity yet to be explored in New Zealand since no such facility or technology (at full scale) currently exists in the country. In order to "close the loop" by inserting this resource back into a circular economy, a monofill storage facility is proposed to build a large reservoir of floc material for possible reuse. A shredder facility is to be installed and operated on the new Green Steel site, and the recovered residue floc (resource) is to be placed directly in the monofill site on the same site.

Figure A: End of Life Vehicles (ELV) prepared and stored for shredding at National Green Steel's current processing and recovery plant in Manukau, Auckland.

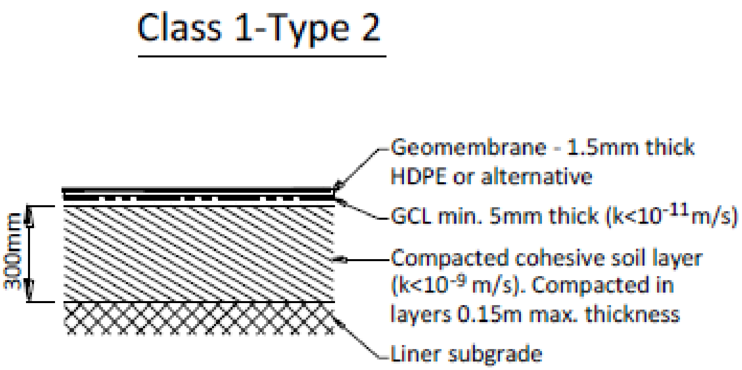
The floc has minimal smell or vapours and produces little, if any, leachate while stored in the open for short periods at the Manukau processing plant. The floc can be handled with conventional earthmoving plant. It can be stored by placing it in a lined storage landfill to depths of 3*m* to 4*m*, covering with a soil cover layer and ultimately a final soil cap and vegetation layer. Reusing the floc would reverse the process and allow the floc to be recovered and transported to a processing plant.

The monofill site could then be reused (allowing the power station to be fired up only when sufficient floc is available) or removed, and the land returned to a suitable end use.

Figure B: Recovered floc material, post shredding, stockpiled at National Green Steel's processing and recovery plant in Manukau, Auckland.

2.2 Characteristics of the Engineered Monofill

The Engineering Report provides information and details on the characteristics of the engineered monofill sites within the Green Steel project site. Of specific mention - the monofill will include a Class 1 base liner (ref. item 5.6 Technical Guidelines; WasteMINZ, 2023) – as defined by the nature of the waste stream (non-putrescible industrial). The site owner has opted to install a Class 1 (Type 2) liner, albeit a Class 2 liner system would suffice for this waste type. A Class 1 liner will suitably contain (and collect) leachate emissions and minimise potential leakage. Strategically located leachate drainage is also constructed on top of the liner. Figure C below shows the engineered Class 1 liner of the Green Steel Monofill sites and the example provided in the current WasteMINZ guideline.



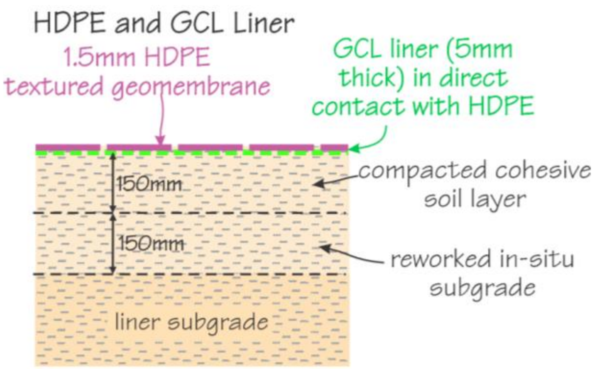


Figure C: Class 1 Monofill Liner. (Above right) the engineered liner system applied to the Green Steel Monofill, and (above left) the WasteMINZ guideline example (source: WasteMINZ 2023)

An engineered subsoil drainage system will be provided below the base liner in each valley (Figure M5.5). This also provides an appropriate leakage detection system for the site, as the outlets can be continuously monitored. The subsoil drains extend beneath the compacted engineered fill for the toe embankments to a monitoring manhole on the downstream side, detailed in the Engineering Report.

Subsoil water discharge from the southwest monofill will then be directed into a stormwater channel flowing into the stormwater retention pond (SRP). Subsoil water discharge from the northeast monofill is to continue discharge to the existing receiving environment with the option of active extraction by pumping and removal.

3. Leachate Characteristics of the Monofill Floc

3.1 Laboratory Scale Testing

An early study entitled 'Characterisation testing of shredding wastes' by Tonkin and Taylor (2019), attached to the Engineering Report for reference, carried out two leaching tests on samples of the material, namely an SPLP (Synthetic Precipitation Leaching Procedure) and a TCLP (Toxicity Characteristic Leaching Procedure) test. The latter (TCLP) test is arguably more relevant to a landfilled waste body containing biodegradable organics (i.e. a Municipal Solid Waste (MSW) type landfill), and the former SPLP test is more relevant simulating normal atmospheric conditions for a monofill located on the Green Steel site. Each laboratory test procedure involved testing three 50*g* samples collected from the floc stockpile. Tonkin and Taylor (2019) presented results for the six tests, and key parameters are presented in the Engineering Report.

Tonkin and Taylor (2019) concluded that there were levels of concern with specific parameters, notably zinc and ethylene glycol. Other parameters of concern in the TCLP test were elevated levels of zinc, nickel and lead. All these parameters were considered for the larger pilot-scale waste lysimeter leaching trials.

3.2 Pilot Plant Waste Lysimeter Testing

The waste lysimeter trials were conducted to determine the leachate quality characteristics that leach through a depth of representative floc waste material under rainfall conditions equivalent to the actual monofill site.

Initial sampling from the waste lysimeter provided results that were comparable to those obtained by Tonkin and Taylor (2019), except for ethylene glycol. The latter results were distinctly lower throughout the trials. The representative wastes in the lysimeter were obtained off-conveyor during several hours of production and from the stockpile in the yard where quartering techniques were employed. Zinc levels were comparably higher, whilst lead and nickel levels were similar across the combined range of analytical results of samples from the lysimeter.

Testing for Per- and Polyfluoroalkyl Substances (PFAS) levels was additionally conducted. Results from samples showed to be below recreational water quality levels as well as levels reported in the

Ecological Freshwater Guideline PFAS Management Plan HEPA (PFAS Management Plan: Heads of EPA's Australian and New Zealand (HEPA), January 2018) (PDP, 2019). PFAS levels during Stage 2, i.e. longer-term leaching conditions, were displayed to be only at traceable concentration levels <0.1$\mu g/\ell$.

3.3 Monofill Leachate Quality Predictions

Leachate quality findings are presented in Table 1 below for a high-strength monofill leachate (i.e. higher average leachate quality values encountered) and long-term leaching strength.

Table 1: Leachate Quality Predictions from National Green Steel's Monofill

Leachate Quality Predictions*						
Leachate Quality Parameter	**Units**	**Long Term Leaching Strength**	**High Strength Monofill Leachate**	**ANZG (2018) DGV[1] 80% Species Protection**	**ANZG (2018) DGV[2] 95% Species Protection**	**NZ Drinking Water Standard (2022)**
pH	-	>7.0 <7.8	7.0 to 7.1	-	-	-
PFAS	$\mu g/\ell$	<0.1	0.700	-	-	0.63
Boron	mg/ℓ	0.6	**1.9**	2.5	0.94	2.4
Chromium (Cr)	mg/ℓ	<0.1	**1.00**	0.04	0.001	0.05
Copper (Cu)	mg/ℓ	<0.1	**0.3**	0.0025	0.0017	2
Iron	mg/ℓ	<0.1	0.5	-	-	-
Lead (Pb)	mg/ℓ	<0.1	**0.3**	0.0094	0.0044	0.01
Manganese (Mn)	mg/ℓ	0.1	2.0	3.6	1.9	0.4
Nickel (Ni)	mg/ℓ	<0.1	**0.4**	0.017	0.011	0.08
Zinc (Zn)	mg/ℓ	<0.1	**2.8**	0.031	0.0096	1.5
Ethylene glycol	mg/ℓ	<20	<20	-	-	-
Chemical Oxygen Demand (COD)	mg/ℓ	<100	<100	-	-	-
*based on lysimeter trials set up on 27/01/2021						
Notes: 1. Default Guideline Value Freshwater Guideline - 80% Species Protection 2. Default Guideline Value Freshwater Guideline - 95% Species Protection 3. Bold denotes exceedance of ANZG (2018) DGVs						

As there is currently no monofill operating in New Zealand, the predicted quality of the anticipated leachate has been based on the laboratory and pilot scale test results and typical infiltration rates for rainfall effects on Municipal Solid Waste (MSW) landfills which are built in a similar manner with thick layers of MSW waste covered by intermediate soil cover and a final, long term capping layer.

Typical MSW landfills return leachate flows as a percentage of annual rainfall, provided in Table 2 as follows:

Table 2: Estimated leachate flows as a percentage of annual rainfall

Operational Area	Intermediate Cover Area	Final Cap Area
20%	12%	7%

Leachate flow rates are highly sensitive to major storm events and the type of cover at the time of the event. Plastic and/or heavy-duty canvas tarpaulins may be used in specific areas where soil cover is difficult to place. Using an annual rainfall at the site of 1,400*mm/year*, the leachate flow rates have been estimated, as shown in Table 3.

Table 3: Leachate production best estimates calculated on a high-end (1.4*m*) of annual average rainfall

Monofill Stage	Total Area	Unit	Operational 20% Area (ha)	Volume (m^3/day)	Intermediate Cover 12% Area (ha)	Volume (m^3/day)	Final Cover 7% Area (ha)	Volume (m^3/day)	Total Est. Leachate Production (m^3/day)
Stage 1a (SW Monofill)	50 x 100 Area =								
	5,000	m^2							
	0.5	*ha*	0.5	3.8	-	0	-	0	**3.8**
Stages 1 & 2 (SW Monofill)	27,000	m^2							
	2.7	*ha*	0.5	3.8	1.2	5.5	1.0	2.7	**12.0**
Stages 3 & 4 (SW Monofill)	2.7 +1.45 =								
	4.15	*ha*	0.5	3.8	1.55	7.1	2.1	5.6	**16.6**
Stages 1 & 2 (NE Monofill)	0.5 + 1.54 =								
	2.04	*ha*	0.5	3.8	1.04	4.8	0.5	1.3	**10.0**
Long Term (All Monofill Stages)	6.2	*ha*	0	0.0	0	0.0	6.2	16.7	**16.7**

The above estimates should be interpreted with caution, taking into account unforeseen events (such as heavy rainfall and maximum operational area). Seasonal influence can be very strong, with higher flows in winter (June to November) and lower flows in summer. Extreme out-of-season storm events can be anticipated in modern climatic changing times.
The site should be designed to accommodate the following leachate flows:

- Year 1 – 6m^3/day with peak of 12m^3/day over three days
- Year 5 – 14m^3/day with peak of 20m^3/day over three days
- Year 10 – 20m^3/day with peak of 25m^3/day over three days
  Long-term flow rate estimate at 15 to 17m^3/day

The emergency leachate storage system entails closing the outlet valves and storing leachate at the base of each monofill stage. This option would be for emergency situations only and only used for exceptional rainfall events.

As the monofill increases in size, the buffering capacity of the site increases, and daily averages should be more accurate. At the start of filling, Stage 1a is operational over 0.5ha and exposed to a single heavy rainfall event. In this situation, it is standard practice to complete the Stage 1a liner area and to then provide temporary baffles to deflect clean stormwater runoff from lined areas that are not yet covered.

3.4 Leachate Management and Disposal

The leachate quality is expected to mirror the results obtained in the lysimeter trials. Predicted leachate quality concentrations for parameters of particular concern are provided in Table 1. The leachate higher strengths relate to averaged peaks in quality during the initial flush conditions when new floc is placed on the site and the expected strength in the longer term.

During the early operational phase of the monofill, leachate volumes from the waste body are to be stored in on-site leachate tanks. The leachate will then be transferred to road tankers and taken off-site for disposal at a wastewater treatment plant (WWTP). After several months of filling, the leachate flow rate and strength will be attenuated by percolation through the floc matrix, and leachate quality will stabilise from the early quality concentrations that will be encountered. With the onset of stable leachate quality concentrations, an on-site treatment system can be considered. Note: any on-site treatment system will require the appropriate consent, and these are not part of the current application. This application relies on leachate capture, temporary storage in tanks and then transportation off-site by tanker truck for treatment.

4. Monofill Environmental Monitoring

4.1 Overview

The management of emissions from the monofill waste body is to be strictly controlled with the aim of minimising potential discharge to the receiving environment, with the closest point being adjacent to the southwest monofill. The Waipapa Stream runs along the outer southern and western boundary of the Green Steel site. Discharge management is focused on limiting rainfall or stormwater ingress into the monofill to reduce the volume of leachate produced.

This Monitoring Plan is recommended for the first year of operation under the new consent and may be revised following the results of the first year of operation.

4.2 Air Quality Monitoring

Monofill daily management will ensure there shall be no discharge of airborne particulate matter that is objectionable to the extent that it causes an adverse effect at or beyond the boundary of the site. Dust suppression of access roads to the disposal area, typically by water tanker, is to be carried out regularly.

No landfill gas emissions are anticipated from the landfill; however, surface emission monitoring checks on the site can be conducted if such a concern is raised in the future.

4.3 Surface Water Monitoring

Surface water sampling, i.e. of rainwater/stormwater and/or stored water in ponds, will be undertaken according to the details in Table 4 and the following:

- Samples will be collected as grab samples in laboratory-supplied containers.
- Chain-of-custody documentation will be completed for all samples.
- Samples will be kept in cooler boxes (on ice) and dispatched to the laboratory within one day of collection.
- All sample analyses will be undertaken in accordance with “Standard Methods for the Examination of Water and Waste Water, APHA 2012” or the current acceptable equivalent method.

Proposed surface water sampling locations are shown in Figures D and E in section 5, for the southwestern and northeastern monofill sites respectively.

Table 4: Surface Water Sampling Requirements

Location	Frequency	Parameters	Laboratory Detection Limit	Trigger Value[1]
			(mg/l)	(mg/l)
Lowest sediment retention pond (SRP)	Following significant rainfall events	Ph		-
		Total Hardness		-
		Dissolved Total Organic Carbon[2]		-
		EC		-
		COD		-
		Suspended Solids		-
		Dissolved boron		2.5
		Dissolved chromium		0.04
		Dissolved copper		0.0025[2]
		Dissolved nickel		0.017
		Dissolved zinc		0.031

[1] The trigger values are based on the ANZECC (2000) and ANZECC (2018) Default Guideline Values for 80% protection of freshwater species.

[2] Copper DGVs to be modified for DOC.

4.4 Leachate Monitoring

Annual sampling and analytical testing of the leachate is to be conducted for a *full suite* of parameters provided in Table 5 below.

Table 5: Leachate Sampling Requirements and Predicted Leachate Quality (Annual *Full Suite*)

Leachate Quality Parameter	Units	Predicted Monofill Leachate Quality
pH	-	7.0 to 7.1
PFAS	*µg/l*	<0.1 to 0.700
Boron	*mg/l*	0.6 to 1.9
Chromium (Cr)	*mg/l*	<0.1 to 1.00
Copper (Cu)	*mg/l*	<0.1 to 0.3
Iron	*mg/l*	<0.1 to 0.5
Lead (Pb)	*mg/l*	<0.1 to 0.3
Manganese (Mn)	*mg/l*	0.1 to 2.0
Nickel (Ni)	*mg/l*	<0.1 to 0.4
Zinc (Zn)	*mg/l*	<0.1 to 2.8
Ethylene glycol	*mg/l*	<20
Chemical Oxygen Demand (COD)	*mg/l*	<1000

4.5 Subsoil Water Monitoring

The subsoil drain below the lining system serves as an instrumental leachate leakage detection system below the landfill. The drain may rarely achieve a steady flow and is likely to be seasonal. Sampling of the water from this drain is to be carried out when flow is noticed, or if flow is regular, at three-monthly intervals (i.e. quarterly). If, in the latter case, water flow from the subsoil drain becomes regular, then monitoring of water quality will be carried out after one week following significant rainfall events.

4.6 Groundwater Monitoring

Three (3) proposed groundwater monitoring bores are to be used for groundwater monitoring, shown in Figure M1.3. Groundwater sampling will be undertaken according to the details in Table 6 and the following:

- The water level (static water level) will be measured from the top of casing before each sampling occasion.
- Samples will be collected with disposable groundwater bailers and placed in laboratory-supplied containers.
- Before sampling, a minimum of three casing volumes of water will be removed from the borehole. Alternatively, temperature, conductivity (EC) and pH measurements will be monitored, and sampling undertaken once these parameters have stabilised.
- Samples to be analysed for dissolved constituents will be field-filtered whenever practicable.
- Chain-of-custody documentation will be completed for all samples.
- Samples will be kept on ice (cooler bins) and dispatched to the laboratory within one day of collection.
- All sample analyses will be undertaken in accordance with "Standard Methods for the Examination of Water and Waste Water, APHA 2012".
- Sampling and testing of half-yearly groundwater samples (refer Table 4) is to be conducted by Green Steel staff on-site or own laboratory.
- Sampling and testing of biennial groundwater samples (from all monitoring bores listed in Table 6) is to be conducted by an independent groundwater specialist.
- In the case of biennial groundwater monitoring data differing by more than two standard deviations (2SD), then monitoring of the parameter in the particular bore must be changed to an agreed sampling frequency.

Table 6: Groundwater Sampling Requirements

Location	Frequency	Parameters	Laboratory Detection Limit (mg/l)	Trigger Value[1] (mg/l)
Bores MBA, MBB and MBC	Half-yearly (August and March month)	pH	-	-
		Total Hardness	*mg/l (as $CaCO_3$)*	-
		Dissolved Total Organic Carbon	*mg/l*	-
		EC (Electrical Conductivity)	*mS/m*	-
		Dissolved boron	*mg/l*	2.5
		Dissolved chromium	*mg/l*	0.04
		Dissolved copper	*mg/l*	0.0025
		Dissolved nickel	*mg/l*	0.017
		Dissolved lead	*mg/l*	0.0094
		Dissolved zinc	*mg/l*	0.031
Bores MBA, MBB and MBC	Biennially	COD	*mg/l*	-
		Alk (Alkalinity)	*mg/l (as $CaCO_3$)*	-
		Ammoniacal-Nitrogen	*mg/l*	2.18
		Sodium	*mg/l*	-
		Sulphate	*mg/l*	-
		Chloride	*mg/l*	-
		Reactive silica	*mg/l*	-
		Dissolved arsenic	*mg/l*	0.36
		Dissolved boron	*mg/l*	2.5
		Dissolved cadmium	*mg/l*	0.0008
		Dissolved chromium	*mg/l*	0.040
		Dissolved copper	*mg/l*	0.0025
		Dissolved and total iron	*mg/l*	-
		Dissolved lead	*mg/l*	0.0094
		Dissolved and total manganese	*mg/l*	3.6
		Dissolved mercury	*mg/l*	0,001
		Dissolved nickel	*mg/l*	0.017
		Dissolved zinc	*mg/l*	0.031
		Ethylene glycol	*mg/l*	tbd
		PFAS	*µg/l*	tbd

[1] The trigger values are based on the ANZECC (2000) and ANZECC (2018) Default Guideline Values for 80% protection of freshwater species.

5. Surface Water Runoff and Effects

5.1 Surface Water Diversions and Controls

The southwest monofill site is located on a broad ridge line which will be cut down to the proposed design level to form a gently sloping subgrade surface. The Engineering Report drawings show the liner subgrade and surrounding cut and fill slopes, and the plan and section details are shown in Figures M2.1 and M4.2, respectively. The monofill operation involves the placement of floc material comprising shaping, grading and compacting, and regular covering with soil layers or alternative methods, e.g. heavy-duty synthetic sheets. Cover soil types include operational, intermediate and final capping cover over the placed floc.

Extensive stormwater and sediment control features are proposed, including diversion bunds, cutoff channels, and sediment control ponds, as shown in Figure M5.7 and the Engineering Report drawings. Figure D below, extracted from Figure M5.7, illustrates the proposed surface runoff diversions and controls. These will isolate the monofill footprint from surface runoff and ensure that only direct rainfall on the site contributes to the leachate flow from the base of the site. Subsoil drainage waters will be collected in a monitoring chamber and *daylighted* to flow around the monofill through a dedicated channel, as shown in Figure M5.5. Figure E below shows the surface water sampling location for the northeastern monofill.

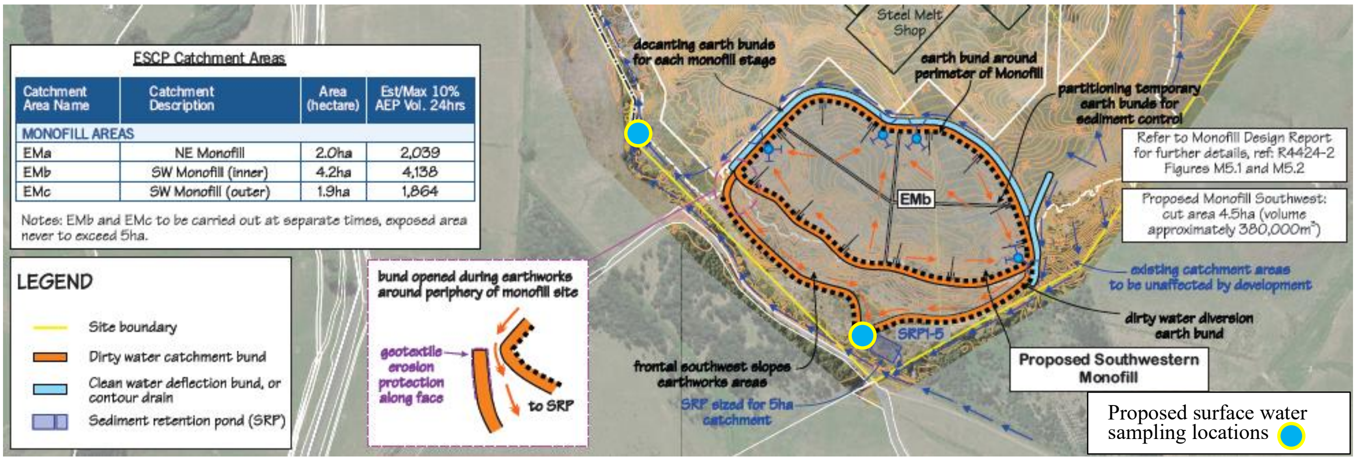


Figure D: Class 1 monofill in the southwestern portion of the Green Steel site, showing stormwater containment bunds, stormwater retention pond (SRP) and *dirty* and *clean* water direction channels. Proposed surface water sampling locations are also shown. (image sourced from Figure M5.7, attached)

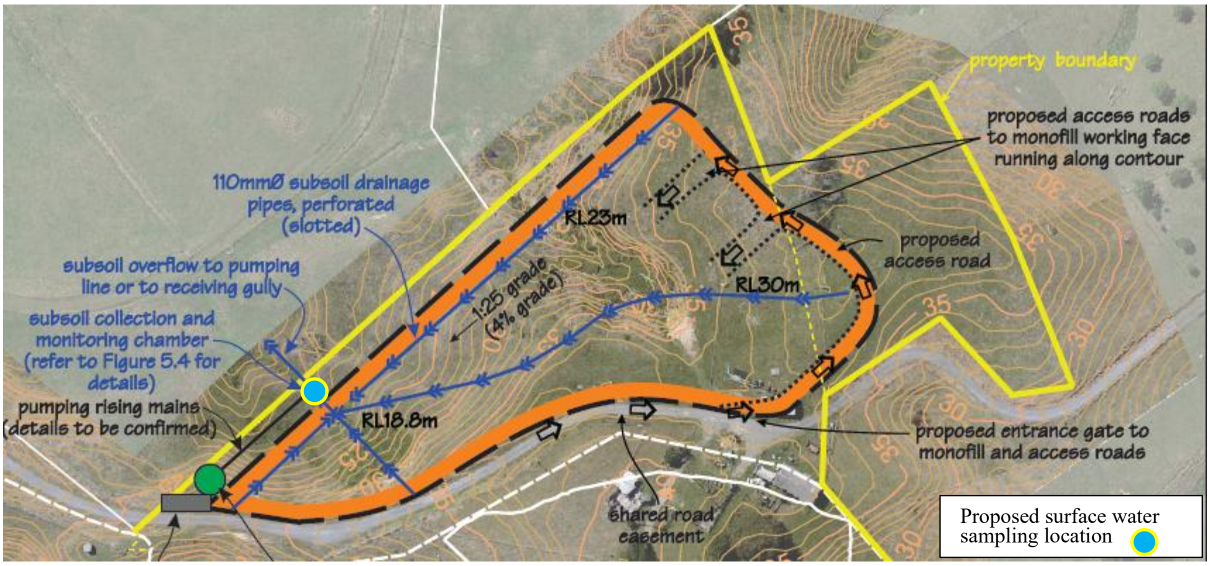


Figure E: Proposed surface water sampling location for the Class 1 monofill in the northeastern portion of the Green Steel site (image sourced from Figure M2.2 attached)

5.2 Surface Water Effects

Surface water engineered controls are combined with monitoring requirements listed in Section 4.3, which will include:

i. Physical inspections after any significant storm event to check on the integrity of the surface water control features.
ii. Routine sampling of sediment control ponds for a short list of leachate parameters.
iii. Annual sampling of the main sediment control pond for the longer list of leachate parameters.

Sampling locations are shown in the plan in Figure D above.

With good surface water controls and effective temporary cover and capping of the monofill, any adverse effects on surface waters are expected to be less than minor.

6. Groundwater Flow Paths and Effects

6.1 Groundwater Diversion Drains and Controls

There are no significant groundwater flows beneath the monofill site. Isolated and perched groundwater is present on the ridge, but the bulk earthworks will remove these areas, and any groundwater flows will be cutoff and/or collected by the surface water diversion systems. Any seeps identified in the cut faces will be drained via subsoil drains and diverted to surface water drains (Figure M5.5).

6.2 Monofill Liner and Leak Detection System

The proposed liner system is detailed in Figure F below. It includes all features acting together to avoid any potential leachate leakage and/or limit any monofill leachate to the absolute minimum.

Any groundwater seepage will be collected in the underlying subsoil drains (Figure F), which mirror the leachate collection drains on top of the liner. The subsoil drains ensure that the liner subgrade is fully drained, and they also act as an early warning leak-detection system. The drains discharge by gravity to a monitoring manhole located near the low point of the monofill floor.

6.3 Groundwater Monitoring Bores and Flow Paths

In addition to the leak detection drains, monitoring of deeper groundwater flows will be undertaken by three monitoring boreholes, as shown in Figure M1.3. These will be positioned with two locations downgradient of any flowpaths and one located upgradient of any potential leakage flow path. Intake screens will be located at natural interface depths. This will be mirrored for the northeastern monofill.

An indicative groundwater flowpath is shown in Figure M6.1, denoted by the line through points 1, 2, 3 and 4. A conceptual cross-section drawn through these groundwater flowpath points (equivalent to section J-J1 in Figure M4.2) is provided in Figure M6.2. Ground locations numbered 1, 2, 3 and 4 indicate the following:

(1) Upgradient location: Green Steel Project Platform
(2) Monofill floc storage site with Class 1 liner system
(3) Buttress fill soil area
(4) Downgradient location: property boundary, farm drain and Waipapa Stream

Borehole MBA is located close to the greatest potential concentration of monofill leachate near the leachate collection chamber. Borehole MBB is located down-gradient of the site in relation to an expected northwest dip direction. Borehole MBC is up-gradient in relation to bedding and the high point of the natural ridge line.

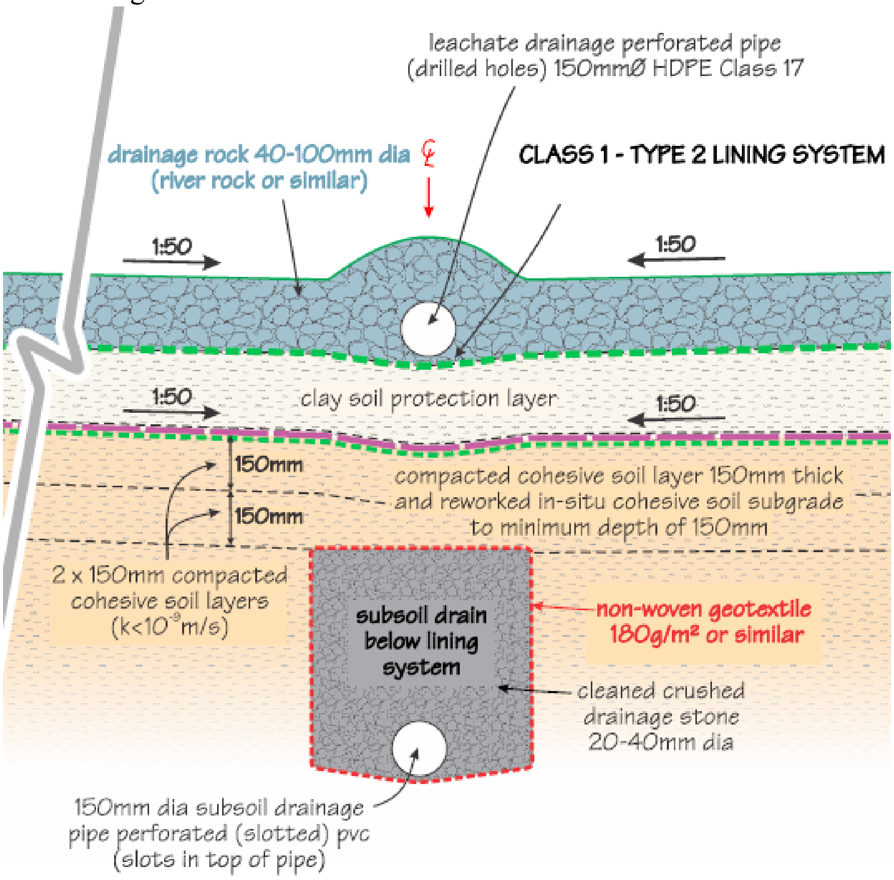


Figure F: Monofill Liner Barrier System for Green Steel

6.4 Liner Leakage Rates

Published leakage rates for a properly designed and constructed composite liner founded on a clay-based subgrade amount to 0.0010 $m^3/ha/day$. This translates to a daily flow rate of 4.464 litres for the southwest monofill liner area (area = 45,160m^2). The calculation approach, based upon assumptions that defects in the liner may occur during installation and construction, is adopted by most landfill design engineers in New Zealand and sourced from key available literature, i.e. Giroud and Bonaparte (1989), Giroud et al. (1994), Bonaparte et al. (1996), Rowe (1997) and Foose et al. (2002). The calculation is summarised as follows:

- 300*mm* leachate head on the liner, and
- total liner thickness: 1.5*mm* HDPE + 5.5*mm* GCL + 2 x 150*mm* CCLs = 307*mm*
- hydraulic gradient of potential leakage through HDPE membrane through GCL thus = 54.8
- consider Giroud et al. approach, i.e. two holes/defects per 4,000m^2 and potentially 2*mØ* wetted area at each hole → adopt Darcy's equation: *Q* = kiA (where i = hydraulic gradient)
- Permeability of GCL: consider a Cirtex Bentosure NW5000 = 2.5 x 10^{-11} *m/s*
- Therefore: $Q_{Leachate}$ = [2.5 x 10^{-11} x 54.8 x 37.7] x 3,600 x 24 x 1000 = <u>4.464*ℓ/day*</u>

Consideration of subsoil drainage below the barrier system: apply a conservative assumption of 50% diversion.

- Thus potential leachate leakage flow $Q_{Leachate}$ = <u>2.232*ℓ/day*</u> (say <u>2.2*ℓ/day*</u>)
  - i.e. 0.00050 $m^3/ha/day$

Considering the contribution of the unsaturated zone (some 3*m* in depth) of low permeability Amokura soils below the liner, the following can be deduced:

- Depth of unsaturated soils = 3*m*
- Vertical permeability of soils (k_v)* = 3.4 x 10^{-9} *m/s*

  *based on Earthtech's experience on similar or same soil type encountered on neighbouring sites, i.e. Springhill Correctional Facility and Hampton Downs Landfill site.
- This provides an estimated flow rate: *Q* = <u>2.241*ℓ/day*</u>
  - i.e. 0.00050 $m^3/ha/day$
  - a very similar result to the above potential (theoretical) leakage through the liner
- and, estimated time to permeate through the unsaturated soils zone: <u>28 *years*</u>

This is an insignificant amount in the context of the site, and any adverse effects are expected to be fully mitigated by attenuation within the clay soils below the site.

6.5 Liner Leakage Effects on Groundwater

From section 6.4 above, potential effects on groundwater quality can be determined as follows:

- Groundwater flow volume area GW_{area} :
  - Consider 50*m* depth and flow path width equivalent to monofill width = 330*m*
  - Thus, GW_{area} = 50 x 330 = 16,500m^2
- Horizontal permeability of Amokura soils (k_h)* = 1.5 x 10^{-7}*m/s*

  *based on Earthtech's experience on similar or same soil type encountered on neighbouring sites, i.e. Springhill Correctional Facility and Hampton Downs Landfill site.
- Hydraulic gradient ($i = h/L$):

- h = RL9m (GW level) – RL5m (Waipapa Stream) = 4m
- Distance from monofill to boundary = 200m
- Thus $i = h/L$ = (4m ÷ 200m) = 0.02

- Therefore, groundwater (GW) flow:
  - Q_{GW} = k.i. GW_{area}
  - Q_{GW} = (1.5 x 10^{-7} x 0.02 x 16,500) x 3,600 x 24 x 1000 = 4,276.8ℓ/day

Dilution Effects:

Dilution provides a simple and conservative calculation to obtain a first assessment of effects at the discharge location or point of compliance, i.e. the property boundary. If dilution is sufficient to meet the effects standards, further modelling is unnecessary as a full attenuation model assessment will always give a lower contaminant level than the dilution model.

Thus, a dilution effect factor (D_{EF}) for potential leachate leakage into the groundwater, reaching the closest boundary to the monofill site is:

- Dilution effect factor (D_{EF}) = $Q_{GW} \div Q_{Leachate}$
- D_{eff} = 4,276.8ℓ/day ÷ 2.232ℓ/day
- Thus, D_{EF} = 1,916

Groundwater quality at the property boundary is thus determined as follows:

- Consider boron (B) for example:

$$B_c = \frac{B_L + B_{GW}}{LV + GWV}$$

Where B_c = the predicted concentration of boron at site boundary
B_L = boron flux of the leachate*
B_{GW} = boron flux of the groundwater*
LV = leachate volume (per day or year)
(*to be determined once groundwater quality data is available from the proposed groundwater monitoring bores, MBA, MBB and MBC)

Indicatively, the potential magnitude of the effect on groundwater chemical composition change is simply related as follows:

$$B_C = \frac{B_L}{D_{EF}}$$

Where B_C = the predicted concentration at site boundary
B_L = boron concentration in the leachate
= 1.9mg/ℓ (conservatively using the high strength concentration)

$$B_C = \frac{1.9}{1{,}916}$$

$$B_C \quad = \underline{0.001 mg/\ell}$$

Similarly, potential magnitude change to groundwater quality, in relation to current groundwater quality conditions at the property boundary (for all other considered leachate chemical parameters of concern), is provided in Table 7 below:

Table 7: Green Steel Monofill Southwestern Boundary Groundwater Quality – Indicative Magnitude of Change to Groundwater Quality Predictions

Groundwater Quality Predictions						
Leachate Quality Parameter	Units	High Strength Monofill Leachate*	Indicative Change to Quality Prediction at Site Boundary	ANZG (2018) DGV[1] 80% Species Protection	ANZG (2018) DGV[2] 95% Species Protection	NZ Drinking Water Standard (2022)
pH	-	7.0 to 7.1	tbd	-	-	-
PFAS	$\mu g/\ell$	0.700	0.0004	-	-	0.63
Boron	mg/ℓ	**1.9**	0.0010	2.5	0.94	2.4
Chromium (Cr)	mg/ℓ	**1.00**	0.0005	0.04	0.001	0.05
Copper (Cu)	mg/ℓ	**0.3**	0.0002	0.0025	0.0017	2
Iron	mg/ℓ	0.5	0.0003	-	-	-
Lead (Pb)	mg/ℓ	**0.3**	0.0002	0.0094	0.0044	0.01
Manganese (Mn)	mg/ℓ	2.0	0.0010	3.6	1.9	0.4
Nickel (Ni)	mg/ℓ	**0.4**	0.0002	0.017	0.011	0.08
Zinc (Zn)	mg/ℓ	**2.8**	0.0015	0.031	0.0096	1.5
Ethylene glycol	mg/ℓ	<20	0.01	-	-	-
Chemical Oxygen Demand (COD)	mg/ℓ	<100	0.05	-	-	-

tbd – to be determined

*based on lysimeter trials set up on 27/01/2021

Notes:

1. Default Guideline Value Freshwater Guideline - 80% Species Protection
2. Default Guideline Value Freshwater Guideline - 95% Species Protection
3. Bold denotes exceedance of ANZG (2018) DGVs

On the basis of the above, adverse effects on groundwater are expected to be less than minor.

7. Air Discharge Effects

7.1 Dust, Odour and Gas Discharges

No dust, odour or gaseous discharges have been noted from the stockpiled materials located in Manukau City. Controls will be in place to avoid delivering floc to site when wind conditions exceed a specified wind speed (*km/hr*) – to be determined.

7.2 Monitoring Systems

A dust monitoring system is anticipated to monitor all dust effects on the site. This system, still to be concluded, will include any effects from the monofill.

Effects on air quality discharge should be minor to less than minor if the site is operated in accordance with the Monofill Management Plan.

8. Other Site Wide Effects

The following effects can be monitored, effectively managed and mitigated.

- Noise.
- Vibration.
- Traffic.
- Wildlife.
- Vegetation (weeds, etc.).

Effects should be minor to less than minor for considerations listed above if the site is operated in accordance with the Monofill Management Plan.

9. Conclusions and Recommendations

a. The monofill sites are to receive a single waste type only, this being the residual floc material derived from the metals resource recovery process – referred to as "floc". No other waste type is to be disposed into the proposed monofills. Slag waste, derived from the steel smelting processes, is to be treated on site (recovered and recycled into aggregate), and excess slag will be disposed to landfill.

b. This plan incorporates an evaluation of effects for the proposed monofill development. The southwest (SW) monofill site is sizably larger in area and volume compared to the NE monofill and located closer to the Waipapa Stream (which runs along the site boundary). It is noted that no leakage through the liner is anticipated with the Class 1 liner and engineering design approach applied. Underlying geology has been demonstrated to be highly favourable to mitigating any potential leakage effects, and environmental effects on the receiving environment can be expected to be minor to less than minor. The subsoil drains will also provide an effective precautionary leachate leakage detection system under the lining system.

c. It is noted that the potential liner leakage volume calculated and provided in this plan (i.e. 2.2*ℓ/day*) is a theoretical value applied to evaluate potential environmental effects. The calculation approach is adopted by most landfill design engineers in New Zealand and is sourced from key available literature.

d. With good surface water controls and effective temporary cover and capping of the monofill, any adverse effects on surface waters are expected to be less than minor.

e. Baseline monitoring in the Waipapa stream is recommended to assist with setting trigger limits and establishing flow rates.

f. In addition to the two sampling locations identified in Figure D in section 5 of this plan, monitoring of discharges from the Northeastern monofill will be closely mirrored. Stormwater discharges from the silt retention ponds (SRPs) at the northern end of the site and also upstream and downstream of all discharge points of the monofill operation are to be monitored - so that impacts associated with the site operation can be easily identified.

g. Groundwater quality is to be monitored by three strategically located boreholes, shown in Figure M1.3. These will be positioned with two locations down-gradient of any flow paths and one located up-gradient of any potential leakage flow path. Intake screens will be located at natural interface depths. Groundwater quality data will be made available from the sampling of the proposed groundwater monitoring bores, MBA, MBB and MBC. This will be mirrored for the northeastern monofill, thus named MBD, MBE and MBF.

h. Effects on groundwater quality is indicatively determined in this plan, and results are presented in Table 7. On the basis of the evaluation, adverse effects on groundwater are expected to be less than minor.

i. Effects on air quality discharge should be minor to less than minor if the site is operated in accordance with the Monofill Management Plan.

j. Other effects considered include noise, vibration, traffic, vegetation, and wildlife. Effects should be minor to less than minor if the site is operated in accordance with the Monofill Management Plan.

10. Drawings Disclaimer

The are several drawings attached to this plan, numbered as Figure M1.2 through M6.2, which are referred to in the technical content of this Preliminary Geotechnical Assessment Report. 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 plan or report.

11. References

Bonaparte et al. (1996) *Evaluation of various aspects of GCL performance.* Appendix F, Rep of 1995 Workshop on Geosynthetic Clay Liners. D.E. Daniel and H.B. Scranton, eds, Rep. No. EPA/600/R-96-149, F1-F34.

Foose et al (2002) *Comparison of Solute Transport in Three Composite Liners*. J. Geotech. Geoenviron. Eng., 391-403.

Giroud, J.P. and Bonaparte (1989) *Leakage through Liners Constructed with Geomembranes – Part I. Geomembrane Liners*. Published in Geotextiles and Geomembranes 8 Journal (1989) pp 27-67. Paper first received 18 June 1987; revised and accepted 23 September 1988.

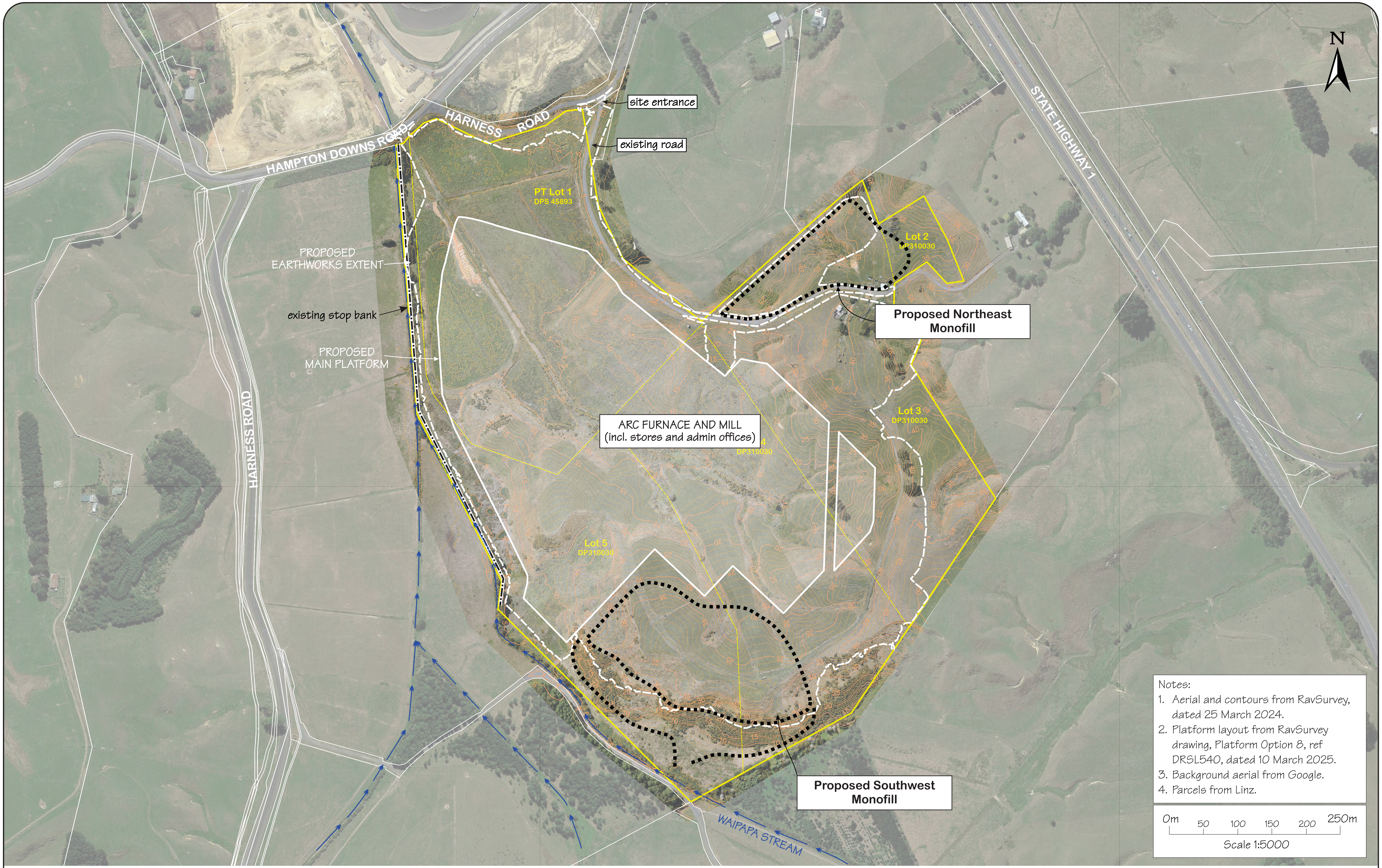
Giroud et al(1994) *Evaluation of landfill liners.* International Conference on Geotextiles, Geomembranes and Related Products, Singapore.

PDP (2019) HEPA (PFAS Management Plan: Heads of EPA's Australian and New Zealand (HEPA), January 2018). From Pattle Delamore Partners (2019) report on PFAS (https://www.mfe.govt.nz/sites/default/files/media/Land/woodbourne-csir-2019-part-1.pdf)

Rowe, K. (1997) *Geosynthetic in Barrier Systems for Waste Containment Facilities.* Short Course Presented at GeoEnvironment 97, 1st Aust NZ Conference in Environmental Geotechnics, Melbourne.

Tonkin and Taylor (2019) *Characterisation testing of shredding wastes.* Report submitted to Mr Vipan Garg, National Steel, 19 February 2019. Tonkin and Taylor, Job No: 1004057.0000.

WasteMINZ (2023) *Technical Guidelines for Disposal to Land*. Waste Management Institute New Zealand (WasteMINZ), Revision 3.1, September 2023.



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

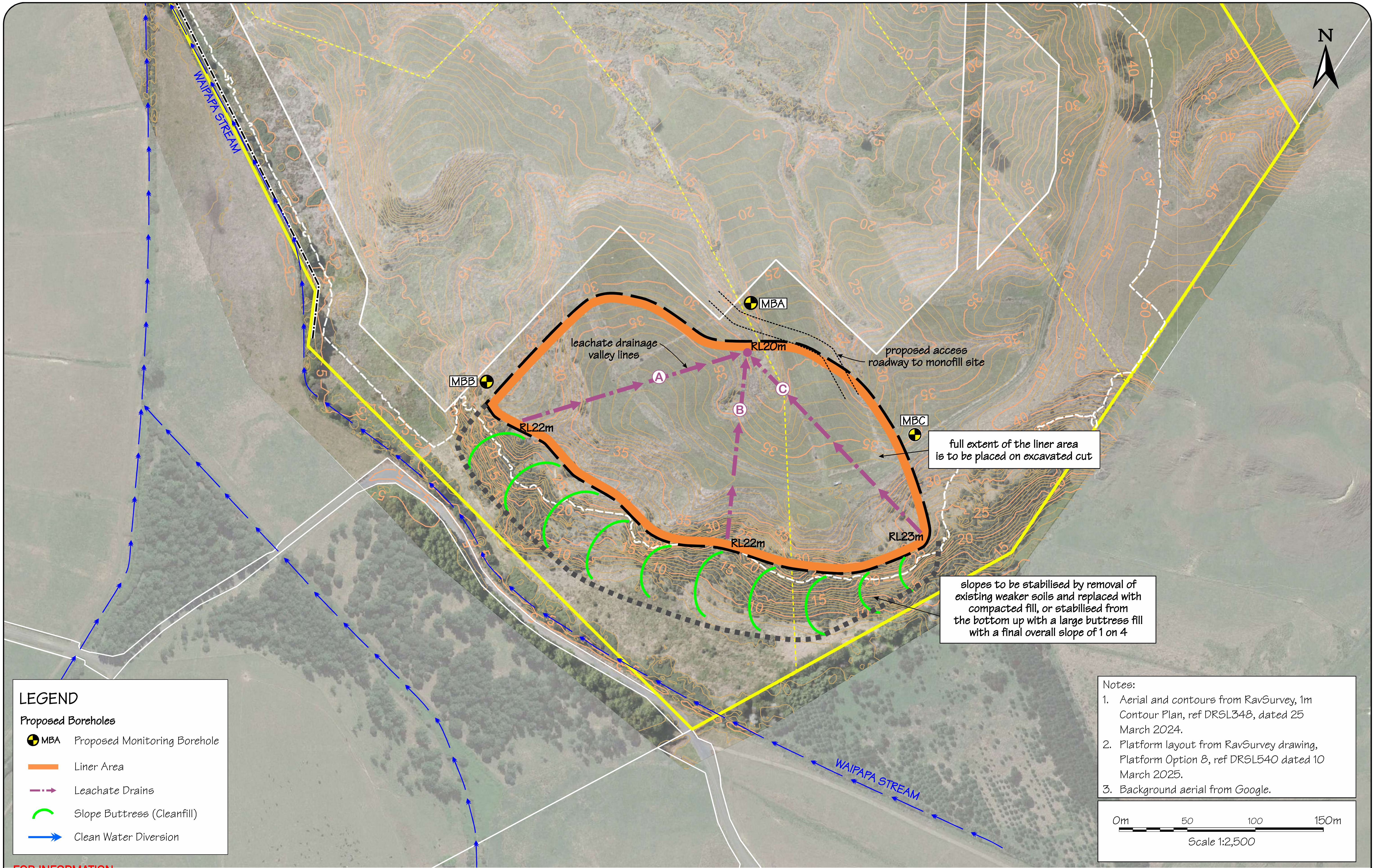
MONOFILL ENGINEERING REPORT
THE GREEN STEEL PROJECT, 61 HAMPTON DOWNS ROAD

National Green Steel Limited

Monofill Location Plan

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	28-02-25	DRAFT FOR COMMENT	L.S	A.N	S.SW	
B	30-05-25	FINAL	L.S	A.N	S.SW	

DRAWING NO.: FIG. M1.2
REF: 4424
SCALE: 1:5000
CRS: Mt Eden 2000
DATUM: AVD46



LEGEND

Proposed Boreholes

- MBA — Proposed Monitoring Borehole
- Liner Area
- Leachate Drains
- Slope Buttress (Cleanfill)
- Clean Water Diversion

Notes:

1. Aerial and contours from RavSurvey, 1m Contour Plan, ref DRSL348, dated 25 March 2024.
2. Platform layout from RavSurvey drawing, Platform Option 8, ref DRSL540 dated 10 March 2025.
3. Background aerial from Google.

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EARTHTECH

Earthtech Consulting Ltd.

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

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Proposed Monitoring Borehole Locations

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	26-02-25	DRAFT FOR COMMENT	L.S	A.N	S.SW	
B	14-03-25	DRAFT FOR COMMENT	L.S	A.N	S.SW	
C	29-05-25	FINAL	L.S	A.N	S.SW	

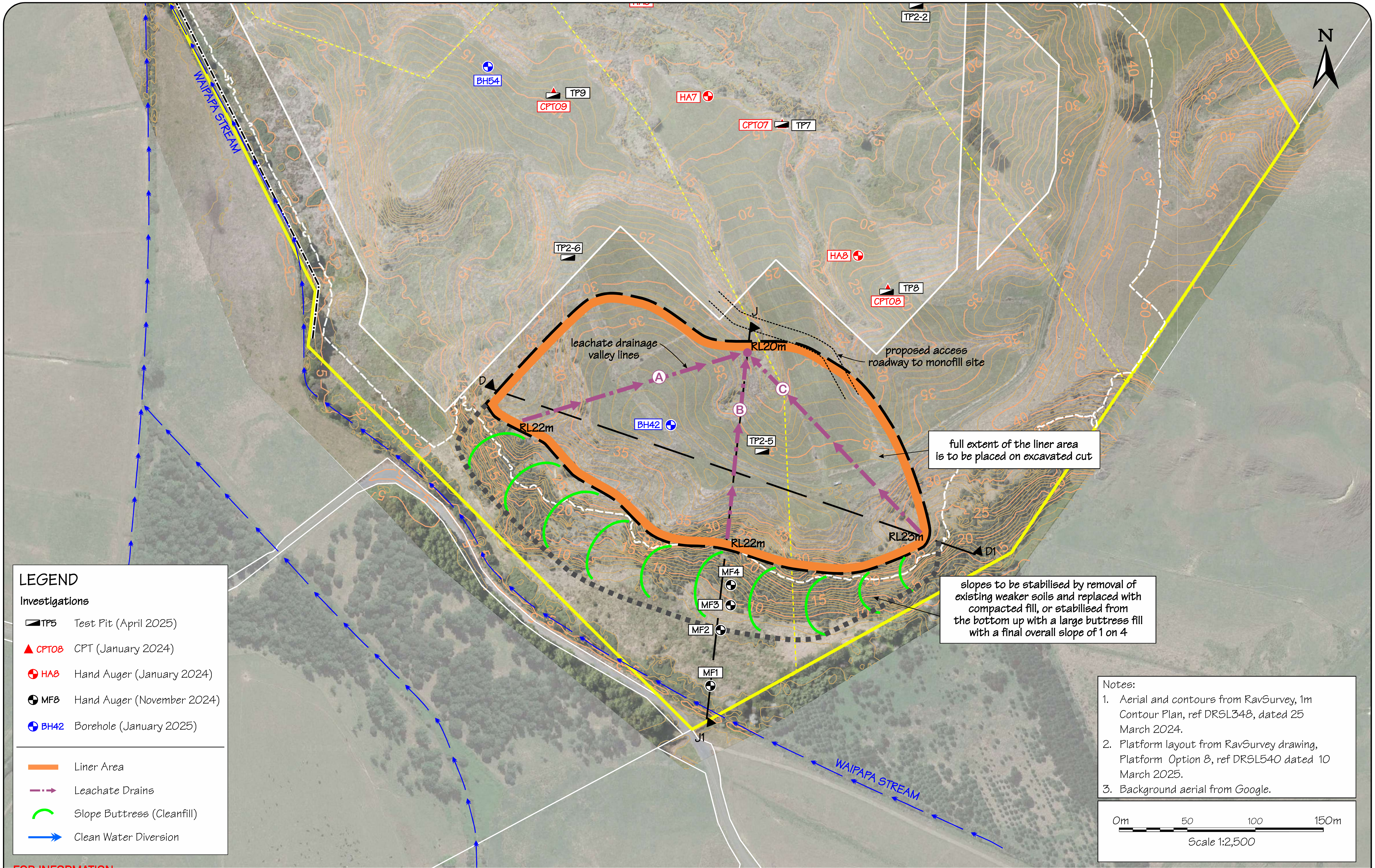
DRAWING NO.: FIG. M1.3

REF: 4424

SCALE: 1:2500

CRS: Mt Eden 2000

DATUM: AVD46



Notes:

1. Aerial and contours from RavSurvey, 1m Contour Plan, ref DRSL348, dated 25 March 2024.
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Earthtech Consulting Ltd.
P.O. Box 721, Pukekohe
Phone: 64 9 238 3669
Email: admin@earthtech.co.nz

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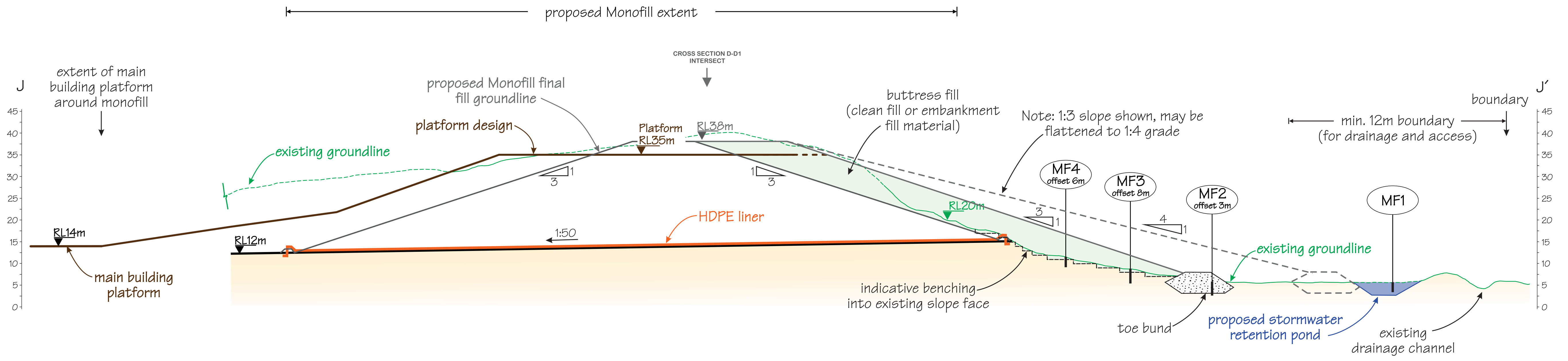
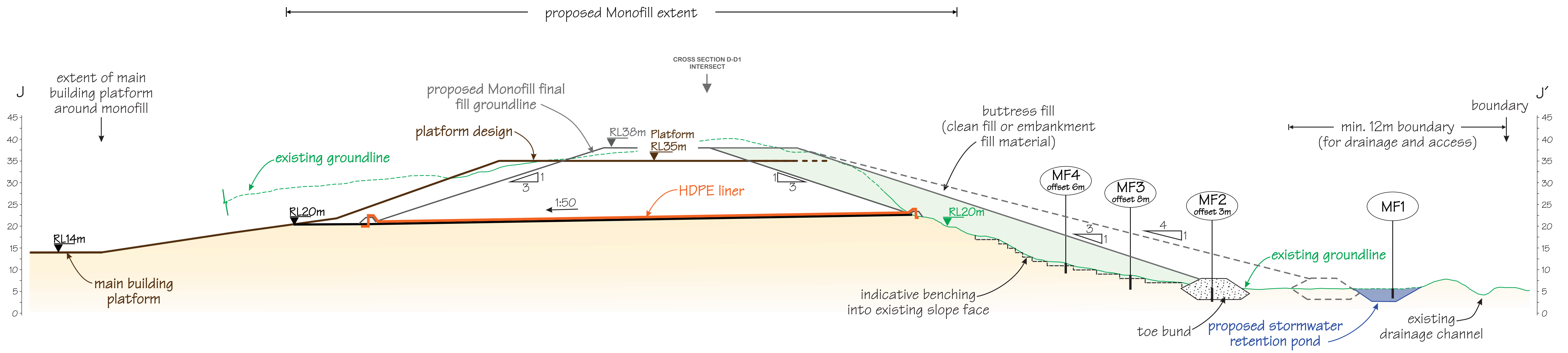
Site Layout Plan for Southwest Monofill

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	06-12-24	DRAFT FOR COMMENT	A.N	A.N	S.SW	
B	28-02-25	UPDATE PLATFORMS	L.S	A.N	S.SW	
C	29-05-25	ADD TEST PITS	L.S	A.N	S.SW	[signature]

DRAWING NO.: FIG. M2.1
REF: 4424
SCALE: 1:2500
CRS: Mt Eden 2000
DATUM: AVD46



Basegrade to RL12m



Basegrade to RL20m

Notes:
1. Groundline, basegrade and final fill contours from RavSurvey drawings DRSL 529 and DRSL531, dated 28 February 2025.
2. Minimum basegrades of 1:50 (2%) are required for the Class 1 liner system.

0m 10 30 50m
Scale 1:1,000

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

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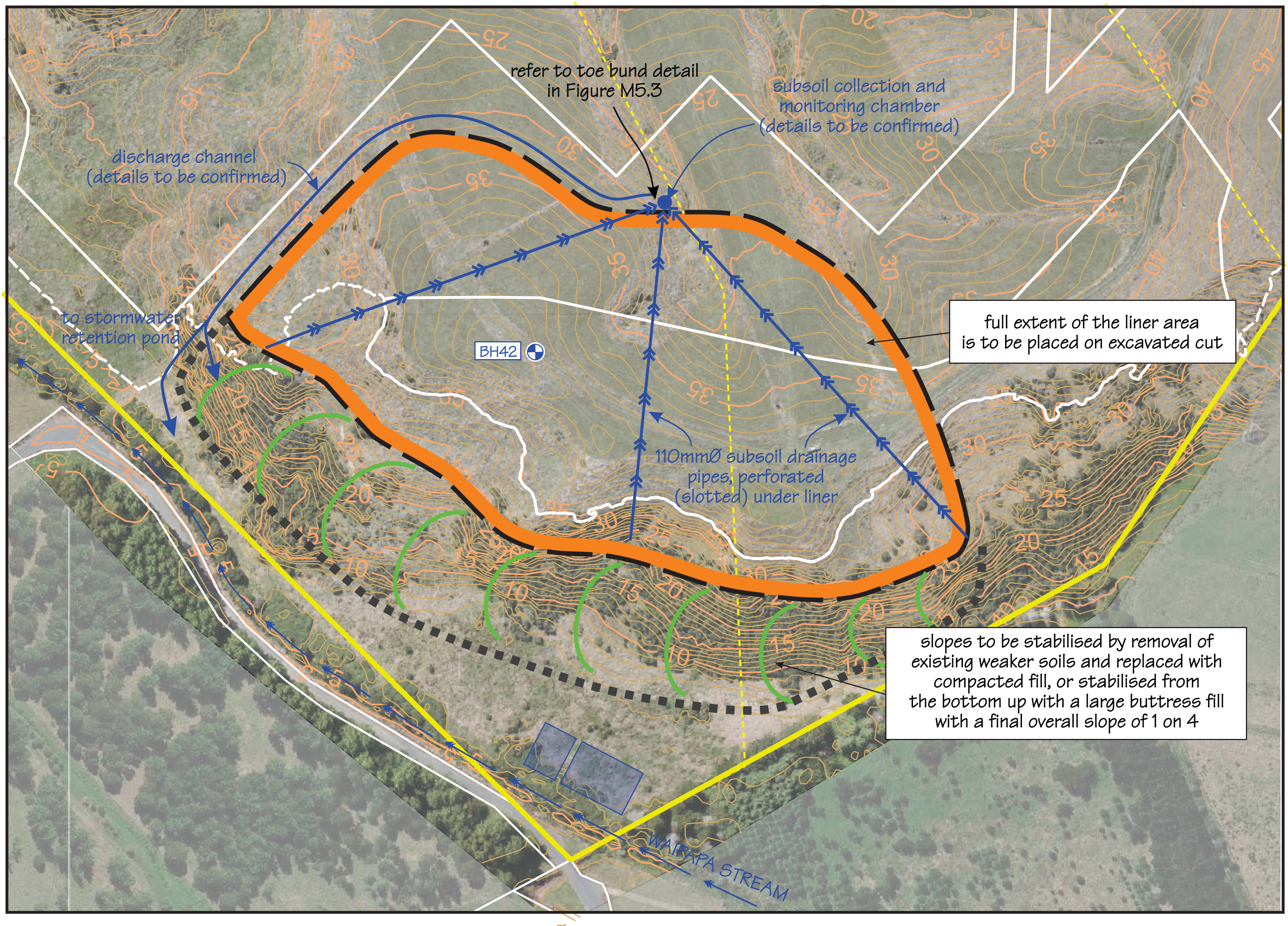
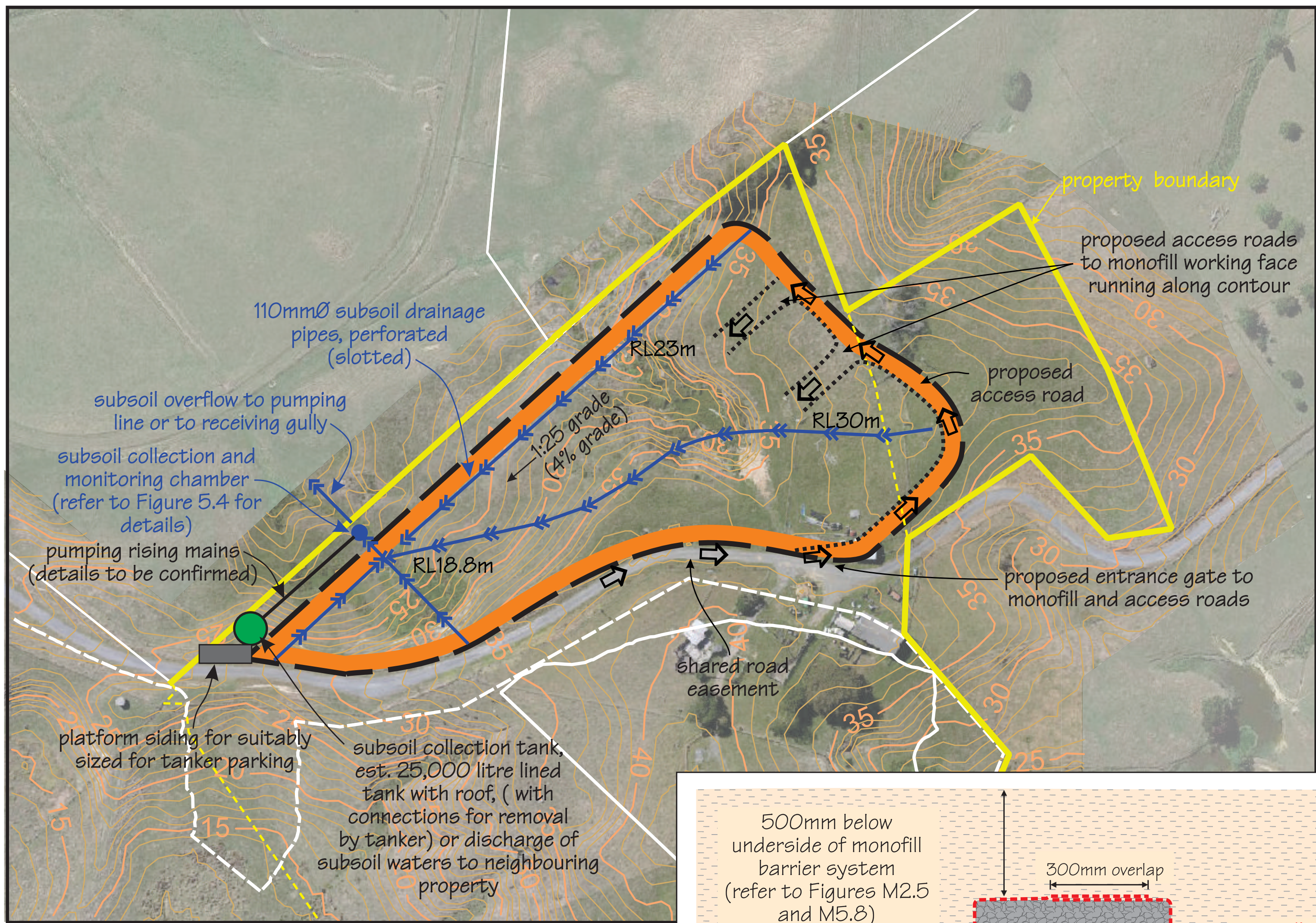
Cross-Section J-J1 - Southwest Monofill

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	06-12-24	DRAFT FOR COMMENT	A.N	A.N	S.SW	
B	28-02-25	DRAFT FOR ENGINEERING REPORT	L.S	A.N	S.SW	
C	30-05-25	FINAL	L.S	A.N	S.SW	

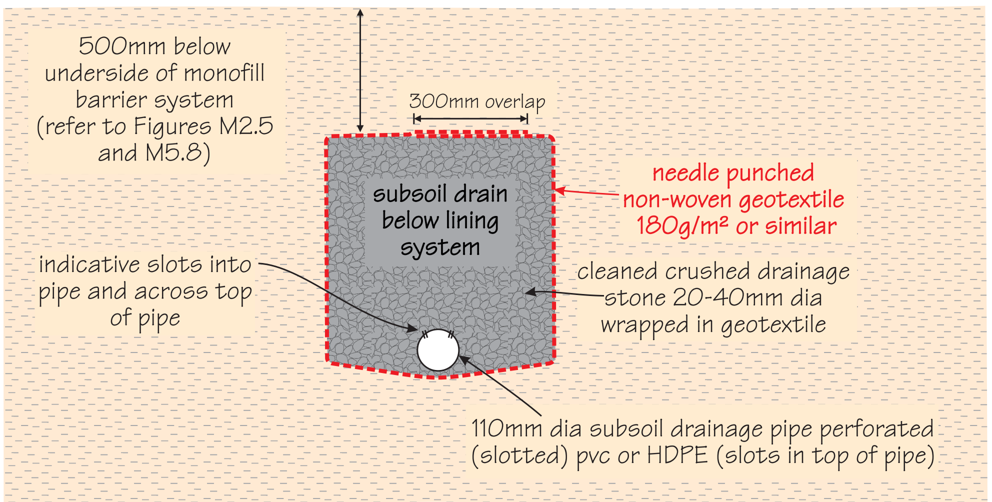
DRAWING NO.: FIG. M4.2
REF: 4424-R2
SCALE: 1:1000
CRS: Mt Eden 2000
DATUM: AVD46





0m 50 100 150m

Scale 1:2,500



Subsoil Drain Detail

0m 0.5 1m

Scale 1:20

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

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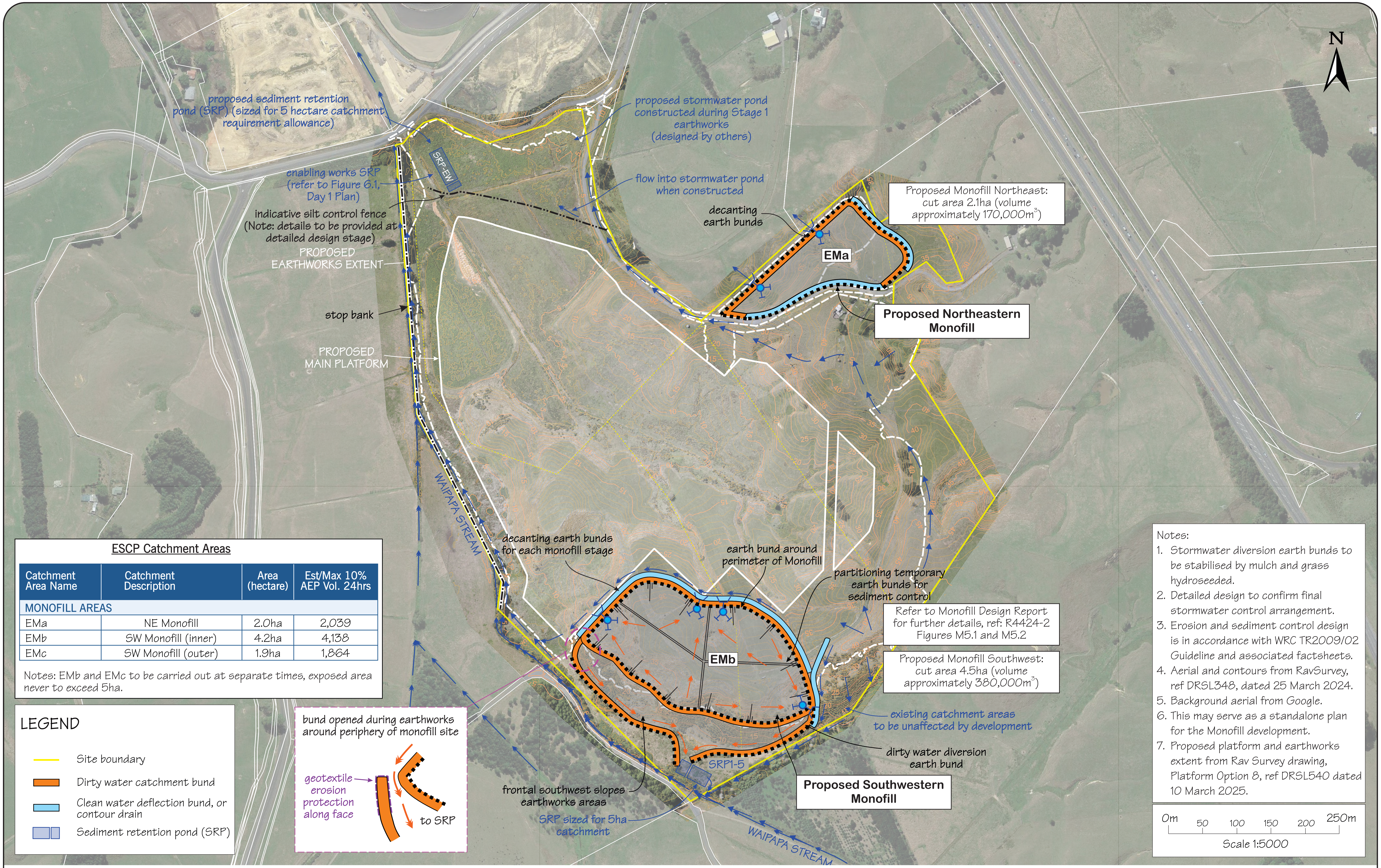
Liner, Leachate and Subsoil Drainage Details

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	28-02-25	DRAFT FOR COMMENT	L.S	A.N	S.SW	
A	30-05-25	FINAL	L.S	A.N	S.SW	

DRAWING NO.: FIG. M5.5
REF: 4424
SCALE: as shown
CRS:
DATUM:



ESCP Catchment Areas

Catchment Area Name	Catchment Description	Area (hectare)	Est/Max 10% AEP Vol. 24hrs
MONOFILL AREAS			
EMa	NE Monofill	2.0ha	2,039
EMb	SW Monofill (inner)	4.2ha	4,138
EMc	SW Monofill (outer)	1.9ha	1,864

Notes: EMb and EMc to be carried out at separate times, exposed area never to exceed 5ha.

LEGEND

- Site boundary
- Dirty water catchment bund
- Clean water deflection bund, or contour drain
- Sediment retention pond (SRP)

Notes:
1. Stormwater diversion earth bunds to be stabilised by mulch and grass hydroseeded.
2. Detailed design to confirm final stormwater control arrangement.
3. Erosion and sediment control design is in accordance with WRC TR2009/02 Guideline and associated factsheets.
4. Aerial and contours from RavSurvey, ref DRSL348, dated 25 March 2024.
5. Background aerial from Google.
6. This may serve as a standalone plan for the Monofill development.
7. Proposed platform and earthworks extent from Rav Survey drawing, Platform Option 8, ref DRSL540 dated 10 March 2025.

0m 50 100 150 200 250m
Scale 1:5000

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

MONOFILL ENGINEERING REPORT
THE GREEN STEEL PROJECT, 61 HAMPTON DOWNS ROAD
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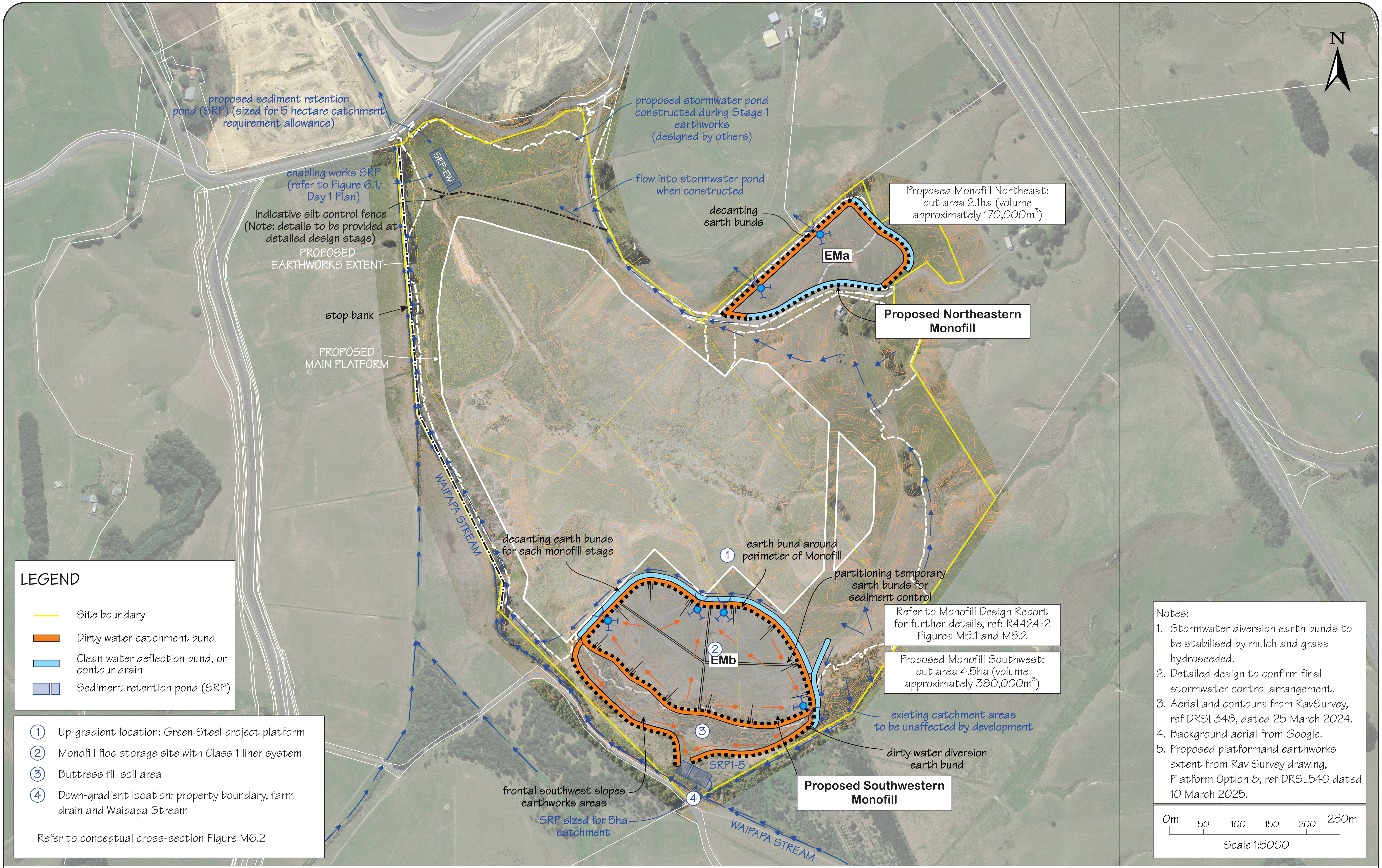
Monofill Stormwater Control Plan

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	28-02-25	DRAFT FOR COMMENT	L.S	A.N	S.SW	
B	30-05-25	FINAL	L.S	A.N	S.SW	

DRAWING NO.: FIG. M5.7
REF: 4424
SCALE: 1:5000
CRS: Mt Eden 2000
DATUM: AVD46



LEGEND

- Site boundary
- Dirty water catchment bund
- Clean water deflection bund, or contour drain
- Sediment retention pond (SRP)

1. Up-gradient location: Green Steel project platform
2. Monofill floc storage site with Class 1 liner system
3. Buttress fill soil area
4. Down-gradient location: property boundary, farm drain and Waipapa Stream

Refer to conceptual cross-section Figure M6.2

Notes:
1. Stormwater diversion earth bunds to be stabilised by mulch and grass hydroseeded.
2. Detailed design to confirm final stormwater control arrangement.
3. Aerial and contours from RavSurvey, ref DRSL348, dated 25 March 2024.
4. Background aerial from Google.
5. Proposed platformand earthworks extent from Rav Survey drawing, Platform Option 8, ref DRSL540 dated 10 March 2025.

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Earthtech Consulting Ltd.

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

MONOFILL ENGINEERING REPORT

THE GREEN STEEL PROJECT, 61 HAMPTON DOWNS ROAD

National Green Steel Limited

Monofill Conceptual Plan Surface and Groundwater Flow Paths

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	14-03-25	DRAFT FOR COMMENT	L.S	A.N	S.SW	
B	30-05-25	FINAL	L.S	A.N	S.SW	

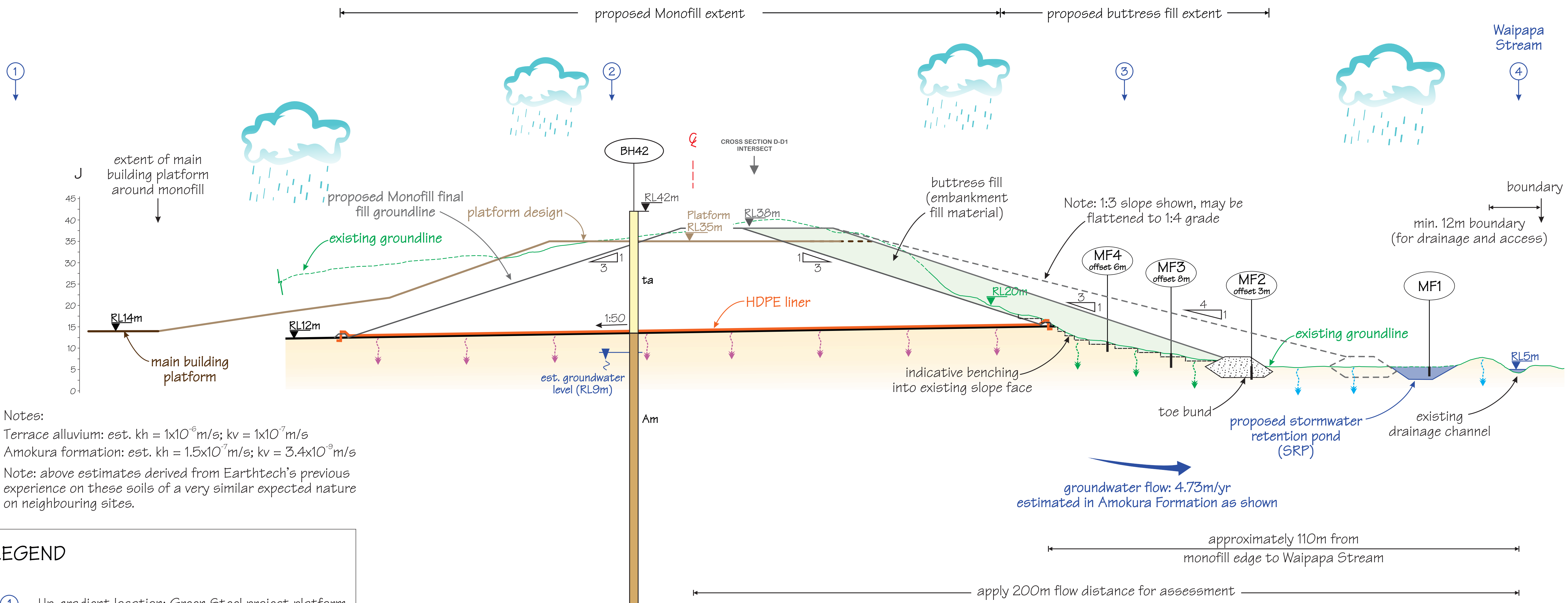
DRAWING NO.: FIG. M6.1

REF: 4424

SCALE: 1:5000

CRS: Mt Eden 2000

DATUM: AVD46



Notes:

Terrace alluvium: est. kh = 1×10^{-6} m/s; kv = 1×10^{-7} m/s

Amokura formation: est. kh = 1.5×10^{-7} m/s; kv = 3.4×10^{-9} m/s

Note: above estimates derived from Earthtech's previous experience on these soils of a very similar expected nature on neighbouring sites.

LEGEND

- (1) Up-gradient location: Green Steel project platform
- (2) Monofill floc storage site with Class 1 liner system
- (3) Buttress fill soil area
- (4) Down-gradient location: property boundary, farm drain and Waipapa Stream
- Natural existing ground infiltration
- Potential cleanfill or embankment fill infiltration
- Potential leachate infiltration
- ta — Terrace alluvium
- am — Amokura formation

Notes:

1. Groundline, basegrade and final fill contours from RavSurvey drawing DRSL531, dated 28 February 2025.
2. Minimum basegrades of 1:50 (2%) are required for the Class 1 liner system.

0m 10 30 50m

Scale 1:1,000

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EARTHTECH

Earthtech Consulting Ltd.

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

MONOFILL MONITORING PLAN

THE GREEN STEEL PROJECT, 61 HAMPTON DOWNS ROAD

National Green Steel Limited

Conceptual Cross-Section J-J1 of Lined Monofill

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	13-03-25	DRAFT FOR COMMENT	L.S	A.N	S.SW	
B	30-05-25	FINAL	L.S	A.N	S.SW	

DRAWING NO.: FIG. M6.2

REF: 4424

SCALE: 1:1000

CRS: Mt Eden 2000

DATUM: AVD46

Monofill Monitoring Plan and Evaluation of Surface and Groundwater Effects

Green Steel Monofill

61 Hampton Downs Road, Hampton Downs, Waikato

Appendix A

Waste Lysimeter Trials (R4424-3, 28 February 2025)

AHN/R4424-3/ls/cam

28 February 2025

The Managing Director
National Green Steel Limited
29 Hobill Avenue
Wiri
Manukau 2104

Attention: **Mr Vipan Garg**
vipan@nationalsteel.co.nz

Dear Sir

RE: WASTE LYSIMETER TRIALS: LEACHATE CHARACTERISATION TESTING AND FLOW RATES - MONOFILL AT THE GREEN STEEL PROJECT, 61 HAMPTON DOWNS ROAD

1. Background

The key determinant for a landfill (monofill) liner or barrier system, for any proposed waste containment site containing a material that may potentially pollute the natural receiving environment, is the quality and volume characteristics of the leachable liquid from such material. This leached liquid, typically referred to as '*leachate*' is produced by rainfall leaching through waste undergoing physical change, chemical breakdown and biodegradation within the waste body. The quality characteristics of this leachate will be specific to the waste floc material produced by National Steel's materials recovery processes, of end-of-life vehicles (ELVs) and whiteware.

An early study entitled 'Characterisation testing of shredding wastes' by Tonkin and Taylor (2019), attached to this letter report for reference, carried out two leaching tests on samples of the material, namely an SPLP (Synthetic Precipitation Leaching Procedure) and a TCLP (Toxicity Characteristic Leaching Procedure) test. The latter (TCLP) test is arguably more relevant to a landfilled waste body containing biodegradable organics (i.e. a Municipal Solid Waste (MSW) type landfill), and the former test is more relevant to the *real-life* situation (simulating normal atmospheric conditions) for a monofill located on the Green Steel site. Each test procedure involved testing of three 50*g* samples collected from the floc stockpile on 24 April 2018. Results were presented by Tonkin and Taylor (2019) for the six tests. Key parameters are presented in Table 2 (attached) of this letter report as the maximum recorded value of each of the SPLP and TCLP tests. Tonkin and Taylor (2019) concluded levels of concern with specific parameters – notably zinc and ethylene glycol. Other parameters of concern in the TCLP test were elevated levels of nickel and lead.

Following a pre-consenting project introduction meeting with the Waikato Regional Council (WRC) and in a follow-up email letter on 22 January 2021 from Jonathan Caldwell (WRC) to Craig Shearer (National Steel's Planner), the WRC requested that Per- and Polyfluoroalkyl Substances (PFAS) be determined in the leaching water from the material to be monofilled.

Earthtech Consulting Limited (ECL) has carried out the engineering design of the proposed site and calculated that a potential leaching water volume of up to 12m^3 per day for Stage 1, increasing to 21m^3 per day could be generated by the site. If a very 'tight' cell-technique operation is employed (described herein) then such *leachate* water could be reduced.

In order to appropriately model actual waste leaching conditions, a waste lysimeter was established at National Steel's yard comprising an enclosed leaching column some 2*m* in height, subjected to water ingress equivalent to rainfall conditions that may occur on the proposed Green Steel site at 61 Hampton Downs Road, Hampton Downs, Waikato. A total of 1,526*kg* of waste floc was tested in the lysimeter over a period of two months.

2. Aim and Objectives of the Lysimeter Trials

The aim of the lysimeter trials was to determine the quality characteristics of water (leachate) that leaches through a depth of representative waste materials from National Steel's materials recovery processes, under rainfall conditions equivalent to the actual site. Furthermore, the aim was to provide an experimental apparatus that would mimic the actual (full-scale) monofill landfill leaching behavioural conditions, producing an equivalent leachate that can be analysed for quality characteristics.

Objectives of the trials were to:

i. Obtain a representative waste volume that is typical of the sustained output from the National Steel processes (in Manukau, Auckland) and establish a leaching column of such wastes of a practicably applicable height (of some 2*m*);
ii. Subject the waste column to water ingress that accurately mimics rainfall conditions at the site. Lysimeter leaching conditions are to be over two (2) stages, i.e. (Stage 1) an initial flush stage and (Stage 2) a stage for ongoing or long-term representative leaching conditions;
iii. To assess any possible biodecomposition, biochemical or any chemical effects of the waste under field capacity (saturated) conditions;
iv. Sustain the trials for a period of eight weeks with regular sampling and analytical testing – specifically concentrating on the parameters of specific concern, i.e. PFAS, zinc, ethylene glycol, lead and nickel; and
v. To report on findings.

3. Per- and Polyfluoroalkyl Substances (PFAS)

Per- and Polyfluoroalkyl Substances (PFAS) are a large group of manufactured compounds that are used in a wide range of industrial applications. PFAS are the major components in legacy Aqueous Film Forming Foams (AFFF) firefighting products that met former military and domestic specifications (Eurofins, 2021). PFAS compounds are also used to repel oil and water in textile products like clothing, carpeting, furniture and car textiles, as well as in food packaging and in the manufacture of fluoropolymers used in non-stick cookware.

Some of the unique chemical characteristics that make PFAS compounds attractive for use in textiles, packaging and cookware, also render them resistant to biodegradation in the environment. Therefore, PFAS compounds are persistent and have been widely reported to bioaccumulate in humans and wildlife. PFAS compounds have been found throughout the environment in groundwater, surface water, biosolids, soil and sediment, and studies have shown detections of PFAS in air, biota and food (Eberle, 2021).

4. Previous Findings

The previous findings originated from the report 'Characterisation testing of shredding wastes' (Tonkin and Taylor, 2019). The principal parameters of concern were established to be zinc and ethylene glycol from the SPLP testing procedure and lead and nickel from the TCLP testing procedure. A summary of the previous findings is listed as follows:

i. Under normal atmospheric conditions, the wastes generated leachate that generally complied with Class 2 landfill acceptance criteria, except for zinc concentrations which exceeded these criteria;
ii. Aside from the major minerals that are expected to be present (calcium, magnesium, potassium, sodium), zinc and ethylene glycol were reported at the highest concentrations in both the SPLP and TCLP analyses. Ethylene glycol is a primary component of antifreeze formulations used in motor vehicle engine cooling systems;
iii. The concentrations of zinc, nickel, and lead were reported to exceed Class 2 landfill criteria in the results of the TCLP analyses;
iv. The material may be suitable for disposal to a new Class 2 monofill (i.e. accepting only this waste type) if either:
    - There is potential to <u>pre-treat the waste to reduce zinc concentrations</u>; or
    - The facility is or can be designed in a way that mitigates zinc discharges; and
v. Unless pre-treatment, which could potentially include stabilisation, can be demonstrated to sufficiently reduce zinc concentrations, both a new monofill or stockpiling facility will need to be engineered to mitigate zinc discharges, i.e. appropriate lining required.

5. Establishment of the Trials and Methodology

The waste leaching lysimeter apparatus was established on 27 January 2021 at National Steel's property at 29 Hobill Avenue, Manukau. The apparatus, illustrated in Figure A below, contains a 2*m* column of representative wastes. The establishment of the trials is described in the notes provided in Table 1 below, including the set-up and testing stages of the methodology.

Water (leachate) samples from the lysimeter were tested at the Eurofins Environmental Laboratories located in New Zealand and Australia. Eurofins Environment Australia carried out the PFAS analyses.

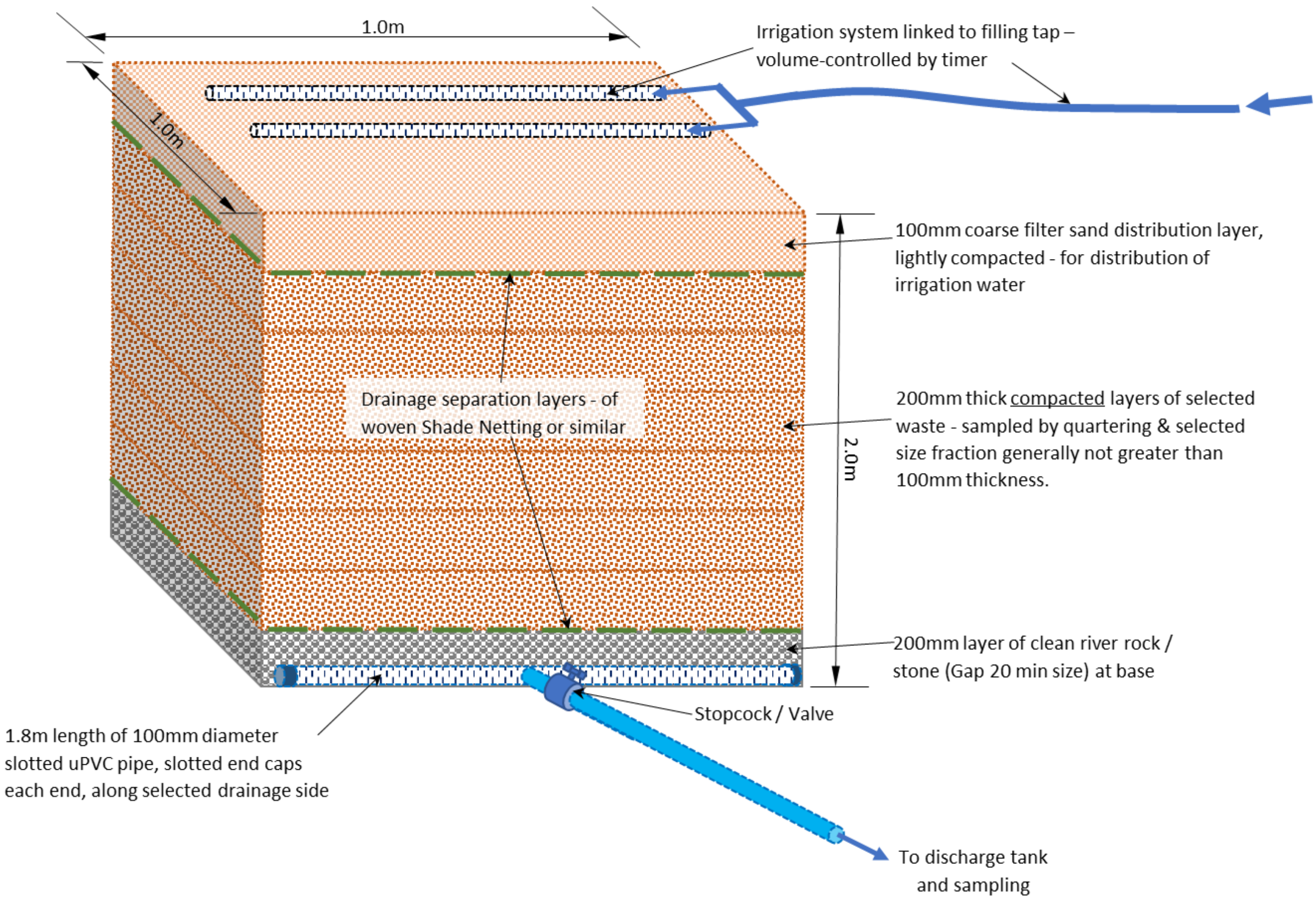


Figure A: National Steel's Monofill Waste Lysimeter Apparatus

6. Lysimeter Trials Findings and Results

The initial sampling from the waste lysimeter provided results that were somewhat closely comparable to those obtained by Tonkin and Taylor (2019), except for ethylene glycol. The latter results were distinctly lower throughout the trials for ethylene glycol. The representative wastes in the lysimeter were obtained off-conveyor during the course of several hours of production as well as from the stockpile in the yard where quartering techniques were employed. It is possible, whilst arguably *stating the obvious*, that the reason for ethylene glycol not being detected at any elevated levels throughout these lysimeter trials is owed to the representativity of the waste samples. Zinc levels were comparably higher, whilst lead and nickel levels were comparably similar across the combined range of analytical results of samples from the lysimeter.

PFAS levels were detected from samples but showed to be below recreational water quality levels as well as levels reported in the Ecological Freshwater Guideline PFAS Management Plan HEPA (PFAS Management Plan: Heads of EPA's Australian and New Zealand (HEPA), January 2018) (PDP, 2019). PFAS levels during Stage 2, i.e. leaching conditions, displayed to be only at traceable levels of concentrations $<0.1\mu g/\ell$. Whilst found to not be a current concern, it can be recommended that PFAS checks be carried out on samples from the site in the future.

Zinc concentrations were initially high but dropped below the $1.0mg/\ell$ threshold for a Class 2 and/or Class 3 landfill for ongoing leaching conditions of the wastes (Stage 2), with levels from $0.67mg/\ell$ to

0.83mg/ℓ. Zinc concentrations during the initial flush stage (Stage 1) demonstrated elevated levels exceeding Class 1 landfill waste acceptance criteria (WAC) (WasteMINZ, 2023). Boron concentrations showed to initially exceed Class 2 and 3 landfill limits but lower than the Class 1 landfill limit, during the initial flush stage (Stage 1). Boron levels were then reduced to below Class 2 and 3 landfill limits during ongoing leaching conditions (Stage 2). Concentrations for chromium and lead showed to be lower than the 1.0mg/ℓ and 0.5mg/ℓ thresholds, respectively, for Class 2 and/or Class 3 landfills. Levels for nickel also showed to be lower than the 1.0mg/ℓ threshold for Class 2 and/or Class 3 landfills. Concentration levels for copper demonstrated to be up to 0.23mg/ℓ during the initial flush stage (Stage 1), reducing to traceable levels 0.003mg/ℓ during ongoing leaching conditions (Stage 2), hence lower than the 0.5mg/ℓ threshold, for Class 2 and/or Class 3 landfills.

The analytical results for the lysimeter trials are presented in Table 2 (attached), with L1-1 and L1-2 representing the initial flush results and L1-3 and L1-4 representing longer term conditions.

Table 1: National Steel's Monofill Waste Lysimeter Apparatus and Experimentation

Establishment on Wednesday 27 January 2021 at National Steel's Yard

Description	Qty	Units	Comment
Empty Bucket:	0.5	kg	
Full Bucket:	11.2	kg	Lightly Compacted Wastes
Water Added:	12.75	litres	
Mass of water:	12.75	kg	
Vol. of Bucket:	19	litres	
Void Ratio:	67%		
Full Bucket:	14.5	kg	Compacted Wastes (with 5kg hand tamper)
Vol. Water Added:	9.5	litres	
Void Ratio:	50%		
Density of Lightly Comp. Waste:	589.5	kg/m^3	
Density of Comp. Waste:	763.2	kg/m^3	
Lysimeter Vol Waste:	2,000	litres	
Surface Area:	1	m^2	
Est. Mass of Waste:	1,526	kg	
Field Capacity Vol Water:	1,000	litres	
Field Capacity Mass Water:	1,000	kg	
Irrigation Flow Rate:	8	litres/min	As measured
Stage 1			***Attaining Field Capacity Conditions***
No. Days to achieve Field Capacity:	5	days	To achieve field capacity
Volume of Water Reqd:	1,000	litres	To achieve field capacity
Adjustment of Timer:	192	litres/day	1 dose per hour
Time for Completion:	5.2	days	
Stage 2			***Attaining Steady Leaching Conditions***
Annual Rainfall (Max):	1,440	mm/year	
Volume of Water Reqd:	4	litres/day	To achieve equivalent rainfall conditions
Adjustment of Timer:	24	litres/day	1 dose per 8 hours - OK.

7. Monofill Leachate Strength Design Parameters

The monofill design, construction and operation are closely aligned to standard municipal solid waste (MSW) landfills. The waste floc is considered biologically 'inert' and distinctly very different to MSW. The waste body is, however, expected to behave physically in a similar manner in regard to leachate production rates. Leachate quality will be distinctly different to MSW landfill leachate since there will be no (or extremely low effects from) biological breakdown of the wastes. The leachate quality is expected to mirror the results obtained in the lysimeter trials. Predicted leachate quality concentrations for parameters of particular concern, for initial flush and longer-term leaching conditions, are provided in Table 3 below.

The initial flush strength parameters apply to Stage 1A, but as the existing fill ages in place, the strength is expected to reduce to the long-term leachate strength parameters.

Table 3: Leachate Quality Predictions from National Steel's Monofill

Leachate Lysimeter Apparatus and Experimentation

Establishment on Wednesday 27 January 2021 at National Steel's Yard

Leachate Quality Predictions*			
Parameter	Units	Initial Flush Leaching Strength	Long Term Leaching Strength
pH	-	7.0 to 7.1	7.2 to 7.3
PFAS	µg/l	0.700	<0.1
Boron	mg/l	5.0	0.8
Chromium (Cr)	mg/l	0.05	0.003
Copper (Cu)	mg/l	0.23	0.003
Iron	mg/l	47.0	0.05
Lead (Pb)	mg/l	0.22	0.18
Manganese (Mn)	mg/l	4.1	0.2
Nickel (Ni)	mg/l	0.32	0.002
Zinc (Zn)	mg/l	16.0	0.83
Ethylene glycol	mg/l	<20	<20
Chemical Oxygen Demand (COD)	mg/l	2,000	280

*based on lysimeter trials set up on 27/01/2021

8. Filling Techniques to Reduce Leachate Volumes

The majority of the site extends over Amokura Formation and rhyolitic terrace deposits geology. Overall, this geology underlying the proposed monofill (two areas within the Green Steel site, i.e. southwest and northeast) is characterised by low permeability soils and rock that provide favourable conditions for secondary site containment of monofill leachate. Notwithstanding this, the reduction (or minimisation) of water ingress into the monofill is crucial to ensure that leachate production is minimal.

The proposed filling technique to be employed is that of the 'Cellular Technique' whereby small individual 'cells' are planned, stormwater appropriately managed around such cells, rainwater ingress minimised through the use of temporary covers and a continued (daily) cover-soil operation, with a *bottom-up* or *top-down* filling approach applied. This technique is illustrated in the indicative sketches of Figure B below:

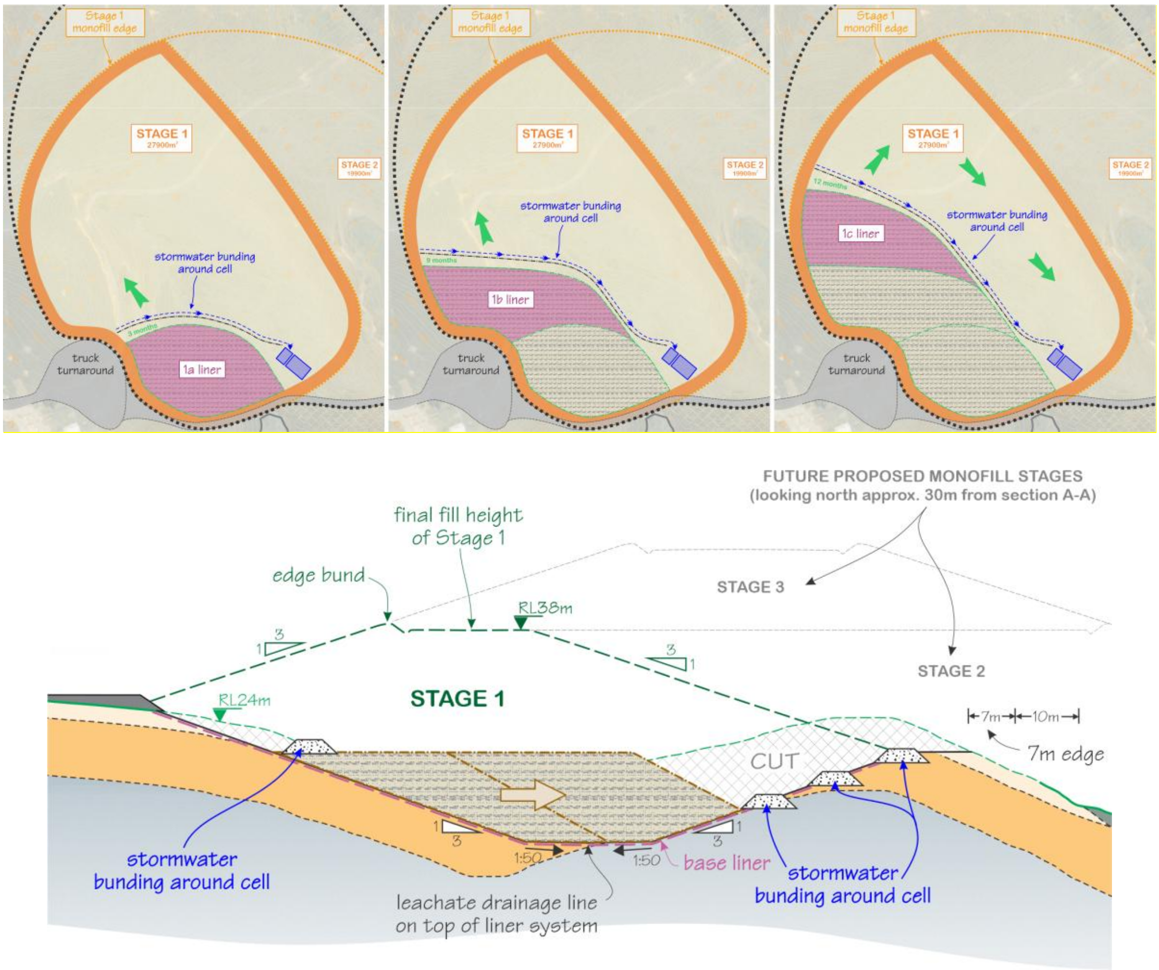


Figure B: Indicative Sketches Illustrating Cellular Filling Technique for the Monofill

9. Monofill Leachate Production Rates

Leachate flow is essentially created by rainfall which infiltrates cover and capping materials and slowly percolates through the waste body to collect in the purpose designed leachate collection layer which sits directly on top of the landfill liner. Daily leachate flow is affected by:

- daily rainfall
- daily evaporation
- surface area of exposed waste
- cover and capping layers that deflect the rainfall
- absorptive capacity (or loss) of the waste – also referred to as 'field capacity'
- rate of placement of the waste and compactive effort
- diversion controls in place to divert clean water run-off

Typical MSW landfills generally return leachate flows as a percentage of annual rainfall as follows:

Operational Area	Intermediate Cover Area	Final Cap Area
20%	12%	7%

Leachate flow rates are highly sensitive to major storm events and the integrity of the cover at the time of the event. Best estimates to indicate likely flows have been calculated on the basis of a high-end 1.4*m* of annual average rainfall, provided in the table below.

Monofill Stage	Total Area	Unit	Operational	Volume	Intermediate Cover	Volume	Final Cover	Volume	Total Est. Leachate Production
			20%		12%		7%		
			Area (ha)	(m^3/day)	Area (ha)	(m^3/day)	Area (ha)	(m^3/day)	(m^3/day)
Stage 1a (SW Monofill)	50 x 100 Area = 5,000	m^2							
	0.5	ha	0.5	3.8	-	0	-	0	**3.8**
Stages 1 & 2 (SW Monofill)	27,000	m^2							
	2.7	ha	0.5	3.8	1.2	5.5	1.0	2.7	**12.0**
Stages 3 & 4 (SW Monofill)	2.7 +1.45 = 4.15	ha	0.5	3.8	1.55	7.1	2.1	5.6	**16.6**
Stages 1 & 2 (NE Monofill)	0.5 + 1.54 = 2.04	ha	0.5	3.8	1.04	4.8	0.5	1.3	**10.0**
Long Term (All Monofill Stages)	6.2	ha	0	0.0	0	0.0	6.2	16.7	**16.7**

As the monofill increases with size, the buffering capacity of the site increases, and daily averages should be more accurate. At the start of filling, the entire site is operational over 0.5*ha* and exposed to a single heavy rainfall event. Hence, the above estimates need to be interpreted with caution and allowance for unforeseen events (heavy rainfall and maximum operational area). Seasonal influences can be very strong, with higher flows often in winter (June to November) and lower flows in summer (notwithstanding any extreme climatic event, e.g. the high rainfall and cyclone events that occurred in January through February 2023).

The site should be designed to accommodate the following leachate flows during the operation of both monofill areas in any sequence:

- Year 1 – 4m^3/day with peak of 12m^3/day over three days
- Year 5 – 17m^3/day with peak of 30m^3/day over three days
- Year 10 – 27m^3/day with peak of 50m^3/day over three days
  Long-term flow rate estimate at 17m^3/day (combined monofills)

10. Conclusions and Recommendations

The monofill waste lysimeter trials were sustained for some eight weeks, allowing for appropriate flushing to mimic rainfall waters through a column of representative wastes (from National Steel's materials recovery processes). Regular sampling and analytical testing were carried out across the trial period, specifically concentrating on the parameters of specific concern, i.e. PFAS, zinc, ethylene glycol, lead and nickel.

Previous investigation works by others (Tonkin and Taylor, 2019) reported zinc and ethylene glycol as the highest concentrations in both the SPLP and TCLP analyses. The concentrations of zinc, nickel, and lead were reported to exceed Class 2 landfill criteria in the results of the TCLP analyses. A conclusion of this previous work was that unless pre-treatment, which could potentially include stabilisation, can be demonstrated to sufficiently reduce zinc concentrations, a new monofill will need to be engineered to mitigate zinc discharges, e.g. appropriate lining (as a minimum).

Zinc levels were found to be comparably higher than the Tonkin and Taylor (2019) results during the initial flush (Stage 1) conditions. During ongoing leaching conditions (Stage 2), zinc concentrations showed to be below the $1mg/\ell$ threshold for a Class 2 and/or Class 3 landfill, with levels from $0.67mg/\ell$ to $0.83mg/\ell$.

PFAS levels were detected from the wastes under initial flush conditions (Stage 1). However, under long-term leaching conditions (Stage 2), showed to be below recreational water quality levels as well as below levels reported in the Ecological Freshwater Guideline PFAS Management Plan HEPA (PFAS Management Plan: Heads of EPA's Australian and New Zealand (HEPA), January 2018) (PDP, 2019). Whilst found not to be a current concern, PFAS checks could be carried out on samples from the site in the future as part of the monitoring protocol.

Leachate quality predictions and estimated flows are provided in this report for the proposed life of the monofill operations. Extreme weather events can significantly alter these figures. Therefore, an operational plan should be closely followed to ensure that rainfall ingress is minimised throughout the operational phase of the monofill.

The lysimeter trials have demonstrated the importance of scale whereby laboratory scale has been increased to pilot-plant scale magnitude, with representativity of the wastes and equatable environmental conditions. Indeed, the initial results for some parameters of concern showed to be similar to the findings by others – wherein the SPLP test results were found to be comparable. The water effluent (leachate) quality concentrations for the parameters of particular concern (PFAS, zinc, ethylene glycol, lead and nickel levels) have shown to be below the concentration thresholds for Class 2 and Class 3 landfills. The lysimeter trials demonstrated long-term leaching conditions for the combined range of analytical results of samples. Zinc levels during the initial flush life phase of the monofill will be elevated. Additionally, the nature of the wastes that are to be disposed, or stored for a lengthy period in the proposed monofill are definably 'non-putrescible industrial/commercial wastes' (WasteMINZ, 2023).

In conclusion, a Class 2 landfill lining system is recommended for a proposed monofill facility on the Green Steel site at 61 Hampton Downs Road, Hampton Downs, Waikato.

Predicted leachate quality parameters and quantities are provided in this report to calculate environmental loadings.

Yours faithfully

LINDSAY STRACHAN CPEng.
Senior Engineer
EARTHTECH CONSULTING LTD

A H NELSON CPEng.
Principal Geotechnical Engineer
EARTHTECH CONSULTING LTD

Encls: Table 2 – National Steel's Monofill Waste Lysimeter Trials Analytical Results
Lysimeter Establishment Presentation
Full Laboratory Results for LS-1, LS-2, LS-3 and LS-4 Samples
Tonkin and Taylor (2019) Report

References

Eurofins (2021) *Eurofins Environmental Testing - PFAS Analysis in New Zealand*. environment.eurofins.com.au

Eberle (2021) Remediation Journal - Evaluation of the effects of PFAS soil adsorption and transformation in the presence of divalent cations under ambient conditions, and https://regenesis.com/wp-content/uploads/2021/10/2021_McGregor-Zhao_PFAS-TCE_rem.21675.pdf (2021)

PDP (2019) HEPA (PFAS Management Plan: Heads of EPA's Australian and New Zealand (HEPA), January 2018). From Pattle Delamore Partners (2019) report on PFAS (https://www.mfe.govt.nz/sites/default/files/media/Land/woodbourne-csir-2019-part-1.pdf)

Tonkin and Taylor (2019) *Characterisation testing of shredding wastes.* Report submitted to Mr Vipan Garg, National Steel, 19 February 2019. Tonkin and Taylor, Job No: 1004057.0000.

WasteMINZ (2023) *Technical Guidelines for Disposal to Land*. Waste Management Institute New Zealand (WasteMINZ), Revision 3.1, September 2023.

Table 2: National Steel's Monofill Waste Lysimeter Trials Analytical Results

Leachate Lysimeter Apparatus and Experimentation

Establishment on Wednesday 27 January 2021 at National Steel's Yard

Parameter	Units	T&T (2019) Results		MONOFILL WASTE LYSIMETER TRIALS – Initial Flush (Stage 1): Result L1-1 (Eurofins Ref.: Sample 1)	Initial Flush (Stage 1): Result L1-2 (Eurofins Ref.: Sample 2)	Leaching Conditions (Stage 2): Result L1-3 (Eurofins Ref.: L1)	Leaching Conditions (Stage 2): Result L1-4 (Eurofins Ref.: L2)	Class 1 Landfill	Class 2 Landfill	Class 3 Landfill	Freshwater Trigger	Drinking Water+	Recreational Water Quality++	Ecological Freshwater Guideline - 99% Ecosystem Protection*	Ecological Freshwater Guideline - 95% Ecosystem Protection*	Ecological Freshwater Guideline - 90% Ecosystem Protection*
		SPLP	TCLP													
Dates				**3-Feb-21**	**11-Feb-21**	**9-Mar-21**	**23-Mar-21**									
pH	-	8.0		7.0	7.1	7.3	7.2	5.9 – 8.5	5.9 – 8.3	>6.5pH<8.5						
PFAS (Sum)	µg/l	not tested		0.665	0.682	<0.1	<0.1	no limit	no limit	no limit						
Sum (PFHxS + PFOS)	µg/l	not tested		0.082	0.114	<0.1	<0.1	no limit	no limit	no limit		0.070	2.0			
PFOA (Sum)	µg/l	not tested		0.133	0.142	<0.1	<0.1	no limit	no limit	no limit		0.560	10.0	19.0	220	632
Total PFOS	µg/l	not tested		0.192	0.234	<0.1	<0.1	no limit	no limit	no limit				0.00023	0.130	2.0
Boron (B)	mg/l	0.670	1.010	5.0	4.3	0.640	0.820	20.0	2.0	2.0						
Chromium (Cr)	mg/l	0.018	<0.011	0.048	0.022	0.002	0.003	5.0	1.0	0.5						
Copper (Cu)	mg/l	0.129	0.139	0.230	0.150	0.003	0.002	5.0	0.5	0.5						
Iron (Fe)	mg/l	not tested	not tested	47.0	25.0	<0.05	<0.05	no limit	no limit	no limit						
Lead (Pb)	mg/l	0.087	1.070	0.220	0.190	0.024	0.180	5.0	1.0	0.5	0.0034					
Manganese (Mn)	mg/l	not tested	not tested	4.1	3.0	0.110	0.190	no limit	no limit	no limit						
Nickel (Ni)	mg/l	0.050	1.880	0.320	0.190	0.001	0.002	10.0	1.0	1.0	0.011					
Zinc (Zn)	mg/l	5.60	73.00	5.2	16.0	0.670	0.830	10.0	1.0	1.0	0.008					
Ethylene glycol	mg/l	123.0	100.0	<20	<20	<20	<20	no limit	no limit	no limit	0.33					
Chemical Oxygen Demand (COD)	mg/l	not tested	not tested	2,000	1,300	86	280	no limit	no limit	no limit						

Notes:
+ MOH (Ministry of Health - MoH, 2017)
++ AGNHMRC (Australian Govt Health and Medical Research Council (2019)
* HEPA - PFAS Management Plan: Heads of EPA's Australian and New Zealand (HEPA) (Jan, 2018)
Concentration limits for Class 1, 2 and 3 landfills refer to maximum allowable TCLP concentrations
[yellow] Denotes where a Class 1 Landfill limit is exceeded

GREEN STEEL MONOFILL

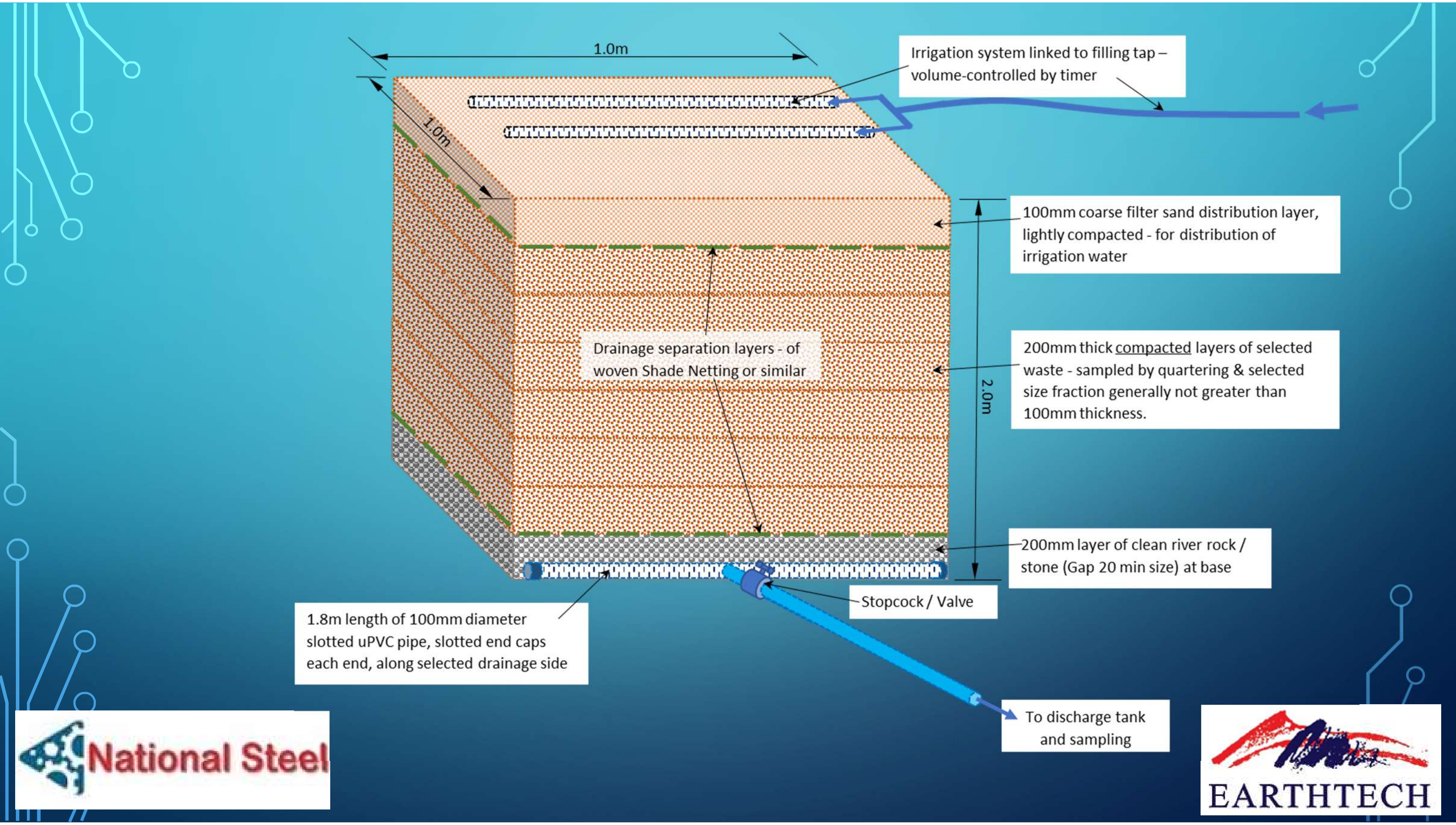
61 HAMPTON DOWNS ROAD, HAMPTON DOWNS, WAIKATO

Leachate Lysimeter Apparatus Establishment

27 JANUARY 2021

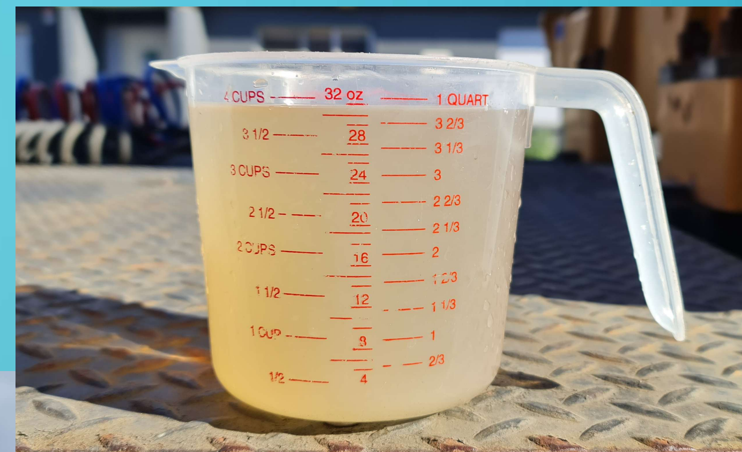
National Steel

EARTHTECH


1.0m
1.0m
2.0m
Irrigation system linked to filling tap – volume-controlled by timer
100mm coarse filter sand distribution layer, lightly compacted - for distribution of irrigation water
Drainage separation layers - of woven Shade Netting or similar
200mm thick compacted layers of selected waste - sampled by quartering & selected size fraction generally not greater than 100mm thickness.
200mm layer of clean river rock / stone (Gap 20 min size) at base
Stopcock / Valve
1.8m length of 100mm diameter slotted uPVC pipe, slotted end caps each end, along selected drainage side
To discharge tank and sampling
National Steel
EARTHTECH

National Steel





4 CUPS
32 oz
1 QUART
3 1/2
28
3 CUPS
24
2 1/2
20
2 CUPS
16
1 1/2
12
1 CUP
8
1/2
4

PFOS/PFOA/Fluorotelomers
Client: NATIONAL STEEL
Ref: 4197
Sample ID: "L2" LYSIMETER
Date/Time: 23/03/2021
Inorganics
Client: NATIONAL STEEL
Ref: 4197
Semi-Volatile Organics
Client: NATIONAL STEEL
Sample ID: "L2" LYSIMETER
Date/Time: 23/03/2021
Preserved Inorganics
Client: NATIONAL STEEL
Sample ID: "L2"
Date/Time: 23/03/2021
Metals

eurofins | Environment Testing

Certificate of Analysis

National Steel Ltd
29 Hobill Avenue
Wiri Maukau Auckland
NZ 2104

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection and proficiency testing scheme providers reports.

Attention: **Brett Howlett**

Report **782420-W_INT**
Project name
Project ID 4197
Received Date Mar 24, 2021

Client Sample ID			**L1**	**L2**
Sample Matrix			**Water**	**Water**
Eurofins Sample No.			**K21-Ma43216**	**K21-Ma43217**
Date Sampled			**Mar 09, 2021**	**Mar 23, 2021**
Test/Reference	LOR	Unit		
Volatile Organics				
1.1-Dichloroethane	0.001	mg/L	< 0.001	< 0.001
1.1-Dichloroethene	0.001	mg/L	< 0.001	< 0.001
1.1.1-Trichloroethane	0.001	mg/L	< 0.001	< 0.001
1.1.1.2-Tetrachloroethane	0.001	mg/L	< 0.001	< 0.001
1.1.2-Trichloroethane	0.001	mg/L	< 0.001	< 0.001
1.1.2.2-Tetrachloroethane	0.001	mg/L	< 0.001	< 0.001
1.2-Dibromoethane	0.001	mg/L	< 0.001	< 0.001
1.2-Dichlorobenzene	0.001	mg/L	< 0.001	< 0.001
1.2-Dichloroethane	0.001	mg/L	< 0.001	< 0.001
1.2-Dichloropropane	0.001	mg/L	< 0.001	< 0.001
1.2.3-Trichloropropane	0.001	mg/L	< 0.001	< 0.001
1.2.4-Trimethylbenzene	0.001	mg/L	< 0.001	0.003
1.3-Dichlorobenzene	0.001	mg/L	< 0.001	< 0.001
1.3-Dichloropropane	0.001	mg/L	< 0.001	< 0.001
1.3.5-Trimethylbenzene	0.001	mg/L	< 0.001	< 0.001
1.4-Dichlorobenzene	0.001	mg/L	< 0.001	< 0.001
2-Butanone (MEK)	0.001	mg/L	< 0.001	< 0.001
2-Propanone (Acetone)	0.001	mg/L	0.009	0.049
4-Chlorotoluene	0.001	mg/L	< 0.001	< 0.001
4-Methyl-2-pentanone (MIBK)	0.001	mg/L	< 0.001	0.004
Allyl chloride	0.001	mg/L	< 0.001	< 0.001
Benzene	0.001	mg/L	< 0.001	0.001
Bromobenzene	0.001	mg/L	< 0.001	< 0.001
Bromochloromethane	0.001	mg/L	< 0.001	< 0.001
Bromodichloromethane	0.001	mg/L	< 0.001	< 0.001
Bromoform	0.001	mg/L	< 0.001	< 0.001
Bromomethane	0.001	mg/L	< 0.001	< 0.001
Carbon disulfide	0.001	mg/L	< 0.001	< 0.001
Carbon Tetrachloride	0.001	mg/L	< 0.001	< 0.001
Chlorobenzene	0.001	mg/L	< 0.001	< 0.001
Chloroethane	0.001	mg/L	< 0.001	< 0.001
Chloroform	0.005	mg/L	< 0.005	< 0.005
Chloromethane	0.001	mg/L	< 0.001	< 0.001
cis-1.2-Dichloroethene	0.001	mg/L	< 0.001	< 0.001
cis-1.3-Dichloropropene	0.001	mg/L	< 0.001	< 0.001

eurofins

Environment Testing

Client Sample ID			L1	L2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Ma43216	K21-Ma43217
Date Sampled			Mar 09, 2021	Mar 23, 2021
Test/Reference	LOR	Unit		
Volatile Organics				
Dibromochloromethane	0.001	mg/L	< 0.001	< 0.001
Dibromomethane	0.001	mg/L	< 0.001	< 0.001
Dichlorodifluoromethane	0.001	mg/L	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	0.002
Iodomethane	0.001	mg/L	< 0.001	< 0.001
Isopropyl benzene (Cumene)	0.001	mg/L	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	0.005
Methylene Chloride	0.001	mg/L	0.001	0.006
o-Xylene	0.001	mg/L	< 0.001	0.004
Styrene	0.001	mg/L	< 0.001	< 0.001
Tetrachloroethene	0.001	mg/L	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	0.009
trans-1.2-Dichloroethene	0.001	mg/L	< 0.001	< 0.001
trans-1.3-Dichloropropene	0.001	mg/L	< 0.001	< 0.001
Trichloroethene	0.001	mg/L	< 0.001	< 0.001
Trichlorofluoromethane	0.001	mg/L	0.009	0.017
Vinyl chloride	0.001	mg/L	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	0.010
Total MAH*	0.003	mg/L	< 0.003	0.021
Vic EPA IWRG 621 CHC (Total)*	0.005	mg/L	< 0.005	0.006
Vic EPA IWRG 621 Other CHC (Total)*	0.005	mg/L	< 0.005	0.006
4-Bromofluorobenzene (surr.)	1	%	106	110
Toluene-d8 (surr.)	1	%	92	111
Glycols*				
Di-Ethylene Glycol*	20	mg/L	< 20	< 20
Ethylene glycol*	20	mg/L	< 20	< 20
Propylene glycol*	20	mg/L	< 20	< 20
Triethylene glycol*	20	mg/L	< 20	< 20
Polychlorinated Biphenyls				
Aroclor-1016	0.001	mg/L	< 0.001	< 0.001
Aroclor-1221	0.001	mg/L	< 0.001	< 0.001
Aroclor-1232	0.001	mg/L	< 0.001	< 0.001
Aroclor-1242	0.001	mg/L	< 0.001	< 0.001
Aroclor-1248	0.001	mg/L	< 0.001	< 0.001
Aroclor-1254	0.001	mg/L	< 0.001	< 0.001
Aroclor-1260	0.001	mg/L	< 0.001	< 0.001
Total PCB*	0.001	mg/L	< 0.001	< 0.001
Dibutylchlorendate (surr.)	1	%	127	94
Tetrachloro-m-xylene (surr.)	1	%	109	107
Total Petroleum Hydrocarbons (NZ MfE 1999)				
TPH-SG C7-C9	0.1	mg/L	< 0.1	< 0.1
TPH-SG C10-C14	0.2	mg/L	< 0.2	< 0.2
TPH-SG C15-C36	0.4	mg/L	< 0.4	< 0.4
TPH-SG C7-C36 (Total)	0.7	mg/L	< 0.7	< 0.7
Semivolatile Organics				
2-Methyl-4.6-dinitrophenol	0.03	mg/L	< 0.03	< 0.03
1-Chloronaphthalene	0.005	mg/L	< 0.005	< 0.005
1-Naphthylamine	0.005	mg/L	< 0.005	< 0.005
1.2-Dichlorobenzene	0.005	mg/L	< 0.005	< 0.005

Client Sample ID			L1	L2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Ma43216	K21-Ma43217
Date Sampled			Mar 09, 2021	Mar 23, 2021
Test/Reference	LOR	Unit		
Semivolatile Organics				
1.2.3-Trichlorobenzene	0.005	mg/L	< 0.005	< 0.005
1.2.3.4-Tetrachlorobenzene	0.005	mg/L	< 0.005	< 0.005
1.2.3.5-Tetrachlorobenzene	0.005	mg/L	< 0.005	< 0.005
1.2.4-Trichlorobenzene	0.005	mg/L	< 0.005	< 0.005
1.2.4.5-Tetrachlorobenzene	0.005	mg/L	< 0.005	< 0.005
1.3-Dichlorobenzene	0.005	mg/L	< 0.005	< 0.005
1.3.5-Trichlorobenzene	0.005	mg/L	< 0.005	< 0.005
1.4-Dichlorobenzene	0.005	mg/L	< 0.005	< 0.005
2-Chloronaphthalene	0.005	mg/L	< 0.005	< 0.005
2-Chlorophenol	0.003	mg/L	< 0.003	< 0.003
2-Methylnaphthalene	0.005	mg/L	< 0.005	< 0.005
2-Methylphenol (o-Cresol)	0.003	mg/L	< 0.003	< 0.003
2-Naphthylamine	0.005	mg/L	< 0.005	< 0.005
2-Nitroaniline	0.005	mg/L	< 0.005	< 0.005
2-Nitrophenol	0.01	mg/L	< 0.01	< 0.01
2-Picoline	0.005	mg/L	< 0.005	< 0.005
2.3.4.6-Tetrachlorophenol	0.01	mg/L	< 0.01	< 0.01
2.4-Dichlorophenol	0.003	mg/L	< 0.003	< 0.003
2.4-Dimethylphenol	0.003	mg/L	< 0.003	< 0.003
2.4-Dinitrophenol	0.03	mg/L	< 0.03	< 0.03
2.4-Dinitrotoluene	0.005	mg/L	< 0.005	< 0.005
2.4.5-Trichlorophenol	0.01	mg/L	< 0.01	< 0.01
2.4.6-Trichlorophenol	0.01	mg/L	< 0.01	< 0.01
2.6-Dichlorophenol	0.003	mg/L	< 0.003	< 0.003
2.6-Dinitrotoluene	0.005	mg/L	< 0.005	< 0.005
3&4-Methylphenol (m&p-Cresol)	0.006	mg/L	< 0.006	0.008
3-Methylcholanthrene	0.005	mg/L	< 0.005	< 0.005
3.3'-Dichlorobenzidine	0.005	mg/L	< 0.005	< 0.005
4-Aminobiphenyl	0.005	mg/L	< 0.005	< 0.005
4-Bromophenyl phenyl ether	0.005	mg/L	< 0.005	< 0.005
4-Chloro-3-methylphenol	0.01	mg/L	< 0.01	< 0.01
4-Chlorophenyl phenyl ether	0.005	mg/L	< 0.005	< 0.005
4-Nitrophenol	0.03	mg/L	< 0.03	< 0.03
4.4'-DDD	0.005	mg/L	< 0.005	< 0.005
4.4'-DDE	0.005	mg/L	< 0.005	< 0.005
4.4'-DDT	0.005	mg/L	< 0.005	< 0.005
7.12-Dimethylbenz(a)anthracene	0.005	mg/L	< 0.005	< 0.005
a-BHC	0.005	mg/L	< 0.005	< 0.005
Acenaphthene	0.001	mg/L	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001
Acetophenone	0.005	mg/L	< 0.005	< 0.005
Aldrin	0.005	mg/L	< 0.005	< 0.005
Aniline	0.005	mg/L	< 0.005	< 0.005
Anthracene	0.001	mg/L	< 0.001	< 0.001
b-BHC	0.005	mg/L	< 0.005	< 0.005
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001

Client Sample ID			L1	L2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Ma43216	K21-Ma43217
Date Sampled			Mar 09, 2021	Mar 23, 2021
Test/Reference	LOR	Unit		
Semivolatile Organics				
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001
Benzyl chloride	0.005	mg/L	< 0.005	< 0.005
Bis(2-chloroethoxy)methane	0.005	mg/L	< 0.005	< 0.005
Bis(2-chloroisopropyl)ether	0.005	mg/L	< 0.005	< 0.005
Bis(2-ethylhexyl)phthalate	0.005	mg/L	< 0.005	< 0.005
Butyl benzyl phthalate	0.005	mg/L	< 0.005	< 0.005
Chrysene	0.001	mg/L	< 0.001	< 0.001
d-BHC	0.005	mg/L	< 0.005	< 0.005
Di-n-butyl phthalate	0.005	mg/L	< 0.005	< 0.005
Di-n-octyl phthalate	0.005	mg/L	< 0.005	< 0.005
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001
Dibenz(a.j)acridine	0.005	mg/L	< 0.005	< 0.005
Dibenzofuran	0.005	mg/L	< 0.005	< 0.005
Dieldrin	0.005	mg/L	< 0.005	< 0.005
Diethyl phthalate	0.005	mg/L	< 0.005	< 0.005
Dimethyl phthalate	0.005	mg/L	< 0.005	< 0.005
Dimethylaminoazobenzene	0.005	mg/L	< 0.005	< 0.005
Diphenylamine	0.005	mg/L	< 0.005	< 0.005
Endosulfan I	0.005	mg/L	< 0.005	< 0.005
Endosulfan II	0.005	mg/L	< 0.005	< 0.005
Endosulfan sulphate	0.005	mg/L	< 0.005	< 0.005
Endrin	0.005	mg/L	< 0.005	< 0.005
Endrin aldehyde	0.005	mg/L	< 0.005	< 0.005
Endrin ketone	0.005	mg/L	< 0.005	< 0.005
Fluoranthene	0.001	mg/L	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001
g-BHC (Lindane)	0.005	mg/L	< 0.005	< 0.005
Heptachlor	0.005	mg/L	< 0.005	< 0.005
Heptachlor epoxide	0.005	mg/L	< 0.005	< 0.005
Hexachlorobenzene	0.005	mg/L	< 0.005	< 0.005
Hexachlorobutadiene	0.005	mg/L	< 0.005	< 0.005
Hexachlorocyclopentadiene	0.005	mg/L	< 0.005	< 0.005
Hexachloroethane	0.005	mg/L	< 0.005	< 0.005
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001
Methoxychlor	0.005	mg/L	< 0.005	< 0.005
N-Nitrosodibutylamine	0.005	mg/L	< 0.005	< 0.005
N-Nitrosodipropylamine	0.005	mg/L	< 0.005	< 0.005
N-Nitrosopiperidine	0.005	mg/L	< 0.005	< 0.005
Naphthalene	0.001	mg/L	< 0.001	< 0.001
Nitrobenzene	0.005	mg/L	< 0.005	< 0.005
Pentachlorobenzene	0.005	mg/L	< 0.005	< 0.005
Pentachloronitrobenzene	0.005	mg/L	< 0.005	< 0.005
Pentachlorophenol	0.01	mg/L	< 0.01	< 0.01
Phenanthrene	0.001	mg/L	< 0.001	< 0.001
Phenol	0.003	mg/L	< 0.003	0.004
Pronamide	0.005	mg/L	< 0.005	< 0.005
Pyrene	0.001	mg/L	< 0.001	< 0.001
Trifluralin	0.005	mg/L	< 0.005	< 0.005
Phenol-d6 (surr.)	1	%	25	60

Client Sample ID			L1	L2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Ma43216	K21-Ma43217
Date Sampled			Mar 09, 2021	Mar 23, 2021
Test/Reference	LOR	Unit		
Semivolatile Organics				
Nitrobenzene-d5 (surr.)	1	%	72	58
2-Fluorobiphenyl (surr.)	1	%	60	84
2.4.6-Tribromophenol (surr.)	1	%	27	84
Chemical Oxygen Demand (filtered)	20	mg/L	86	280
pH (at 25 °C)	0.1	pH Units	7.3	7.2
Metals M22 (NZ MfE)				
Aluminium	0.05	mg/L	< 0.05	< 0.05
Antimony	0.005	mg/L	0.024	0.008
Arsenic	0.001	mg/L	0.082	0.053
Barium	0.02	mg/L	< 0.02	< 0.02
Beryllium	0.001	mg/L	< 0.001	< 0.001
Boron	0.05	mg/L	0.64	0.82
Cadmium	0.0002	mg/L	0.26	0.43
Chromium	0.001	mg/L	0.002	0.003
Cobalt	0.001	mg/L	0.031	0.053
Copper	0.001	mg/L	0.003	0.002
Iron	0.05	mg/L	< 0.05	< 0.05
Lead	0.001	mg/L	0.024	0.18
Manganese	0.005	mg/L	0.11	0.19
Mercury	0.0001	mg/L	0.0002	0.0004
Molybdenum	0.005	mg/L	< 0.005	< 0.005
Nickel	0.001	mg/L	0.001	0.002
Selenium	0.001	mg/L	< 0.001	< 0.001
Silver	0.005	mg/L	< 0.005	< 0.005
Thallium	0.005	mg/L	< 0.005	< 0.005
Tin	0.005	mg/L	< 0.005	< 0.005
Vanadium	0.005	mg/L	0.13	11
Zinc	0.005	mg/L	0.67	0.83
PFASs Summations				
Comments			G01	G01
Sum (PFHxS + PFOS)*	0.001	ug/L	< 0.1	< 0.1
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	< 0.1	< 0.1
Sum of PFASs (n=30)*	0.005	ug/L	< 0.1	< 0.1
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	< 0.1	< 0.1
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	< 0.1	< 0.1
Perfluoroalkyl sulfonamido substances- Trace				
Comments			G01	G01
Perfluorooctane sulfonamide (FOSA)[N11]	0.005	ug/L	< 0.1	< 0.1
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)[N11]	0.005	ug/L	< 0.1	< 0.1
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)[N11]	0.005	ug/L	< 0.1	< 0.1
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)[N11]	0.005	ug/L	< 0.1	< 0.1
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)[N11]	0.005	ug/L	< 0.1	< 0.1
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)[N11]	0.005	ug/L	< 0.1	< 0.1
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)[N11]	0.005	ug/L	< 0.1	< 0.1
13C8-FOSA (surr.)	1	%	116	124

Client Sample ID			L1	L2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Ma43216	K21-Ma43217
Date Sampled			Mar 09, 2021	Mar 23, 2021
Test/Reference	LOR	Unit		
Perfluoroalkyl sulfonamido substances- Trace				
D3-N-MeFOSA (surr.)	1	%	128	143
D5-N-EtFOSA (surr.)	1	%	138	146
D7-N-MeFOSE (surr.)	1	%	134	146
D9-N-EtFOSE (surr.)	1	%	153	156
D5-N-EtFOSAA (surr.)	1	%	117	153
D3-N-MeFOSAA (surr.)	1	%	128	162
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				
Comments			G01	G01
Perfluorobutanoic acid (PFBA)[N11]	0.005	ug/L	< 0.1	< 0.1
Perfluoropentanoic acid (PFPeA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorohexanoic acid (PFHxA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluoroheptanoic acid (PFHpA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorooctanoic acid (PFOA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorononanoic acid (PFNA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorodecanoic acid (PFDA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorotridecanoic acid (PFTrDA)[N15]	0.001	ug/L	< 0.1	< 0.1
Perfluoroundecanoic acid (PFUnDA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorododecanoic acid (PFDoDA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorotetradecanoic acid (PFTeDA)[N11]	0.001	ug/L	< 0.1	< 0.1
13C4-PFBA (surr.)	1	%	109	124
13C5-PFPeA (surr.)	1	%	138	143
13C5-PFHxA (surr.)	1	%	139	152
13C4-PFHpA (surr.)	1	%	134	141
13C8-PFOA (surr.)	1	%	124	139
13C5-PFNA (surr.)	1	%	122	126
13C6-PFDA (surr.)	1	%	121	132
13C2-PFUnDA (surr.)	1	%	133	136
13C2-PFDoDA (surr.)	1	%	117	147
13C2-PFTeDA (surr.)	1	%	149	162
Perfluoroalkyl sulfonic acids (PFSAs)- Trace				
Comments			G01	G01
Perfluorobutanesulfonic acid (PFBS)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorononanesulfonic acid (PFNS)[N15]	0.001	ug/L	< 0.1	< 0.1
Perfluoropropanesulfonic acid (PFPrS)[N15]	0.001	ug/L	< 0.1	< 0.1
Perfluoropentanesulfonic acid (PFPeS)[N15]	0.001	ug/L	< 0.1	< 0.1
Perfluorohexanesulfonic acid (PFHxS)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluoroheptanesulfonic acid (PFHpS)[N15]	0.001	ug/L	< 0.1	< 0.1
Perfluorooctanesulfonic acid (PFOS)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorodecanesulfonic acid (PFDS)[N15]	0.001	ug/L	< 0.1	< 0.1
13C3-PFBS (surr.)	1	%	121	125
18O2-PFHxS (surr.)	1	%	110	122
13C8-PFOS (surr.)	1	%	91	107

Environment Testing

Client Sample ID			L1	L2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Ma43216	K21-Ma43217
Date Sampled			Mar 09, 2021	Mar 23, 2021
Test/Reference	LOR	Unit		
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace				
Comments			G01	G01
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)[N11]	0.001	ug/L	< 0.1	< 0.1
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)[N11]	0.005	ug/L	< 0.1	< 0.1
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)[N11]	0.001	ug/L	< 0.1	< 0.1
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)[N11]	0.001	ug/L	< 0.1	< 0.1
13C2-4:2 FTS (surr.)	1	%	132	144
13C2-6:2 FTSA (surr.)	1	%	167	INT
13C2-8:2 FTSA (surr.)	1	%	109	133
13C2-10:2 FTSA (surr.)	1	%	139	INT

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Volatile Organics	Melbourne	Apr 08, 2021	7 Days
- Method: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices (USEPA 8260)			
Glycols*	Melbourne	Apr 08, 2021	7 Days
- Method: GLYCOLS- US EPA SW846 METHOD 8000 GC-FID.			
Polychlorinated Biphenyls	Melbourne	Apr 08, 2021	7 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water (USEPA 8082)			
Total Petroleum Hydrocarbons (NZ MfE 1999)	Melbourne	Apr 08, 2021	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Semivolatile Organics	Melbourne	Apr 08, 2021	7 Days
- Method: LTM-ORG-2190 SVOC in Water & Soil by GC-MS			
Chemical Oxygen Demand (filtered)	Melbourne	Apr 08, 2021	28 Days
- Method: LTM-INO-4220 Determination of COD in Water			
pH (at 25 °C)	Melbourne	Apr 08, 2021	0 Hours
- Method: LTM-GEN-7090 pH in water by ISE			
Metals M22 (NZ MfE)	Melbourne	Apr 08, 2021	6 Months
- Method: LTM-MET-3040 Metals in Waters Soils Sediments by ICP-MS			
Per- and Polyfluoroalkyl Substances (PFASs) - Trace			
Perfluoroalkyl sulfonamido substances- Trace	Brisbane	Mar 26, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS) - low level			
Perfluoroalkyl carboxylic acids (PFCAs) - Trace	Brisbane	Mar 26, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS) - low level			
Perfluoroalkyl sulfonic acids (PFSAs)- Trace	Brisbane	Mar 26, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS) - low level			
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace	Brisbane	Mar 26, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS) - low level			

Company Name:	National Steel Ltd	**Order No.:**		**Received:**	Mar 24, 2021 11:30 AM
Address:	29 Hobill Avenue Wiri Maukau Auckland NZ 2104	**Report #:**	782420	**Due:**	Mar 31, 2021
		Phone:	021 704 000	**Priority:**	5 Day
		Fax:		**Contact Name:**	Brett Howlett
Project Name:					
Project ID:	4197				

Eurofins Analytical Services Manager : Swati Shahaney

Sample Detail						Chemical Oxygen Demand (filtered)	pH (at 25 °C)	Glycols*	Polychlorinated Biphenyls	Volatile Organics	Total Petroleum Hydrocarbons (NZ MfE 1999)	Semivolatile Organics	Metals M22 (NZ MfE)	Per- and Polyfluoroalkyl Substances (PFASs) - Trace
Auckland Laboratory - IANZ# 1327														
Christchurch Laboratory - IANZ# 1290														
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X	X	
Brisbane Laboratory - NATA Site # 20794														X
External Laboratory														
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**									
1	L1	Mar 09, 2021		Water	K21-Ma43216	X	X	X	X	X	X	X	X	X
2	L2	Mar 23, 2021		Water	K21-Ma43217	X	X	X	X	X	X	X	X	X
Test Counts						2	2	2	2	2	2	2	2	2

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Environment Testing

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Volatile Organics							
1.1-Dichloroethane	mg/L	< 0.001			0.001	Pass	
1.1-Dichloroethene	mg/L	< 0.001			0.001	Pass	
1.1.1-Trichloroethane	mg/L	< 0.001			0.001	Pass	
1.1.1.2-Tetrachloroethane	mg/L	< 0.001			0.001	Pass	
1.1.2-Trichloroethane	mg/L	< 0.001			0.001	Pass	
1.1.2.2-Tetrachloroethane	mg/L	< 0.001			0.001	Pass	
1.2-Dibromoethane	mg/L	< 0.001			0.001	Pass	
1.2-Dichlorobenzene	mg/L	< 0.001			0.001	Pass	
1.2-Dichloroethane	mg/L	< 0.001			0.001	Pass	
1.2-Dichloropropane	mg/L	< 0.001			0.001	Pass	
1.2.3-Trichloropropane	mg/L	< 0.001			0.001	Pass	
1.2.4-Trimethylbenzene	mg/L	< 0.001			0.001	Pass	
1.3-Dichlorobenzene	mg/L	< 0.001			0.001	Pass	
1.3-Dichloropropane	mg/L	< 0.001			0.001	Pass	
1.3.5-Trimethylbenzene	mg/L	< 0.001			0.001	Pass	
1.4-Dichlorobenzene	mg/L	< 0.001			0.001	Pass	
2-Butanone (MEK)	mg/L	< 0.001			0.001	Pass	
2-Propanone (Acetone)	mg/L	< 0.001			0.001	Pass	
4-Chlorotoluene	mg/L	< 0.001			0.001	Pass	
4-Methyl-2-pentanone (MIBK)	mg/L	< 0.001			0.001	Pass	
Allyl chloride	mg/L	< 0.001			0.001	Pass	
Benzene	mg/L	< 0.001			0.001	Pass	
Bromobenzene	mg/L	< 0.001			0.001	Pass	
Bromochloromethane	mg/L	< 0.001			0.001	Pass	
Bromodichloromethane	mg/L	< 0.001			0.001	Pass	
Bromoform	mg/L	< 0.001			0.001	Pass	
Bromomethane	mg/L	< 0.001			0.001	Pass	
Carbon disulfide	mg/L	< 0.001			0.001	Pass	
Carbon Tetrachloride	mg/L	< 0.001			0.001	Pass	
Chlorobenzene	mg/L	< 0.001			0.001	Pass	
Chloroethane	mg/L	< 0.001			0.001	Pass	
Chloroform	mg/L	< 0.005			0.005	Pass	
Chloromethane	mg/L	< 0.001			0.001	Pass	
cis-1.2-Dichloroethene	mg/L	< 0.001			0.001	Pass	
cis-1.3-Dichloropropene	mg/L	< 0.001			0.001	Pass	
Dibromochloromethane	mg/L	< 0.001			0.001	Pass	
Dibromomethane	mg/L	< 0.001			0.001	Pass	
Dichlorodifluoromethane	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
Iodomethane	mg/L	< 0.001			0.001	Pass	
Isopropyl benzene (Cumene)	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
Methylene Chloride	mg/L	< 0.001			0.001	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Styrene	mg/L	< 0.001			0.001	Pass	
Tetrachloroethene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
trans-1.2-Dichloroethene	mg/L	< 0.001			0.001	Pass	
trans-1.3-Dichloropropene	mg/L	< 0.001			0.001	Pass	
Trichloroethene	mg/L	< 0.001			0.001	Pass	

eurofins Environment Testing

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Trichlorofluoromethane	mg/L	< 0.001			0.001	Pass	
Vinyl chloride	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
Glycols*							
Di-Ethylene Glycol*	mg/L	< 20			20	Pass	
Ethylene glycol*	mg/L	< 20			20	Pass	
Propylene glycol*	mg/L	< 20			20	Pass	
Triethylene glycol*	mg/L	< 20			20	Pass	
Method Blank							
Polychlorinated Biphenyls							
Aroclor-1016	mg/L	< 0.001			0.001	Pass	
Aroclor-1221	mg/L	< 0.001			0.001	Pass	
Aroclor-1232	mg/L	< 0.001			0.001	Pass	
Aroclor-1242	mg/L	< 0.001			0.001	Pass	
Aroclor-1248	mg/L	< 0.001			0.001	Pass	
Aroclor-1254	mg/L	< 0.001			0.001	Pass	
Aroclor-1260	mg/L	< 0.001			0.001	Pass	
Total PCB*	mg/L	< 0.001			0.001	Pass	
Method Blank							
Total Petroleum Hydrocarbons (NZ MfE 1999)							
TPH-SG C7-C9	mg/L	< 0.1			0.1	Pass	
TPH-SG C10-C14	mg/L	< 0.2			0.2	Pass	
TPH-SG C15-C36	mg/L	< 0.4			0.4	Pass	
TPH-SG C7-C36 (Total)	mg/L	< 0.7			0.7	Pass	
Method Blank							
Semivolatile Organics							
2-Methyl-4.6-dinitrophenol	mg/L	< 0.03			0.03	Pass	
1-Chloronaphthalene	mg/L	< 0.005			0.005	Pass	
1-Naphthylamine	mg/L	< 0.005			0.005	Pass	
1.2-Dichlorobenzene	mg/L	< 0.005			0.005	Pass	
1.2.3-Trichlorobenzene	mg/L	< 0.005			0.005	Pass	
1.2.3.4-Tetrachlorobenzene	mg/L	< 0.005			0.005	Pass	
1.2.3.5-Tetrachlorobenzene	mg/L	< 0.005			0.005	Pass	
1.2.4-Trichlorobenzene	mg/L	< 0.005			0.005	Pass	
1.2.4.5-Tetrachlorobenzene	mg/L	< 0.005			0.005	Pass	
1.3-Dichlorobenzene	mg/L	< 0.005			0.005	Pass	
1.3.5-Trichlorobenzene	mg/L	< 0.005			0.005	Pass	
1.4-Dichlorobenzene	mg/L	< 0.005			0.005	Pass	
2-Chloronaphthalene	mg/L	< 0.005			0.005	Pass	
2-Chlorophenol	mg/L	< 0.003			0.003	Pass	
2-Methylnaphthalene	mg/L	< 0.005			0.005	Pass	
2-Methylphenol (o-Cresol)	mg/L	< 0.003			0.003	Pass	
2-Naphthylamine	mg/L	< 0.005			0.005	Pass	
2-Nitroaniline	mg/L	< 0.005			0.005	Pass	
2-Nitrophenol	mg/L	< 0.01			0.01	Pass	
2-Picoline	mg/L	< 0.005			0.005	Pass	
2.3.4.6-Tetrachlorophenol	mg/L	< 0.01			0.01	Pass	
2.4-Dichlorophenol	mg/L	< 0.003			0.003	Pass	
2.4-Dimethylphenol	mg/L	< 0.003			0.003	Pass	
2.4-Dinitrophenol	mg/L	< 0.03			0.03	Pass	
2.4-Dinitrotoluene	mg/L	< 0.005			0.005	Pass	
2.4.5-Trichlorophenol	mg/L	< 0.01			0.01	Pass	
2.4.6-Trichlorophenol	mg/L	< 0.01			0.01	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
2.6-Dichlorophenol	mg/L	< 0.003			0.003	Pass	
2.6-Dinitrotoluene	mg/L	< 0.005			0.005	Pass	
3&4-Methylphenol (m&p-Cresol)	mg/L	< 0.006			0.006	Pass	
3-Methylcholanthrene	mg/L	< 0.005			0.005	Pass	
3.3'-Dichlorobenzidine	mg/L	< 0.005			0.005	Pass	
4-Aminobiphenyl	mg/L	< 0.005			0.005	Pass	
4-Bromophenyl phenyl ether	mg/L	< 0.005			0.005	Pass	
4-Chloro-3-methylphenol	mg/L	< 0.01			0.01	Pass	
4-Chlorophenyl phenyl ether	mg/L	< 0.005			0.005	Pass	
4-Nitrophenol	mg/L	< 0.03			0.03	Pass	
4.4'-DDD	mg/L	< 0.005			0.005	Pass	
4.4'-DDE	mg/L	< 0.005			0.005	Pass	
4.4'-DDT	mg/L	< 0.005			0.005	Pass	
7.12-Dimethylbenz(a)anthracene	mg/L	< 0.005			0.005	Pass	
a-BHC	mg/L	< 0.005			0.005	Pass	
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Acetophenone	mg/L	< 0.005			0.005	Pass	
Aldrin	mg/L	< 0.005			0.005	Pass	
Aniline	mg/L	< 0.005			0.005	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
b-BHC	mg/L	< 0.005			0.005	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzyl chloride	mg/L	< 0.005			0.005	Pass	
Bis(2-chloroethoxy)methane	mg/L	< 0.005			0.005	Pass	
Bis(2-chloroisopropyl)ether	mg/L	< 0.005			0.005	Pass	
Bis(2-ethylhexyl)phthalate	mg/L	< 0.005			0.005	Pass	
Butyl benzyl phthalate	mg/L	< 0.005			0.005	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
d-BHC	mg/L	< 0.005			0.005	Pass	
Di-n-butyl phthalate	mg/L	< 0.005			0.005	Pass	
Di-n-octyl phthalate	mg/L	< 0.005			0.005	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.001			0.001	Pass	
Dibenz(a.j)acridine	mg/L	< 0.005			0.005	Pass	
Dibenzofuran	mg/L	< 0.005			0.005	Pass	
Dieldrin	mg/L	< 0.005			0.005	Pass	
Diethyl phthalate	mg/L	< 0.005			0.005	Pass	
Dimethyl phthalate	mg/L	< 0.005			0.005	Pass	
Dimethylaminoazobenzene	mg/L	< 0.005			0.005	Pass	
Diphenylamine	mg/L	< 0.005			0.005	Pass	
Endosulfan I	mg/L	< 0.005			0.005	Pass	
Endosulfan II	mg/L	< 0.005			0.005	Pass	
Endosulfan sulphate	mg/L	< 0.005			0.005	Pass	
Endrin	mg/L	< 0.005			0.005	Pass	
Endrin aldehyde	mg/L	< 0.005			0.005	Pass	
Endrin ketone	mg/L	< 0.005			0.005	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
g-BHC (Lindane)	mg/L	< 0.005			0.005	Pass	
Heptachlor	mg/L	< 0.005			0.005	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Heptachlor epoxide	mg/L	< 0.005			0.005	Pass	
Hexachlorobenzene	mg/L	< 0.005			0.005	Pass	
Hexachlorobutadiene	mg/L	< 0.005			0.005	Pass	
Hexachlorocyclopentadiene	mg/L	< 0.005			0.005	Pass	
Hexachloroethane	mg/L	< 0.005			0.005	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Methoxychlor	mg/L	< 0.005			0.005	Pass	
N-Nitrosodibutylamine	mg/L	< 0.005			0.005	Pass	
N-Nitrosodipropylamine	mg/L	< 0.005			0.005	Pass	
N-Nitrosopiperidine	mg/L	< 0.005			0.005	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Nitrobenzene	mg/L	< 0.005			0.005	Pass	
Pentachlorobenzene	mg/L	< 0.005			0.005	Pass	
Pentachloronitrobenzene	mg/L	< 0.005			0.005	Pass	
Pentachlorophenol	mg/L	< 0.01			0.01	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Phenol	mg/L	< 0.003			0.003	Pass	
Pronamide	mg/L	< 0.005			0.005	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
Trifluralin	mg/L	< 0.005			0.005	Pass	
Method Blank							
Chemical Oxygen Demand (filtered)	mg/L	< 20			20	Pass	
Method Blank							
Metals M22 (NZ MfE)							
Aluminium	mg/L	< 0.05			0.05	Pass	
Antimony	mg/L	< 0.005			0.005	Pass	
Arsenic	mg/L	< 0.001			0.001	Pass	
Barium	mg/L	< 0.02			0.02	Pass	
Beryllium	mg/L	< 0.001			0.001	Pass	
Boron	mg/L	< 0.05			0.05	Pass	
Cadmium	mg/L	< 0.0002			0.0002	Pass	
Chromium	mg/L	< 0.001			0.001	Pass	
Cobalt	mg/L	< 0.001			0.001	Pass	
Iron	mg/L	< 0.05			0.05	Pass	
Lead	mg/L	< 0.001			0.001	Pass	
Manganese	mg/L	< 0.005			0.005	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Molybdenum	mg/L	< 0.005			0.005	Pass	
Nickel	mg/L	< 0.001			0.001	Pass	
Selenium	mg/L	< 0.001			0.001	Pass	
Silver	mg/L	< 0.005			0.005	Pass	
Thallium	mg/L	< 0.005			0.005	Pass	
Tin	mg/L	< 0.005			0.005	Pass	
Vanadium	mg/L	< 0.005			0.005	Pass	
Zinc	mg/L	< 0.005			0.005	Pass	
Method Blank							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)	ug/L	< 0.005			0.005	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	ug/L	< 0.005			0.005	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	ug/L	< 0.005			0.005	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	ug/L	< 0.005			0.005	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	ug/L	< 0.005			0.005	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ug/L	< 0.005			0.005	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ug/L	< 0.005			0.005	Pass	

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Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Perfluoroalkyl carboxylic acids (PFCAs) - Trace							
Perfluorobutanoic acid (PFBA)	ug/L	< 0.005			0.005	Pass	
Perfluoropentanoic acid (PFPeA)	ug/L	< 0.001			0.001	Pass	
Perfluorohexanoic acid (PFHxA)	ug/L	< 0.001			0.001	Pass	
Perfluoroheptanoic acid (PFHpA)	ug/L	< 0.001			0.001	Pass	
Perfluorooctanoic acid (PFOA)	ug/L	< 0.001			0.001	Pass	
Perfluorononanoic acid (PFNA)	ug/L	< 0.001			0.001	Pass	
Perfluorodecanoic acid (PFDA)	ug/L	< 0.001			0.001	Pass	
Perfluorotridecanoic acid (PFTrDA)	ug/L	< 0.001			0.001	Pass	
Perfluoroundecanoic acid (PFUnDA)	ug/L	< 0.001			0.001	Pass	
Perfluorododecanoic acid (PFDoDA)	ug/L	< 0.001			0.001	Pass	
Perfluorotetradecanoic acid (PFTeDA)	ug/L	< 0.001			0.001	Pass	
Method Blank							
Perfluoroalkyl sulfonic acids (PFSAs)- Trace							
Perfluorobutanesulfonic acid (PFBS)	ug/L	< 0.001			0.001	Pass	
Perfluorononanesulfonic acid (PFNS)	ug/L	< 0.001			0.001	Pass	
Perfluoropropanesulfonic acid (PFPrS)	ug/L	< 0.001			0.001	Pass	
Perfluoropentanesulfonic acid (PFPeS)	ug/L	< 0.001			0.001	Pass	
Perfluorohexanesulfonic acid (PFHxS)	ug/L	< 0.001			0.001	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	ug/L	< 0.001			0.001	Pass	
Perfluorooctanesulfonic acid (PFOS)	ug/L	< 0.001			0.001	Pass	
Perfluorodecanesulfonic acid (PFDS)	ug/L	< 0.001			0.001	Pass	
Method Blank							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	ug/L	< 0.005			0.005	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	ug/L	< 0.001			0.001	Pass	
LCS - % Recovery							
Volatile Organics							
1.1-Dichloroethene	%	98			70-130	Pass	
1.1.1-Trichloroethane	%	91			70-130	Pass	
1.2-Dichlorobenzene	%	91			70-130	Pass	
1.2-Dichloroethane	%	104			70-130	Pass	
Benzene	%	100			70-130	Pass	
Ethylbenzene	%	104			70-130	Pass	
m&p-Xylenes	%	98			70-130	Pass	
Trichloroethene	%	77			70-130	Pass	
Xylenes - Total*	%	100			70-130	Pass	
LCS - % Recovery							
Glycols*							
Ethylene glycol*	%	113			70-130	Pass	
Propylene glycol*	%	112			70-130	Pass	
LCS - % Recovery							
Total Petroleum Hydrocarbons (NZ MfE 1999)							
TPH-SG C7-C9	%	91			70-130	Pass	
LCS - % Recovery							
Semivolatile Organics							
2-Methyl-4.6-dinitrophenol	%	75			30-130	Pass	
1.2-Dichlorobenzene	%	78			75-125	Pass	
1.2.4-Trichlorobenzene	%	87			70-130	Pass	
1.4-Dichlorobenzene	%	73			70-130	Pass	
2-Chlorophenol	%	53			30-130	Pass	

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Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
2-Methylphenol (o-Cresol)	%	51			30-130	Pass	
2-Nitrophenol	%	72			30-130	Pass	
2.4-Dichlorophenol	%	80			30-130	Pass	
2.4-Dimethylphenol	%	62			30-130	Pass	
2.4-Dinitrotoluene	%	78			70-130	Pass	
2.4.5-Trichlorophenol	%	72			30-130	Pass	
2.4.6-Trichlorophenol	%	70			30-130	Pass	
2.6-Dichlorophenol	%	64			30-130	Pass	
3&4-Methylphenol (m&p-Cresol)	%	61			30-130	Pass	
4-Chloro-3-methylphenol	%	65			30-130	Pass	
4-Nitrophenol	%	42			30-130	Pass	
Acenaphthene	%	89			70-130	Pass	
Acenaphthylene	%	79			70-130	Pass	
Anthracene	%	80			70-130	Pass	
Benz(a)anthracene	%	75			70-130	Pass	
Benzo(a)pyrene	%	89			70-130	Pass	
Benzo(b&j)fluoranthene	%	92			70-130	Pass	
Benzo(g.h.i)perylene	%	79			70-130	Pass	
Benzo(k)fluoranthene	%	80			70-130	Pass	
Chrysene	%	98			70-130	Pass	
Dibenz(a.h)anthracene	%	89			70-130	Pass	
Fluoranthene	%	103			70-130	Pass	
Fluorene	%	105			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	87			70-130	Pass	
N-Nitrosodipropylamine	%	88			70-130	Pass	
Naphthalene	%	93			70-130	Pass	
Pentachlorophenol	%	71			30-130	Pass	
Phenanthrene	%	99			70-130	Pass	
Phenol	%	40			30-130	Pass	
Pyrene	%	104			70-130	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)	%	121			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	%	137			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	%	109			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	%	120			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	%	114			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	%	119			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	%	119			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl carboxylic acids (PFCAs) - Trace							
Perfluorobutanoic acid (PFBA)	%	93			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	130			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	120			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	107			50-150	Pass	
Perfluorooctanoic acid (PFOA)	%	116			50-150	Pass	
Perfluorononanoic acid (PFNA)	%	109			50-150	Pass	
Perfluorodecanoic acid (PFDA)	%	106			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	%	126			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	%	115			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	%	113			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	%	120			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonic acids (PFSAs)- Trace							

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Perfluorobutanesulfonic acid (PFBS)			%	104			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)			%	114			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)			%	145			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)			%	95			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)			%	97			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)			%	106			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)			%	106			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)			%	112			50-150	Pass	
LCS - % Recovery									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace									
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)			%	114			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)			%	117			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)			%	118			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)			%	110			50-150	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Perfluoroalkyl sulfonamido substances- Trace				Result 1					
Perfluorooctane sulfonamide (FOSA)	B21-Ma48936	NCP	%	98			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	B21-Ma48936	NCP	%	116			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	B21-Ma48936	NCP	%	110			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	B21-Ma48936	NCP	%	114			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	B21-Ma48936	NCP	%	111			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	B21-Ma48936	NCP	%	105			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	B21-Ma48936	NCP	%	103			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1					
Perfluorobutanoic acid (PFBA)	B21-Ma48936	NCP	%	83			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	B21-Ma48936	NCP	%	103			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	B21-Ma48936	NCP	%	105			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	B21-Ma48936	NCP	%	90			50-150	Pass	
Perfluorooctanoic acid (PFOA)	B21-Ma48936	NCP	%	95			50-150	Pass	
Perfluorononanoic acid (PFNA)	B21-Ma48936	NCP	%	94			50-150	Pass	
Perfluorodecanoic acid (PFDA)	B21-Ma48936	NCP	%	104			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	B21-Ma48936	NCP	%	128			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	B21-Ma48936	NCP	%	114			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	B21-Ma48936	NCP	%	119			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	B21-Ma48936	NCP	%	125			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl sulfonic acids (PFSAs)- Trace				Result 1					
Perfluorobutanesulfonic acid (PFBS)	B21-Ma48936	NCP	%	76			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)	B21-Ma48936	NCP	%	87			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)	B21-Ma48936	NCP	%	93			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Perfluoropentanesulfonic acid (PFPeS)	B21-Ma48936	NCP	%	91			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	B21-Ma48936	NCP	%	88			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	B21-Ma48936	NCP	%	108			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	B21-Ma48936	NCP	%	77			50-150	Pass	
Spike - % Recovery									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace				Result 1					
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	B21-Ma48936	NCP	%	109			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	B21-Ma48936	NCP	%	114			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	B21-Ma48936	NCP	%	105			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	B21-Ma48936	NCP	%	99			50-150	Pass	
Spike - % Recovery									
Glycols*				Result 1					
Di-Ethylene Glycol*	K21-Ma43217	CP	%	102			70-130	Pass	
Ethylene glycol*	K21-Ma43217	CP	%	110			70-130	Pass	
Propylene glycol*	K21-Ma43217	CP	%	106			70-130	Pass	
Triethylene glycol*	K21-Ma43217	CP	%	84			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Glycols*				Result 1	Result 2	RPD			
Di-Ethylene Glycol*	K21-Ma43216	CP	mg/L	< 20	< 20	<1	30%	Pass	
Ethylene glycol*	K21-Ma43216	CP	mg/L	< 20	< 20	<1	30%	Pass	
Propylene glycol*	K21-Ma43216	CP	mg/L	< 20	< 20	<1	30%	Pass	
Triethylene glycol*	K21-Ma43216	CP	mg/L	< 20	< 20	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
pH (at 25 °C)	M21-Ap10040	NCP	pH Units	8.4	8.5	pass	30%	Pass	
Duplicate									
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD			
Perfluorooctane sulfonamide (FOSA)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	

Duplicate									
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD			
Perfluorobutanoic acid (PFBA)	B21-Ma48936	NCP	ug/L	0.026	0.023	12	30%	Pass	
Perfluoropentanoic acid (PFPeA)	B21-Ma48936	NCP	ug/L	0.004	0.004	4.0	30%	Pass	
Perfluorohexanoic acid (PFHxA)	B21-Ma48936	NCP	ug/L	0.009	0.009	5.0	30%	Pass	
Perfluoroheptanoic acid (PFHpA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorooctanoic acid (PFOA)	B21-Ma48936	NCP	ug/L	0.002	0.002	2.0	30%	Pass	
Perfluorononanoic acid (PFNA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorotridecanoic acid (PFTrDA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnDA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorododecanoic acid (PFDoDA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorotetradecanoic acid (PFTeDA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
Perfluoroalkyl sulfonic acids (PFSAs)- Trace				Result 1	Result 2	RPD			
Perfluorobutanesulfonic acid (PFBS)	B21-Ma48936	NCP	ug/L	0.002	0.002	1.0	30%	Pass	
Perfluorononanesulfonic acid (PFNS)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoropropanesulfonic acid (PFPrS)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoropentanesulfonic acid (PFPeS)	B21-Ma48936	NCP	ug/L	0.001	0.001	1.0	30%	Pass	
Perfluorohexanesulfonic acid (PFHxS)	B21-Ma48936	NCP	ug/L	0.010	0.009	13	30%	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorodecanesulfonic acid (PFDS)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace				Result 1	Result 2	RPD			
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
G01	The LORs have been raised due to matrix interference
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
N11	Isotope dilution is used for calibration of each native compound for which an exact labelled analogue is available (Isotope Dilution Quantitation). The isotopically labelled analogues allow identification and recovery correction of the concentration of the associated native PFAS compounds.
N15	Where the native PFAS compound does not have labelled analogue then the quantification is made using the Extracted Internal Standard Analyte with the closest retention time to the analyte and no recovery correction has been made (Internal Standard Quantitation).
N16	Analysis performed by Eurofins Environment Testing Australia

Authorised by:

Swati Shahaney	Analytical Services Manager
Emily Rosenberg	Senior Analyst-Metal (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Sarah McCallion	Senior Analyst-PFAS (QLD)
Scott Beddoes	Senior Analyst-Inorganic (VIC)
Vivian Wang	Senior Analyst-Volatile (VIC)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Environment Testing

Certificate of Analysis

National Steel Ltd
29 Hobill Avenue
Wiri Maukau Auckland
NZ 2104

Attention: **Vipan Garg**

Report **773546-W_INT**
Project name 650 FALLS ROAD MONOFILL FACILITY
Project ID 4197
Received Date Feb 11, 2021

Client Sample ID			**SAMPLE 1**	**SAMPLE 2**
Sample Matrix			**Water**	**Water**
Eurofins Sample No.			**K21-Fe24634**	**K21-Fe24635**
Date Sampled			**Feb 03, 2021**	**Feb 11, 2021**
Test/Reference	LOR	Unit		
Volatile Organics				
1.1-Dichloroethane	0.001	mg/L	< 0.002	< 0.01
1.1-Dichloroethene	0.001	mg/L	< 0.002	< 0.002
1.1.1-Trichloroethane	0.001	mg/L	< 0.002	< 0.01
1.1.1.2-Tetrachloroethane	0.001	mg/L	< 0.002	< 0.01
1.1.2-Trichloroethane	0.001	mg/L	< 0.002	< 0.01
1.1.2.2-Tetrachloroethane	0.001	mg/L	< 0.002	< 0.01
1.2-Dibromoethane	0.001	mg/L	< 0.002	< 0.01
1.2-Dichlorobenzene	0.001	mg/L	< 0.002	< 0.01
1.2-Dichloroethane	0.001	mg/L	< 0.002	< 0.01
1.2-Dichloropropane	0.001	mg/L	0.003	< 0.01
1.2.3-Trichloropropane	0.001	mg/L	< 0.002	< 0.01
1.2.4-Trimethylbenzene	0.001	mg/L	0.028	< 0.01
1.3-Dichlorobenzene	0.001	mg/L	< 0.002	< 0.01
1.3-Dichloropropane	0.001	mg/L	< 0.002	< 0.01
1.3.5-Trimethylbenzene	0.001	mg/L	0.005	< 0.01
1.4-Dichlorobenzene	0.001	mg/L	< 0.002	< 0.01
2-Butanone (MEK)	0.001	mg/L	0.050	0.15
2-Propanone (Acetone)	0.001	mg/L	0.12	1.4
4-Chlorotoluene	0.001	mg/L	< 0.002	< 0.01
4-Methyl-2-pentanone (MIBK)	0.001	mg/L	0.17	0.15
Allyl chloride	0.001	mg/L	< 0.02	< 0.01
Benzene	0.001	mg/L	0.011	< 0.01
Bromobenzene	0.001	mg/L	< 0.002	< 0.01
Bromochloromethane	0.001	mg/L	< 0.002	< 0.01
Bromodichloromethane	0.001	mg/L	< 0.002	< 0.01
Bromoform	0.001	mg/L	< 0.002	< 0.01
Bromomethane	0.001	mg/L	< 0.002	< 0.01
Carbon disulfide	0.001	mg/L	< 0.002	< 0.01
Carbon Tetrachloride	0.001	mg/L	< 0.002	< 0.01
Chlorobenzene	0.001	mg/L	< 0.002	< 0.01
Chloroethane	0.001	mg/L	< 0.002	< 0.01
Chloroform	0.005	mg/L	< 0.005	< 0.01
Chloromethane	0.001	mg/L	0.002	< 0.01
cis-1.2-Dichloroethene	0.001	mg/L	< 0.002	< 0.01
cis-1.3-Dichloropropene	0.001	mg/L	< 0.002	< 0.01

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Environment Testing

Client Sample ID			SAMPLE 1	SAMPLE 2
Sample Matrix			**Water**	**Water**
Eurofins Sample No.			**K21-Fe24634**	**K21-Fe24635**
Date Sampled			**Feb 03, 2021**	**Feb 11, 2021**
Test/Reference	LOR	Unit		
Volatile Organics				
Dibromochloromethane	0.001	mg/L	< 0.002	< 0.01
Dibromomethane	0.001	mg/L	< 0.002	< 0.01
Dichlorodifluoromethane	0.001	mg/L	< 0.002	< 0.01
Ethylbenzene	0.001	mg/L	0.021	0.015
Iodomethane	0.001	mg/L	< 0.002	< 0.01
Isopropyl benzene (Cumene)	0.001	mg/L	< 0.002	< 0.01
m&p-Xylenes	0.002	mg/L	0.052	0.038
Methylene Chloride	0.001	mg/L	< 0.002	< 0.002
o-Xylene	0.001	mg/L	0.050	0.036
Styrene	0.001	mg/L	0.009	< 0.01
Tetrachloroethene	0.001	mg/L	< 0.002	< 0.01
Toluene	0.001	mg/L	0.088	0.083
trans-1.2-Dichloroethene	0.001	mg/L	< 0.002	< 0.01
trans-1.3-Dichloropropene	0.001	mg/L	< 0.002	< 0.01
Trichloroethene	0.001	mg/L	< 0.002	< 0.01
Trichlorofluoromethane	0.001	mg/L	0.022	< 0.01
Vinyl chloride	0.001	mg/L	< 0.002	< 0.01
Xylenes - Total*	0.003	mg/L	0.10	0.074
Total MAH*	0.003	mg/L	0.231	0.172
Vic EPA IWRG 621 CHC (Total)*	0.005	mg/L	< 0.005	< 0.01
Vic EPA IWRG 621 Other CHC (Total)*	0.005	mg/L	< 0.005	< 0.01
4-Bromofluorobenzene (surr.)	1	%	140	148
Toluene-d8 (surr.)	1	%	94	123
Glycols*				
Di-Ethylene Glycol*	20	mg/L		
Ethylene glycol*	20	mg/L		
Propylene glycol*	20	mg/L		
Triethylene glycol*	20	mg/L		
Polychlorinated Biphenyls				
Aroclor-1016	0.001	mg/L		
Aroclor-1221	0.001	mg/L		
Aroclor-1232	0.001	mg/L		
Aroclor-1242	0.001	mg/L		
Aroclor-1248	0.001	mg/L		
Aroclor-1254	0.001	mg/L		
Aroclor-1260	0.001	mg/L		
Total PCB*	0.001	mg/L		
Dibutylchlorendate (surr.)	1	%		
Tetrachloro-m-xylene (surr.)	1	%		
Total Petroleum Hydrocarbons (NZ MfE 1999)				
TPH-SG C7-C9	0.1	mg/L		
TPH-SG C10-C14	0.2	mg/L		
TPH-SG C15-C36	0.4	mg/L		
TPH-SG C7-C36 (Total)	0.7	mg/L		
Semivolatile Organics				
2-Methyl-4.6-dinitrophenol	0.03	mg/L		
1-Chloronaphthalene	0.005	mg/L		
1-Naphthylamine	0.005	mg/L		
1.2-Dichlorobenzene	0.005	mg/L		

Client Sample ID			SAMPLE 1	SAMPLE 2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Fe24634	K21-Fe24635
Date Sampled			Feb 03, 2021	Feb 11, 2021
Test/Reference	LOR	Unit		
Semivolatile Organics				
1.2.3-Trichlorobenzene	0.005	mg/L		
1.2.3.4-Tetrachlorobenzene	0.005	mg/L		
1.2.3.5-Tetrachlorobenzene	0.005	mg/L		
1.2.4-Trichlorobenzene	0.005	mg/L		
1.2.4.5-Tetrachlorobenzene	0.005	mg/L		
1.3-Dichlorobenzene	0.005	mg/L		
1.3.5-Trichlorobenzene	0.005	mg/L		
1.4-Dichlorobenzene	0.005	mg/L		
2-Chloronaphthalene	0.005	mg/L		
2-Chlorophenol	0.003	mg/L		
2-Methylnaphthalene	0.005	mg/L		
2-Methylphenol (o-Cresol)	0.003	mg/L		
2-Naphthylamine	0.005	mg/L		
2-Nitroaniline	0.005	mg/L		
2-Nitrophenol	0.01	mg/L		
2-Picoline	0.005	mg/L		
2.3.4.6-Tetrachlorophenol	0.01	mg/L		
2.4-Dichlorophenol	0.003	mg/L		
2.4-Dimethylphenol	0.003	mg/L		
2.4-Dinitrophenol	0.03	mg/L		
2.4-Dinitrotoluene	0.005	mg/L		
2.4.5-Trichlorophenol	0.01	mg/L		
2.4.6-Trichlorophenol	0.01	mg/L		
2.6-Dichlorophenol	0.003	mg/L		
2.6-Dinitrotoluene	0.005	mg/L		
3&4-Methylphenol (m&p-Cresol)	0.006	mg/L		
3-Methylcholanthrene	0.005	mg/L		
3.3'-Dichlorobenzidine	0.005	mg/L		
4-Aminobiphenyl	0.005	mg/L		
4-Bromophenyl phenyl ether	0.005	mg/L		
4-Chloro-3-methylphenol	0.01	mg/L		
4-Chlorophenyl phenyl ether	0.005	mg/L		
4-Nitrophenol	0.03	mg/L		
4.4'-DDD	0.005	mg/L		
4.4'-DDE	0.005	mg/L		
4.4'-DDT	0.005	mg/L		
7.12-Dimethylbenz(a)anthracene	0.005	mg/L		
a-BHC	0.005	mg/L		
Acenaphthene	0.001	mg/L		
Acenaphthylene	0.001	mg/L		
Acetophenone	0.005	mg/L		
Aldrin	0.005	mg/L		
Aniline	0.005	mg/L		
Anthracene	0.001	mg/L		
b-BHC	0.005	mg/L		
Benz(a)anthracene	0.001	mg/L		
Benzo(a)pyrene	0.001	mg/L		
Benzo(b&j)fluoranthene[N07]	0.001	mg/L		
Benzo(g.h.i)perylene	0.001	mg/L		

Environment Testing

Client Sample ID			SAMPLE 1	SAMPLE 2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Fe24634	K21-Fe24635
Date Sampled			Feb 03, 2021	Feb 11, 2021
Test/Reference	LOR	Unit		
Semivolatile Organics				
Benzo(k)fluoranthene	0.001	mg/L		
Benzyl chloride	0.005	mg/L		
Bis(2-chloroethoxy)methane	0.005	mg/L		
Bis(2-chloroisopropyl)ether	0.005	mg/L		
Bis(2-ethylhexyl)phthalate	0.005	mg/L		
Butyl benzyl phthalate	0.005	mg/L		
Chrysene	0.001	mg/L		
d-BHC	0.005	mg/L		
Di-n-butyl phthalate	0.005	mg/L		
Di-n-octyl phthalate	0.005	mg/L		
Dibenz(a.h)anthracene	0.001	mg/L		
Dibenz(a.j)acridine	0.005	mg/L		
Dibenzofuran	0.005	mg/L		
Dieldrin	0.005	mg/L		
Diethyl phthalate	0.005	mg/L		
Dimethyl phthalate	0.005	mg/L		
Dimethylaminoazobenzene	0.005	mg/L		
Diphenylamine	0.005	mg/L		
Endosulfan I	0.005	mg/L		
Endosulfan II	0.005	mg/L		
Endosulfan sulphate	0.005	mg/L		
Endrin	0.005	mg/L		
Endrin aldehyde	0.005	mg/L		
Endrin ketone	0.005	mg/L		
Fluoranthene	0.001	mg/L		
Fluorene	0.001	mg/L		
g-BHC (Lindane)	0.005	mg/L		
Heptachlor	0.005	mg/L		
Heptachlor epoxide	0.005	mg/L		
Hexachlorobenzene	0.005	mg/L		
Hexachlorobutadiene	0.005	mg/L		
Hexachlorocyclopentadiene	0.005	mg/L		
Hexachloroethane	0.005	mg/L		
Indeno(1.2.3-cd)pyrene	0.001	mg/L		
Methoxychlor	0.005	mg/L		
N-Nitrosodibutylamine	0.005	mg/L		
N-Nitrosodipropylamine	0.005	mg/L		
N-Nitrosopiperidine	0.005	mg/L		
Naphthalene	0.001	mg/L		
Nitrobenzene	0.005	mg/L		
Pentachlorobenzene	0.005	mg/L		
Pentachloronitrobenzene	0.005	mg/L		
Pentachlorophenol	0.01	mg/L		
Phenanthrene	0.001	mg/L		
Phenol	0.003	mg/L		
Pronamide	0.005	mg/L		
Pyrene	0.001	mg/L		
Trifluralin	0.005	mg/L		
Phenol-d6 (surr.)	1	%		

eurofins | Environment Testing

Client Sample ID			SAMPLE 1	SAMPLE 2
Sample Matrix			**Water**	**Water**
Eurofins Sample No.			**K21-Fe24634**	**K21-Fe24635**
Date Sampled			**Feb 03, 2021**	**Feb 11, 2021**
Test/Reference	LOR	Unit		
Semivolatile Organics				
Nitrobenzene-d5 (surr.)	1	%		
2-Fluorobiphenyl (surr.)	1	%		
2.4.6-Tribromophenol (surr.)	1	%		
Chemical Oxygen Demand (filtered)	20	mg/L		
pH (at 25 °C)	0.1	pH Units	7.0	-
Metals M22 (NZ MfE)				
Aluminium	0.05	mg/L	0.10	0.06
Antimony	0.005	mg/L	0.10	0.053
Arsenic	0.001	mg/L	0.011	0.011
Barium	0.02	mg/L	0.36	0.26
Beryllium	0.001	mg/L	< 0.001	< 0.001
Boron	0.05	mg/L	5.0	4.3
Cadmium	0.0002	mg/L	< 0.0002	0.0007
Chromium	0.001	mg/L	0.048	0.022
Cobalt	0.001	mg/L	0.11	0.058
Copper	0.001	mg/L	0.23	0.15
Iron	0.05	mg/L	47	25
Lead	0.001	mg/L	1070000	1070000
Manganese	0.005	mg/L	4.1	3.0
Mercury	0.0001	mg/L	0.0002	0.0002
Molybdenum	0.005	mg/L	0.23	0.29
Nickel	0.001	mg/L	0.32	0.19
Selenium	0.001	mg/L	0.001	< 0.001
Silver	0.005	mg/L	< 0.005	< 0.005
Thallium	0.005	mg/L	< 0.005	< 0.005
Tin	0.005	mg/L	0.009	0.014
Vanadium	0.005	mg/L	< 0.005	0.005
Zinc	0.005	mg/L	52	16
PFASs Summations				
Sum (PFHxS + PFOS)*	0.001	ug/L	0.082	0.114
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	0.192	0.234
Sum of PFASs (n=30)*	0.005	ug/L	0.665	0.682
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	0.133	0.142
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	0.637	0.651
Perfluoroalkyl sulfonamido substances- Trace				
Perfluorooctane sulfonamide (FOSA)[N11]	0.005	ug/L	< 0.005	< 0.005
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)[N11]	0.005	ug/L	< 0.005	< 0.005
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)[N11]	0.005	ug/L	< 0.005	< 0.005
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)[N11]	0.005	ug/L	< 0.005	< 0.005
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)[N11]	0.005	ug/L	< 0.005	< 0.005
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)[N11]	0.005	ug/L	< 0.005	< 0.005
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)[N11]	0.005	ug/L	< 0.005	< 0.005
13C8-FOSA (surr.)	1	%	96	132
D3-N-MeFOSA (surr.)	1	%	85	120
D5-N-EtFOSA (surr.)	1	%	91	128

Client Sample ID			SAMPLE 1	SAMPLE 2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Fe24634	K21-Fe24635
Date Sampled			Feb 03, 2021	Feb 11, 2021
Test/Reference	LOR	Unit		
Perfluoroalkyl sulfonamido substances- Trace				
D7-N-MeFOSE (surr.)	1	%	101	137
D9-N-EtFOSE (surr.)	1	%	90	130
D5-N-EtFOSAA (surr.)	1	%	119	142
D3-N-MeFOSAA (surr.)	1	%	135	76
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				
Perfluorobutanoic acid (PFBA)[N11]	0.005	ug/L	0.16	0.10
Perfluoropentanoic acid (PFPeA)[N11]	0.001	ug/L	0.043	0.040
Perfluorohexanoic acid (PFHxA)[N11]	0.001	ug/L	0.085	0.099
Perfluoroheptanoic acid (PFHpA)[N11]	0.001	ug/L	0.040	0.047
Perfluorooctanoic acid (PFOA)[N11]	0.001	ug/L	0.11	0.12
Perfluorononanoic acid (PFNA)[N11]	0.001	ug/L	0.026	0.028
Perfluorodecanoic acid (PFDA)[N11]	0.001	ug/L	0.002	0.002
Perfluorotridecanoic acid (PFTrDA)[N15]	0.001	ug/L	< 0.001	< 0.001
Perfluoroundecanoic acid (PFUnDA)[N11]	0.001	ug/L	< 0.001	< 0.001
Perfluorododecanoic acid (PFDoDA)[N11]	0.001	ug/L	< 0.001	< 0.001
Perfluorotetradecanoic acid (PFTeDA)[N11]	0.001	ug/L	< 0.001	< 0.001
13C4-PFBA (surr.)	1	%	102	130
13C5-PFPeA (surr.)	1	%	71	60
13C5-PFHxA (surr.)	1	%	75	96
13C4-PFHpA (surr.)	1	%	96	120
13C8-PFOA (surr.)	1	%	100	129
13C5-PFNA (surr.)	1	%	106	144
13C6-PFDA (surr.)	1	%	104	135
13C2-PFUnDA (surr.)	1	%	111	126
13C2-PFDoDA (surr.)	1	%	130	118
13C2-PFTeDA (surr.)	1	%	92	138
Perfluoroalkyl sulfonic acids (PFSAs)- Trace				
Perfluorobutanesulfonic acid (PFBS)[N11]	0.001	ug/L	0.051	0.062
Perfluorononanesulfonic acid (PFNS)[N15]	0.001	ug/L	< 0.001	< 0.001
Perfluoropropanesulfonic acid (PFPrS)[N15]	0.001	ug/L	< 0.001	< 0.001
Perfluoropentanesulfonic acid (PFPeS)[N15]	0.001	ug/L	< 0.001	< 0.001
Perfluorohexanesulfonic acid (PFHxS)[N11]	0.001	ug/L	0.059	0.092
Perfluoroheptanesulfonic acid (PFHpS)[N15]	0.001	ug/L	< 0.001	< 0.001
Perfluorooctanesulfonic acid (PFOS)[N11]	0.001	ug/L	0.023	0.022
Perfluorodecanesulfonic acid (PFDS)[N15]	0.001	ug/L	< 0.001	< 0.001
13C3-PFBS (surr.)	1	%	74	90
18O2-PFHxS (surr.)	1	%	72	96
13C8-PFOS (surr.)	1	%	77	105
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace				
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)[N11]	0.001	ug/L	< 0.001	< 0.001
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)[N11]	0.005	ug/L	0.063	0.067
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)[N11]	0.001	ug/L	0.003	0.002
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)[N11]	0.001	ug/L	< 0.001	0.001
13C2-4:2 FTS (surr.)	1	%	97	121
13C2-6:2 FTSA (surr.)	1	%	120	84
13C2-8:2 FTSA (surr.)	1	%	81	109
13C2-10:2 FTSA (surr.)	1	%	129	97

Environment Testing

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Volatile Organics	Melbourne	Feb 18, 2021	7 Days
- Method: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices (USEPA 8260)			
Glycols*	Melbourne	Feb 18, 2021	7 Days
- Method: GLYCOLS- US EPA SW846 METHOD 8000 GC-FID.			
Polychlorinated Biphenyls	Melbourne	Feb 18, 2021	7 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water (USEPA 8082)			
Total Petroleum Hydrocarbons (NZ MfE 1999)	Melbourne	Feb 18, 2021	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Semivolatile Organics	Melbourne	Feb 18, 2021	7 Days
- Method: LTM-ORG-2190 SVOC in Water & Soil by GC-MS			
Chemical Oxygen Demand (filtered)	Melbourne	Feb 18, 2021	28 Days
- Method: LTM-INO-4220 Determination of COD in Water			
pH (at 25 °C)	Melbourne	Feb 18, 2021	0 Hours
- Method: LTM-GEN-7090 pH in water by ISE			
Metals M22 (NZ MfE)	Melbourne	Feb 18, 2021	6 Months
- Method: LTM-MET-3040 Metals in Waters Soils Sediments by ICP-MS			
Per- and Polyfluoroalkyl Substances (PFASs) - Trace			
PFASs Summations	Melbourne	Feb 12, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl sulfonamido substances- Trace	Melbourne	Feb 18, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl carboxylic acids (PFCAs) - Trace	Melbourne	Feb 18, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl sulfonic acids (PFSAs)- Trace	Melbourne	Feb 18, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace	Melbourne	Feb 18, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			

Company Name: National Steel Ltd
Address: 29 Hobill Avenue, Wiri Maukau Auckland, NZ 2104

Order No.:
Report #: 773546
Phone: 021 704 000
Fax:

Received: Feb 12, 2021 12:00 AM
Due: Feb 18, 2021
Priority: 5 Day
Contact Name: Vipan Garg

Project Name: 650 FALLS ROAD MONOFILL FACILITY
Project ID: 4197

Eurofins Analytical Services Manager : Swati Shahaney

Sample Detail						Chemical Oxygen Demand (filtered)	pH (at 25 °C)	Glycols*	Polychlorinated Biphenyls	Volatile Organics	Total Petroleum Hydrocarbons (NZ MfE 1999)	Semivolatile Organics	Metals M22 (NZ MfE)	Per- and Polyfluoroalkyl Substances (PFASs) - Trace
Auckland Laboratory - IANZ# 1327														
Christchurch Laboratory - IANZ# 1290														
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X	X	X
External Laboratory														
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**									
1	SAMPLE 1	Feb 03, 2021		Water	K21-Fe24634	X	X	X	X	X	X	X	X	X
2	SAMPLE 2	Feb 11, 2021		Water	K21-Fe24635	X		X	X	X	X	X	X	X
Test Counts						2	1	2	2	2	2	2	2	2

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Volatile Organics							
1.1-Dichloroethane	mg/L	< 0.001			0.001	Pass	
1.1-Dichloroethene	mg/L	< 0.001			0.001	Pass	
1.1.1-Trichloroethane	mg/L	< 0.001			0.001	Pass	
1.1.1.2-Tetrachloroethane	mg/L	< 0.001			0.001	Pass	
1.1.2-Trichloroethane	mg/L	< 0.001			0.001	Pass	
1.1.2.2-Tetrachloroethane	mg/L	< 0.001			0.001	Pass	
1.2-Dibromoethane	mg/L	< 0.001			0.001	Pass	
1.2-Dichlorobenzene	mg/L	< 0.001			0.001	Pass	
1.2-Dichloroethane	mg/L	< 0.001			0.001	Pass	
1.2-Dichloropropane	mg/L	< 0.001			0.001	Pass	
1.2.3-Trichloropropane	mg/L	< 0.001			0.001	Pass	
1.2.4-Trimethylbenzene	mg/L	< 0.001			0.001	Pass	
1.3-Dichlorobenzene	mg/L	< 0.001			0.001	Pass	
1.3-Dichloropropane	mg/L	< 0.001			0.001	Pass	
1.3.5-Trimethylbenzene	mg/L	< 0.001			0.001	Pass	
1.4-Dichlorobenzene	mg/L	< 0.001			0.001	Pass	
2-Butanone (MEK)	mg/L	< 0.001			0.001	Pass	
2-Propanone (Acetone)	mg/L	< 0.001			0.001	Pass	
4-Chlorotoluene	mg/L	< 0.001			0.001	Pass	
4-Methyl-2-pentanone (MIBK)	mg/L	< 0.001			0.001	Pass	
Allyl chloride	mg/L	< 0.001			0.001	Pass	
Benzene	mg/L	< 0.001			0.001	Pass	
Bromobenzene	mg/L	< 0.001			0.001	Pass	
Bromochloromethane	mg/L	< 0.001			0.001	Pass	
Bromodichloromethane	mg/L	< 0.001			0.001	Pass	
Bromoform	mg/L	< 0.001			0.001	Pass	
Bromomethane	mg/L	< 0.001			0.001	Pass	
Carbon disulfide	mg/L	< 0.001			0.001	Pass	
Carbon Tetrachloride	mg/L	< 0.001			0.001	Pass	
Chlorobenzene	mg/L	< 0.001			0.001	Pass	
Chloroethane	mg/L	< 0.001			0.001	Pass	
Chloroform	mg/L	< 0.005			0.005	Pass	
Chloromethane	mg/L	< 0.001			0.001	Pass	
cis-1.2-Dichloroethene	mg/L	< 0.001			0.001	Pass	
cis-1.3-Dichloropropene	mg/L	< 0.001			0.001	Pass	
Dibromochloromethane	mg/L	< 0.001			0.001	Pass	
Dibromomethane	mg/L	< 0.001			0.001	Pass	
Dichlorodifluoromethane	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
Iodomethane	mg/L	< 0.001			0.001	Pass	
Isopropyl benzene (Cumene)	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
Methylene Chloride	mg/L	< 0.001			0.001	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Styrene	mg/L	< 0.001			0.001	Pass	
Tetrachloroethene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
trans-1.2-Dichloroethene	mg/L	< 0.001			0.001	Pass	
trans-1.3-Dichloropropene	mg/L	< 0.001			0.001	Pass	
Trichloroethene	mg/L	< 0.001			0.001	Pass	

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Environment Testing

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Trichlorofluoromethane	mg/L	< 0.001			0.001	Pass	
Vinyl chloride	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
Metals M22 (NZ MfE)							
Aluminium	mg/L	< 0.05			0.05	Pass	
Antimony	mg/L	< 0.005			0.005	Pass	
Arsenic	mg/L	< 0.001			0.001	Pass	
Barium	mg/L	< 0.02			0.02	Pass	
Beryllium	mg/L	< 0.001			0.001	Pass	
Boron	mg/L	< 0.05			0.05	Pass	
Cadmium	mg/L	< 0.0002			0.0002	Pass	
Chromium	mg/L	< 0.001			0.001	Pass	
Cobalt	mg/L	< 0.001			0.001	Pass	
Copper	mg/L	< 0.001			0.001	Pass	
Iron	mg/L	< 0.05			0.05	Pass	
Lead	mg/L	< 0.001			0.001	Pass	
Manganese	mg/L	< 0.005			0.005	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Molybdenum	mg/L	< 0.005			0.005	Pass	
Nickel	mg/L	< 0.001			0.001	Pass	
Selenium	mg/L	< 0.001			0.001	Pass	
Silver	mg/L	< 0.005			0.005	Pass	
Thallium	mg/L	< 0.005			0.005	Pass	
Tin	mg/L	< 0.005			0.005	Pass	
Vanadium	mg/L	< 0.005			0.005	Pass	
Zinc	mg/L	< 0.005			0.005	Pass	
Method Blank							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)	ug/L	< 0.005			0.005	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	ug/L	< 0.005			0.005	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	ug/L	< 0.005			0.005	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	ug/L	< 0.005			0.005	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	ug/L	< 0.005			0.005	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ug/L	< 0.005			0.005	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ug/L	< 0.005			0.005	Pass	
Method Blank							
Perfluoroalkyl carboxylic acids (PFCAs) - Trace							
Perfluorobutanoic acid (PFBA)	ug/L	< 0.005			0.005	Pass	
Perfluoropentanoic acid (PFPeA)	ug/L	< 0.001			0.001	Pass	
Perfluorohexanoic acid (PFHxA)	ug/L	< 0.001			0.001	Pass	
Perfluoroheptanoic acid (PFHpA)	ug/L	< 0.001			0.001	Pass	
Perfluorooctanoic acid (PFOA)	ug/L	< 0.001			0.001	Pass	
Perfluorononanoic acid (PFNA)	ug/L	< 0.001			0.001	Pass	
Perfluorodecanoic acid (PFDA)	ug/L	< 0.001			0.001	Pass	
Perfluorotridecanoic acid (PFTrDA)	ug/L	< 0.001			0.001	Pass	
Perfluoroundecanoic acid (PFUnDA)	ug/L	< 0.001			0.001	Pass	
Perfluorododecanoic acid (PFDoDA)	ug/L	< 0.001			0.001	Pass	
Perfluorotetradecanoic acid (PFTeDA)	ug/L	< 0.001			0.001	Pass	
Method Blank							
Perfluoroalkyl sulfonic acids (PFSAs)- Trace							
Perfluorobutanesulfonic acid (PFBS)	ug/L	< 0.001			0.001	Pass	
Perfluorononanesulfonic acid (PFNS)	ug/L	< 0.001			0.001	Pass	
Perfluoropropanesulfonic acid (PFPrS)	ug/L	< 0.001			0.001	Pass	

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Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Perfluoropentanesulfonic acid (PFPeS)	ug/L	< 0.001			0.001	Pass	
Perfluorohexanesulfonic acid (PFHxS)	ug/L	< 0.001			0.001	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	ug/L	< 0.001			0.001	Pass	
Perfluorooctanesulfonic acid (PFOS)	ug/L	< 0.001			0.001	Pass	
Perfluorodecanesulfonic acid (PFDS)	ug/L	< 0.001			0.001	Pass	
Method Blank							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	ug/L	< 0.005			0.005	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	ug/L	< 0.001			0.001	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)	%	70			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	%	122			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	%	96			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	%	108			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	%	105			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	%	90			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	%	95			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl carboxylic acids (PFCAs) - Trace							
Perfluorobutanoic acid (PFBA)	%	136			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	81			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	89			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	89			50-150	Pass	
Perfluorooctanoic acid (PFOA)	%	89			50-150	Pass	
Perfluorononanoic acid (PFNA)	%	81			50-150	Pass	
Perfluorodecanoic acid (PFDA)	%	84			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	%	112			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	%	91			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	%	94			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	%	92			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonic acids (PFSAs)- Trace							
Perfluorobutanesulfonic acid (PFBS)	%	83			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)	%	79			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)	%	86			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	%	87			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	%	90			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	%	94			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	%	91			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	%	69			50-150	Pass	
LCS - % Recovery							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	%	103			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	%	118			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	%	96			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	%	88			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
pH (at 25 °C)	B21-Fe31696	NCP	pH Units	8.8	8.8	pass	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	No
Sample correctly preserved	No
Appropriate sample containers have been used	No
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
N11	Isotope dilution is used for calibration of each native compound for which an exact labelled analogue is available (Isotope Dilution Quantitation). The isotopically labelled analogues allow identification and recovery correction of the concentration of the associated native PFAS compounds.
N15	Where the native PFAS compound does not have labelled analogue then the quantification is made using the Extracted Internal Standard Analyte with the closest retention time to the analyte and no recovery correction has been made (Internal Standard Quantitation).
N16	Analysis performed by Eurofins Environment Testing Australia

Authorised by:

Emily Rosenberg	Senior Analyst-Metal (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Joseph Edouard	Senior Analyst-PFAS (VIC)
Scott Beddoes	Senior Analyst-Inorganic (VIC)
Vivian Wang	Senior Analyst-Volatile (VIC)

Glenn Jackson
General Manager

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Job No: 1004057.0000
19 February 2019

National Steel Limited
29 Hobill Ave
Manukau
Auckland

Attention: Mr Vipan Garg

Dear Vipan

Characterisation testing of shredding wastes

Tonkin & Taylor Limited (T+T) is pleased to present the results of contaminant testing of metal shredding waste at National Steel Limited's site in Manukau, Auckland. This work was carried out in accordance with our proposal of 27 March 2018.

1 Background

National Steel operates a metal shredding facility at 29 Hobill Ave, Manukau (the site). Various types of ferrous and non-ferrous metals are received in various forms and sizes (such as car bodies, whiteware, building materials, cans, cables etc.) from a network of scrap metal suppliers. The metal products are shredded and the metallic component is separated for recycling. Currently the non-metallic component is disposed of as waste to landfill.

National Steel wishes to explore options for disposing of the non-metallic waste in a private landfill, both to reduce disposal costs and potentially allow the materials to be reprocessed in future when technologies become available to recover more of its reusable content.

2 Objective and scope of work

The objective of this investigation was to characterise the discharge (leachate) that may be produced by the waste once it has been disposed to land, and the implications of this on disposal options. The following scope of work was undertaken:

- Collection of three composite samples of non-metallic waste from the output of the shredder;
- Laboratory analysis of the samples for a range of potential contaminants using the Toxicity Characteristic Leaching Procedure (TCLP) and Synthetic Precipitation Leaching Procedure (SPLP);
- Preparation of this report, which summarises our work and comments on the implications of the findings including the potential design and consenting requirements for a private landfill.

Tonkin & Taylor Ltd | 105 Carlton Gore Rd, Newmarket, Auckland 1023, New Zealand
PO Box 5271, Wellesley St, Auckland 1141 P +64-9-355 6000 F +64-9-307 0265 E akl@tonkintaylor.co.nz

3 Methodology

A site visit was made on 24 April 2018. Three samples were collected from across the stockpile formed below the output chute of the non-metallic waste shredder (refer to Photograph 1 provided in Appendix A). The materials appeared to comprise predominantly foam, plastic, vinyl, rubber and very small metallic or wire pieces (refer to Photograph 2 to Photograph 4 provided in Appendix A) in particle sizes from a few to some 200 millimetres.

Samples were shipped to Hill Laboratories in Hamilton for analysis, using TCLP and SPLP methods, for:

- Metals;
- Total petroleum hydrocarbons (TPH);
- Semi-volatile organic compounds (SVOC);
- Polychlorinated biphenyls (PCB);
- Methanol and ethylene; and
- Propylene glycol.

The TCLP method provides an indication of leachate that may be generated under typical landfill conditions (acidic), while the SPLP methods provides an indication of leachate that may be generated under normal atmospheric conditions (e.g. exposure to rainfall), such as might occur within a cleanfill environment.

It was originally proposed that the bulk samples would also be tested, alongside the TCLP and SPLP analyses, to establish the potential contaminant concentrations in the raw waste. However, due to the nature of the materials (principally comprising foam and plastic) the laboratory was unable to perform testing on the bulk samples. Similarly, the particles size of the samples also prevented analysis of the samples for volatile organic compounds (VOCs). These data gaps are not considered to compromise the findings of this preliminary assessment and options to address the gaps are provided in this report.

4 Assessment criteria

The classification of wastes for disposal is addressed by a number of guidelines, standards and regulations including:

- The Ministry for the Environment (MfE) in its documents:
  - A Guide to the Management of Cleanfills. Prepared by Beca Carter Hollings & Ferner Ltd. Published in January 2002 by the Ministry for the Environment (MfE, 2002); and
  - Module 2: Hazardous Waste Guidelines, Landfill Waste Acceptance Criteria and Landfill Classification. Published in May 2004 by the Ministry for the Environment (MfE, 2004).
- Landfill Guidelines. Centre for Advanced Engineering, University of Canterbury, Christchurch New Zealand. First published April 2000 (CAE, 2000).
- In mid-2012 WasteMINZ's Landfill and Residual Waste Sector Group formed a Project Team to guide the development of the "Technical Guidelines for Disposal to Land". The document was been designed to bring together and supersedes the following documents:
  - A Guide to the Management of Cleanfills (MfE, 2002); and
  - Landfill Guidelines (CAE, 2000).

  The "Technical Guidelines for Disposal to Land" were updated in August 2018 (WasteMINZ, 2018) but have yet to be formally endorsed by the MfE.

- Definitions and rules included in various District and Regional Plans, for example in the Auckland Region discharges from cleanfills, managed fills and landfills are controlled by the rules set out in Section E13 of the Auckland Unitary Plan (AUP). Effectively the deposition of more than 250 m^3 per year of cleanfill material (as defined below) triggers the need for resource consent. Cleanfill is defined in the AUP as:

  "Cleanfill material means natural material such as clay, gravel, sand, soil and rock which has been excavated or quarried from areas that are not contaminated with manufactured chemicals or chemical residues as a result of industrial, commercial, mining or agricultural activities. It excludes:

  - *Hazardous substances and material (such as municipal solid waste) likely to create leachate by means of biological breakdown;*
  - *Product and materials derived from hazardous waste treatment, stabilisation and disposal practices;*
  - *Materials such as medical and veterinary waste, asbestos, and radioactive substances;*
  - *Soil and fill material which contain any trace element specified in Table E30.6.1.4.2 at a concentration greater than the background concentration in Auckland soils specified;*
  - *Sulfidic ores and soils;*
  - *Combustible components;*
  - *More than 5% by volume of inert manufactured materials (e.g. concrete, brick, tiles); and*
  - *More than 2% by volume of attached biodegradable material (e.g. vegetation)."*

  Similar definitions and rules are included in most regional plans, including the Waikato and Northland regions.

- Under the AUP discharges to surface or groundwater are required to be considered against the 2000 version of the Australian and New Zealand Environment and Conservation Council's "Australian and New Zealand guidelines for Fresh and Marine Water Quality" (ANZECC Guidelines). These guidelines have recently been superseded by the Australian & New Zealand Guidelines for Fresh and Marine Water Quality[1], however, for the contaminants considered by this assessment the trigger levels/acceptance criteria generally remain unchanged. On this basis this assessment refers to the ANZECC Guidelines, as required by the AUP.

These guidelines have been used to assess the both visual and analytical results obtained by this investigation. We note that the WasteMINZ, 2018 guidelines do not currently provide acceptance criteria for Class 3 landfills (Managed Fill) so this assessment has been limited to Class 2 (C&D landfills). The guidelines note that Class 2 (C&D landfills) may be developed for specific industrial wastes including, monofills, which could include the scenario of a developing a private landfill for National Steel's non-metallic waste.

5 Results

5.1 Visual assessment

As described in Section 4 most regional plans define cleanfill as natural materials which generally exclude manufactured products, particularly those that have the potential to generate leachate. Based on our visual inspection of the shredded non-metallic waste it is clear that the materials would not be able to meet the definition of cleanfill applied in Auckland or the neighbouring regions.

[1] http://www.waterquality.gov.au/anz-guidelines

As a result the material would need to be disposed of to a facility(ies) which meet (as a minimum) the requirements for Class B or Class 2/3 (Managed Fill/C&D Landfills).

Class B or Class 2/3 (Managed Fill/C&D Landfills) are defined in varying ways across the current (CAE, 2000) and proposed (WasteMINZ, 2018) guidance documents but can be summarised as being facilities that have limited or no engineered systems designed to collect landfill leachate or gases. Potential effects at such facilities are controlled by restricting the types of wastes received and appropriately capping the materials once placed. Further assessment of the potential for to dispose of the non-metallic waste to these types of facilities is provided in the following sections.

5.2 Analytical results

A summary of the analytical results if provided in comparison to the relevant acceptance criteria in Appendix B. Only those compounds that were reported above the laboratory limit of reporting and/or for which acceptance criteria are available are shown in Appendix B. Full transcripts as received from the laboratory are provided in Appendix C.

In summary the results show:

- Aside from the major minerals that are expected to be present (calcium, magnesium, potassium, sodium) zinc and ethylene glycol were reported at the highest concentrations in both the SPLP and TCLP analyses. Ethylene glycol is a primary component of antifreeze formulations used in motor vehicle engine cooling systems.
- As expected the TCLP analyses generally resulted in higher concentrations of contaminants in leachate than the SPLP analyses.
- The results of both the SPLP and TCLP analyses reported concentrations of a large number of metals and ethylene glycol which exceeded the ANZECC Guidelines acceptance criteria indicating that that leachate that may be produced from these material could have negative effects on environmental receptors if discharged to natural waterways or groundwater. A number of SVOC compounds are shown as potentially exceeding the ANZECC Guidelines acceptance criteria, however, this is a function of the laboratory reporting limit exceeding the acceptance criteria. There is no other indication that there compounds would be expected to be present in the samples.
- Of the SVOCs only:
    - Phthalates were reported above the laboratory limit of reporting, but below acceptance criteria, in the results of the SPLP analyses. Phthalates are mainly used as plasticisers, substances which are added to plastics to increase their flexibility, transparency, durability, and longevity;
    - Phenols were reported above the laboratory limit of reporting, but below acceptance criteria, in the results of the TCLP analyses. The presence of phenol in the TCLP results could be the result of acid catalysing precursor compounds including benzene and propylene (used in plastics, carpets, paints etc.);
    - Naphthalene and Bis(2-chloroethyl)ether were reported in one sample each, but in both cases the concentrations were close to the laboratory limit of reporting.
- Total petroleum hydrocarbons were also reported above the laboratory limit of reporting in results of both the SPLP and TCLP analyses. Neither environmental nor landfill acceptance criteria are available for these contaminants in the liquid phase. However, the MfE's "Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Revised 2011)" provides acceptance criteria for potable use which have been used as a conservative screening threshold. The concentrations of TPH are all well below the

acceptance criteria for potable use of groundwater and are therefore unlikely to present a significant risk to human health or the environment if discharged as leachate.

- Only zinc concentrations were reported to exceed (by an average of less than 3 times) Class B and/or Class2/C&D landfill criteria in the results of the SPLP analyses. Therefore if processes to separate metallic items from the waste were able to be improved, , or the zinc stabilised by treatment, this could reduce concentrations and potentially allow disposal to a Class B and/or Class2/C&D landfill where wastes are placed and maintained under normal atmospheric conditions, i.e. do no become acidic. Alternatively, wastes maybe suitable for disposal to a Class B or Class2/C&D landfill that can accept slightly elevated zinc concentrations as part of its waste stream. As acceptance criteria for Class B and/or Class2/C&D landfill are generally defined by site specific consent conditions further work would be required to identify if such sites are currently available within economic transport distance.

  If the wastes are maintained under normal atmospheric conditions it may also be an option to stockpile the materials on a suitable site, with appropriate control and treatment of runoff, for later reprocessing. However, if reprocessing does not occur the materials may still require disposal resulting in double handling/storage costs.

  In any case unless pre-treatment, which could potentially include stabilisation, can be demonstrated to sufficiently reduce zinc concentrations both a new monofill or stockpiling facility will need to be engineered to mitigate zinc discharges, e.g. appropriate lining (as a minimum). The costs of design, consenting, construction and operation of a suitable facility may exceed the potential cost savings and return from later reprocessing.

- The concentrations of zinc, nickel, and in one instance lead, were reported to exceed Class B and/or Class2/C&D landfill criteria in the results of the SPLP analyses. Therefore the materials are unlikely to be suitable for disposal to Class B and/or Class2/C&D landfills in which acidic conditions may develop. However, as indicated above if processes to separate metallic items from the waste were able to be improved this could reduce concentrations and potentially allow disposal to a Class B and/or Class2/C&D landfill. Alternatively disposal to Class A landfill indicated to be appropriate (see below).

- TCLP testing indicates that only zinc was reported at concentrations above Class A landfill acceptance criteria. These results indicate that under the acidic conditions, which are expected to occur in a mixed waste landfill, unacceptable zinc concentrations may result in leachate. This may not be a problem where the wastes are being accepted as a small part of a wider mixed waste stream, i.e. zinc concentrations will be diluted, or the disposal site has appropriate engineering controls to capture and treat leachate.

6 Summary and conclusions

In summary the results of this assessment show:

1. Due to their composition the non-metallic shredded wastes are not suitable for disposal as cleanfill. The generation of leachate during SPLP testing (i.e. simulating normal atmospheric conditions), which exceeds typical environmental acceptance criteria, confirms this interpretation.
2. Under normal atmospheric conditions the wastes generate leachate that generally complies with Class B or Class2/C&D landfill acceptance criteria, however, zinc concentrations exceeded these criteria. The wastes maybe therefore be suitable for disposal to Class B or Class2/C&D landfill that can accept slightly elevated zinc concentrations as part of its waste stream and where wastes are placed and maintained under normal atmospheric conditions, i.e. do no become acidic. Further work is required to identify if such sites are currently available within economic transport distance from National Steel's operations.

3 Alternatively the material maybe suitable for disposal to a new Class 2 monofill (i.e. accepting only this waste) if either:

   a There is potential to pre-treat the waste to reduce zinc concentrations; or

   b The facility is or can be designed in a way which mitigate zinc discharges.

   If the above controls are applied it may also be an option to stockpile the materials on a suitable site for later reprocessing. However, if reprocessing does not occur the materials may still require disposal resulting in double handling/storage costs.

   In any case unless pre-treatment, which could potentially include stabilisation, can be demonstrated to sufficiently reduce zinc concentrations both a new monofill or stockpiling facility will need to be engineered to mitigate zinc discharges, e.g. appropriate lining (as a minimum).The costs of design, consenting, construction and operation of a suitable facility may exceed the potential cost savings and return from later reprocessing.

4 TCLP testing indicates that unacceptable zinc concentrations may result in leachate under the acidic conditions that are expected to occur in a mixed waste landfill. This may not be an issue where the wastes are being accepted as a small part of a wider mixed waste stream. However, it does mean that disposal to Class B or Class2/C&D landfill or design of a new private monofill would need to be carefully considered to minimise the potential for acidic conditions to develop.

5 Testing of the non-metallic shredded wastes does indicate that the materials include metallic content that may be available for later recovery by reprocessing in future, when technologies become available/economically viable.

6 Due to the nature of the materials some testing (of raw waste and for VOCs) was not able to be completed using standard laboratory methods. Before further consideration of alternative disposal options is undertaken it is recommended that use of alternative testing methods be assessed in order to address these data gaps and confirm the interpretations presented in this assessment.

7 Applicability

This report has been prepared for the exclusive use of our client National Steel Limited, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Recommendations and opinions in this report are based on discrete sampling data. The nature and continuity of materials are inferred from the discrete data points and it must be appreciated that actual conditions could vary from the assumed model.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Authorised for Tonkin & Taylor Ltd by:

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Shane Moore
Project Director

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Appendix A: Photographs

Photograph 1: Overview of waste output from non-metallic shredder

Photograph 2: Close-up of waste output from non-metallic shredder (jar lid ~90 mm diameter for scale)

Photograph 3: Close-up of waste output from non-metallic shredder (jar ~150 mm long for scale)

Photograph 4: Rubber waste on margin of non-metallic shredder waste pile

Appendix B: Summary analytical results

	Acceptance criteria				Analytical results					
	ANZECC 95% trigger levels freshwater [1]	Class B landfill criteria [2]	C&D (Class 2) landfill criteria [3]	Class A landfill criteria [2]	SPLP analysis			TCLP analysis		
					OP1	OP2	OP3	OP1	OP2	OP3
Metals										
Total Aluminium	0.055	4	4	40	0.3	0.44	0.048	0.45	0.177	< 0.063
Total Arsenic	0.013	0.5	1	5	0.0028	0.0031	0.0013	< 0.021	< 0.021	< 0.021
Total Antimony	*0.009*	0.06	0.06	0.6	0.05	0.055	0.0139	0.0148	0.0147	0.0058
Total Barium	-	10	20	100	0.092	0.21	0.13	0.99	1.22	0.81
Total Beryllium	*0.00013*	1	1	10	< 0.00011	< 0.00011	< 0.00011	< 0.0021	< 0.0021	< 0.0021
Total Boron	0.37	2	2	20	0.67	0.56	0.46	1.01	0.64	0.89
Total Cadmium	0.0002	0.1	0.2	1	0.0006	0.0006	0.00054	0.064	0.033	0.083
Total Calcium	-	-	-	-	21	27	47	230	210	230
Total Chromium	0.001	0.5	1	5	0.0183	0.0097	0.00178	< 0.011	< 0.011	< 0.011
Total Copper	0.0014	0.5	0.5	5	0.129	0.084	0.078	0.044	0.026	0.139
Total Lead	0.0034	0.5	1	5	0.065	0.087	0.044	1.07	0.22	0.54
Total Lithium	-	2	2	20	0.137	0.145	0.099	0.164	0.119	0.146
Total Magnesium	-	-	-	-	3.1	2.3	4.9	20	8.4	14.1
Total Mercury	0.0006	0.02	0.04	0.2	< 0.00008	< 0.00008	< 0.00008	< 0.0021	< 0.0021	< 0.0021
Total Molybdenum	*0.034*	1	1	10	0.43	0.08	0.066	< 0.021	< 0.0042	< 0.0042
Total Nickel	0.011	1	1	10	0.05	0.04	0.05	1.88	1.47	1.61
Total Potassium	-	-	-	-	5.9	4.3	5.7	7.3	5.5	9.4
Total Selenium	0.011	0.11	0.2	1	< 0.0011	< 0.0011	< 0.0011	0.034	0.027	0.056
Total Silver	0.00005	0.5	1	5	0.00013	0.00011	< 0.00011	< 0.0022	< 0.0022	< 0.0022
Total Sodium	-	-	-	-	25	18	25	-	-	-
Total Tin	*0.003*	100	100	1000	0.0105	0.0055	0.00156	< 0.011	< 0.011	< 0.011
Total Uranium	-	-	-	-	0.000026	0.000027	< 0.000021	< 0.00042	< 0.00042	< 0.00042
Total Zinc	0.008	1	1	10	5.6	1.67	1.11	460	340	730
Ethylene glycol	*0.33*	-	-	-	123	91	5	100	69	8
Polycyclic Aromatic Hydrocarbons										
Anthracene	*0.0004*	-	-	-	< 0.0013	< 0.0013	< 0.0013	< 0.003	< 0.003	< 0.003
Benzo[a]pyrene (BAP)	*0.0002*	-	-	-	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Fluoranthene	*0.0014*	-	-	-	< 0.0013	< 0.0013	< 0.0013	< 0.003	< 0.003	< 0.003
Naphthalene	0.016	1	1	10	< 0.0013	0.002	< 0.0013	< 0.003	< 0.003	< 0.003
Total Petroleum Hydrocarbons										
C7 - C9	18 [4]	-	-	-	< 0.06	0.13	< 0.06	0.06	0.11	< 0.06
C10 - C14	> S [4]	-	-	-	< 0.2	0.3	< 0.2	0.3	< 0.2	< 0.2
C15 - C36	> S [4]	-	-	-	1.6	1.2	< 0.4	< 0.4	< 0.4	< 0.4
PCBs										
Total PCB (Sum of 35 congeners)	-	< LOR	5	< LOR	< 0.0006	< 0.0006	< 0.0005	< 0.005	< 0.005	< 0.005
Haloethers										
Bis(2-chloroethyl)ether	-	-	-	-	< 0.003	0.006	< 0.003	< 0.005	< 0.005	< 0.005
Phenols										
2-Chlorophenol	0.49	0.005	-	0.05	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
2,4-Dichlorophenol	0.16	0.005	0.005	0.05	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
3 & 4-Methylphenol (m- + p-cresol)	-	-	20	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
2-Methylphenol (o-Cresol)	-	-	20	-	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
2-Nitrophenol	*0.002*	-	-	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Pentachlorophenol (PCP)	0.01	-	10	-	< 0.05	< 0.05	< 0.05	< 0.10	< 0.10	< 0.10
Phenol	0.32	4	4	40	< 0.005	< 0.005	< 0.005	0.036	0.032	0.017
2,4,5-Trichlorophenol	*0.0005*	-	40	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
2,4,6-Trichlorophenol	0.02	0.01	0.2	0.1	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Plasticisers										
Diethylphthalate	*1*	10	10	100	0.011	0.013	< 0.005	< 0.010	< 0.010	< 0.010
Dimethylphthalate	*3.7*	40	40	400	0.01	0.007	< 0.005	< 0.010	< 0.010	< 0.010
Di-n-butylphthalate	-	30	-	300	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Nitrogen containing compounds										
2,4-Dinitrotoluene	0.065	-	-	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Nitrobenzene	0.55	-	0.2	-	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
Organochlorine Pesticides										
Aldrin	0.000001	0.000008	-	0.00008	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
gamma-BHC (Lindane)	0.0002	-	0.08	-	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
4,4'-DDE	*0.00003*	-	-	-	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
4,4'-DDT	0.00001	-	-	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Dieldrin		0.04	-	0.4	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
Endosulfan I	0.0002	0.03	-	0.3	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Endrin	0.00002	-	-	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Heptachlor	0.00009	-	0.0008	-	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
Other Halogenated compounds										
1,2-Dichlorobenzene	0.16	0.02	0.02	0.2	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
1,3-Dichlorobenzene	0.26	5	-	50	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
1,4-Dichlorobenzene	0.06	-	0.75	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Hexachlorobutadiene	*0.00004*	-	-	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Hexachloroethane	0.36	-	0.3	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
1,2,4-Trichlorobenzene	0.17	4		40	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
Other SVOC										
Isophorone	*0.12*	-	-	-	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
All other SVOC compounds reported below the laboratory limit of reporting										

Notes:

All results in mg/l

< LOR indicates less than laboratory limit of reporting

Dash (-) indicates no trigger level provided or analyte not tested.

Blue shaded values indicate ANZECC 95% guideline exceeded (including low and moderate reliability trigger levels).

Green shaded values indicate Class B and/or C&D landfill criteria exceeded.

Orange shaded values indicate C&D landfill criteria exceeded.

Brown shaded values indicate Class A landfill criteria exceeded.

1 - Australian and New Zealand Environment and Conservation Council (ANZECC), 2000. *Australian and New Zealand guidelines for Fresh and Marine Water Quality*. Values in italics indicate insufficient data available to derive high reliability trigger level. Low or moderate reliability trigger levels are provided.

2 - Ministry for the Environment, 2004. *Module 2: Hazardous Waste Guidelines, Landfill Waste Acceptance Criteria and Landfill Classification.* Table 2, Appendix A.

3 - Waste Management Institute New Zealand (WasteMINZ), August 2018. *Technical Guidelines for Disposal to Land.*

4 - Ministry for the Environment, 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Revised 2011). Potable criteria used as a conservative proxy.

Appendix C: Laboratory analytical report

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

SPv1

Client:	Tonkin & Taylor	**Lab No:**	1969553
Contact:	S Moore	**Date Received:**	26-Apr-2018
	C/- Tonkin & Taylor	**Date Reported:**	11-May-2018
	PO Box 5271	**Quote No:**	87655
	Auckland 1141	**Order No:**	1004057
		Client Reference:	1004057
		Submitted By:	Penelope Lindsay

Sample Type: Miscellaneous

Sample Name:		OP1 24-Apr-2018	OP2 24-Apr-2018	OP3 24-Apr-2018		
Lab Number:		1969553.1	1969553.2	1969553.3		
Individual Tests						
SPLP Sample Weight	g	50	50	50	-	-
SPLP Extractant Type*		De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4	-	-
SPLP Final pH	pH Units	7.6	8.2	8.2	-	-
TCLP Weight of Sample Taken	g	50	50	50	-	-
TCLP Initial Sample pH	pH Units	8.5	8.9	8.6	-	-
TCLP Acid Adjusted Sample pH	pH Units	2.1	2.1	3.1	-	-
TCLP Extractant Type*		NaOH/Acetic acid at pH 4.93 +/- 0.05	NaOH/Acetic acid at pH 4.93 +/- 0.05	NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-
TCLP Extraction Fluid pH	pH Units	5.0	5.0	5.0	-	-
TCLP Post Extraction Sample pH	pH Units	5.8	5.7	6.2	-	-

Sample Type: Aqueous

Sample Name:		OP1 [TCLP Extract]	OP2 [TCLP Extract]	OP3 [TCLP Extract]	OP1 [SPLP Extract]	OP2 [SPLP Extract]
Lab Number:		1969553.4	1969553.5	1969553.6	1969553.10	1969553.11
Individual Tests						
Total Aluminium	g/m³	0.45	0.177	< 0.063	0.30	0.44
Total Antimony	g/m³	0.0148	0.0147	0.0058	0.050	0.055
Total Barium	g/m³	0.99	1.22	0.81	0.092	0.21
Total Beryllium	g/m³	< 0.0021	< 0.0021	< 0.0021	< 0.00011	< 0.00011
Total Boron	g/m³	1.01	0.64	0.89	0.67	0.56
Total Calcium	g/m³	230	210	230	21	27
Total Lithium	g/m³	0.164	0.119	0.146	0.137	0.145
Total Magnesium	g/m³	20	8.4	14.1	3.1	2.3
Total Mercury	g/m³	< 0.0021	< 0.0021	< 0.0021	< 0.00008	< 0.00008
Total Molybdenum	g/m³	< 0.021	< 0.0042	< 0.0042	0.43	0.080
Total Potassium	g/m³	7.3	5.5	9.4	5.9	4.3
Total Selenium	g/m³	0.034	0.027	0.056	< 0.0011	< 0.0011
Total Silver	g/m³	< 0.0022	< 0.0022	< 0.0022	0.00013	0.00011
Total Sodium	g/m³	-	-	-	25	18.0
Total Tin	g/m³	< 0.011	< 0.011	< 0.011	0.0105	0.0055
Total Uranium	g/m³	< 0.00042	< 0.00042	< 0.00042	0.000026	0.000027
Heavy metals, totals, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Arsenic	g/m³	-	-	-	0.0028	0.0031
Total Cadmium	g/m³	-	-	-	0.00060	0.00060
Total Chromium	g/m³	-	-	-	0.0183	0.0097
Total Copper	g/m³	-	-	-	0.129	0.084
Total Lead	g/m³	-	-	-	0.065	0.087

Sample Type: Aqueous						
Sample Name:		OP1 [TCLP Extract]	OP2 [TCLP Extract]	OP3 [TCLP Extract]	OP1 [SPLP Extract]	OP2 [SPLP Extract]
Lab Number:		1969553.4	1969553.5	1969553.6	1969553.10	1969553.11
Heavy metals, totals, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Nickel	g/m^3	-	-	-	0.050	0.040
Total Zinc	g/m^3	-	-	-	5.6	1.67
Heavy metals, totals, screen As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Arsenic	g/m^3	< 0.021	< 0.021	< 0.021	-	-
Total Cadmium	g/m^3	0.064	0.033	0.083	-	-
Total Chromium	g/m^3	< 0.011	< 0.011	< 0.011	-	-
Total Copper	g/m^3	0.044	0.026	0.139	-	-
Total Lead	g/m^3	1.07	0.22	0.54	-	-
Total Nickel	g/m^3	1.88	1.47	1.61	-	-
Total Zinc	g/m^3	460	340	730	-	-
Ethylene Glycol in Water						
Ethylene glycol*	g/m^3	100	69	8	123	91
Propylene Glycol in Water						
Propylene glycol*	g/m^3	< 4	< 4	< 4	< 4	< 4
Methanol in Water - Aqueous Solvents						
Methanol*	g/m^3	< 2	< 2	< 2	< 2	< 2
Polychlorinated Biphenyls Screening in Water, By Liq/Liq						
PCB-18	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-28	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-31	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-44	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-49	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-52	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-60	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-77	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-81	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-86	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-101	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-105	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-110	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-114	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-118	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-121	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-123	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-126	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-128	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-138	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-141	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-149	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-151	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-153	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-156	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-157	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-159	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-167	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-169	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-170	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-180	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-189	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-194	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-206	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-209	g/m^3	< 0.00010	< 0.00010	< 0.00010	-	-
Total PCB (Sum of 35 congeners)	g/m^3	< 0.005	< 0.005	< 0.005	-	-

Sample Type: Aqueous						
Sample Name:		OP1 [TCLP Extract]	OP2 [TCLP Extract]	OP3 [TCLP Extract]	OP1 [SPLP Extract]	OP2 [SPLP Extract]
Lab Number:		1969553.4	1969553.5	1969553.6	1969553.10	1969553.11
Polychlorinated Bipheyls Trace in Water, By Liq/Liq						
Total PCB (Sum of 35 congeners)	g/m³	-	-	-	< 0.0006	< 0.0006
Haloethers Trace in SVOC Water Samples by GC-MS						
Bis(2-chloroethoxy) methane	g/m³	-	-	-	< 0.003	< 0.003
Bis(2-chloroethyl)ether	g/m³	-	-	-	< 0.003	0.006
Bis(2-chloroisopropyl)ether	g/m³	-	-	-	< 0.003	< 0.003
4-Bromophenyl phenyl ether	g/m³	-	-	-	< 0.003	< 0.003
4-Chlorophenyl phenyl ether	g/m³	-	-	-	< 0.003	< 0.003
Haloethers in SVOC Water Samples by GC-MS						
Bis(2-chloroethoxy) methane	g/m³	< 0.005	< 0.005	< 0.005	-	-
Bis(2-chloroethyl)ether	g/m³	< 0.005	< 0.005	< 0.005	-	-
Bis(2-chloroisopropyl)ether	g/m³	< 0.005	< 0.005	< 0.005	-	-
4-Bromophenyl phenyl ether	g/m³	< 0.005	< 0.005	< 0.005	-	-
4-Chlorophenyl phenyl ether	g/m³	< 0.005	< 0.005	< 0.005	-	-
Nitrogen containing compounds in SVOC Water Samples by GC-MS						
2,4-Dinitrotoluene	g/m³	< 0.010	< 0.010	< 0.010	-	-
2,6-Dinitrotoluene	g/m³	< 0.010	< 0.010	< 0.010	-	-
Nitrobenzene	g/m³	< 0.005	< 0.005	< 0.005	-	-
N-Nitrosodi-n-propylamine	g/m³	< 0.010	< 0.010	< 0.010	-	-
N-Nitrosodiphenylamine + Diphenylamine*	g/m3	< 0.010	< 0.010	< 0.010	-	-
Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS						
2,4-Dinitrotoluene	g/m³	-	-	-	< 0.005	< 0.005
2,6-Dinitrotoluene	g/m³	-	-	-	< 0.005	< 0.005
Nitrobenzene	g/m³	-	-	-	< 0.003	< 0.003
N-Nitrosodi-n-propylamine	g/m³	-	-	-	< 0.005	< 0.005
N-Nitrosodiphenylamine + Diphenylamine	g/m3	-	-	-	< 0.005	< 0.005
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
Aldrin	g/m³	-	-	-	< 0.003	< 0.003
alpha-BHC	g/m³	-	-	-	< 0.003	< 0.003
beta-BHC	g/m³	-	-	-	< 0.003	< 0.003
delta-BHC	g/m³	-	-	-	< 0.003	< 0.003
gamma-BHC (Lindane)	g/m³	-	-	-	< 0.003	< 0.003
4,4'-DDD	g/m³	-	-	-	< 0.003	< 0.003
4,4'-DDE	g/m³	-	-	-	< 0.003	< 0.003
4,4'-DDT	g/m³	-	-	-	< 0.005	< 0.005
Dieldrin	g/m³	-	-	-	< 0.003	< 0.003
Endosulfan I	g/m³	-	-	-	< 0.005	< 0.005
Endosulfan II	g/m³	-	-	-	< 0.005	< 0.005
Endosulfan sulfate	g/m³	-	-	-	< 0.005	< 0.005
Endrin	g/m³	-	-	-	< 0.005	< 0.005
Endrin ketone	g/m³	-	-	-	< 0.005	< 0.005
Heptachlor	g/m³	-	-	-	< 0.003	< 0.003
Heptachlor epoxide	g/m³	-	-	-	< 0.003	< 0.003
Hexachlorobenzene	g/m³	-	-	-	< 0.003	< 0.003
Organochlorine Pesticides in SVOC Water Samples by GC-MS						
Aldrin	g/m³	< 0.005	< 0.005	< 0.005	-	-
alpha-BHC	g/m³	< 0.005	< 0.005	< 0.005	-	-
beta-BHC	g/m³	< 0.005	< 0.005	< 0.005	-	-
delta-BHC	g/m³	< 0.005	< 0.005	< 0.005	-	-
gamma-BHC (Lindane)	g/m³	< 0.005	< 0.005	< 0.005	-	-
4,4'-DDD	g/m³	< 0.005	< 0.005	< 0.005	-	-
4,4'-DDE	g/m³	< 0.005	< 0.005	< 0.005	-	-
4,4'-DDT	g/m³	< 0.010	< 0.010	< 0.010	-	-
Dieldrin	g/m³	< 0.005	< 0.005	< 0.005	-	-
Endosulfan I	g/m³	< 0.010	< 0.010	< 0.010	-	-

Sample Type: Aqueous						
Sample Name:		OP1 [TCLP Extract]	OP2 [TCLP Extract]	OP3 [TCLP Extract]	OP1 [SPLP Extract]	OP2 [SPLP Extract]
Lab Number:		1969553.4	1969553.5	1969553.6	1969553.10	1969553.11
Organochlorine Pesticides in SVOC Water Samples by GC-MS						
Endosulfan II	g/m^3	< 0.010	< 0.010	< 0.010	-	-
Endosulfan sulfate	g/m^3	< 0.010	< 0.010	< 0.010	-	-
Endrin	g/m^3	< 0.010	< 0.010	< 0.010	-	-
Endrin ketone	g/m^3	< 0.010	< 0.010	< 0.010	-	-
Heptachlor	g/m^3	< 0.005	< 0.005	< 0.005	-	-
Heptachlor epoxide	g/m^3	< 0.005	< 0.005	< 0.005	-	-
Hexachlorobenzene	g/m^3	< 0.005	< 0.005	< 0.005	-	-
Polycyclic Aromatic Hydrocarbons Trace in SVOC Water Samples						
Acenaphthene	g/m^3	-	-	-	< 0.0013	< 0.0013
Acenaphthylene	g/m^3	-	-	-	< 0.0013	< 0.0013
Anthracene	g/m^3	-	-	-	< 0.0013	< 0.0013
Benzo[a]anthracene	g/m^3	-	-	-	< 0.0013	< 0.0013
Benzo[a]pyrene (BAP)	g/m^3	-	-	-	< 0.003	< 0.003
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m^3	-	-	-	< 0.003	< 0.003
Benzo[g,h,i]perylene	g/m^3	-	-	-	< 0.003	< 0.003
Benzo[k]fluoranthene	g/m^3	-	-	-	< 0.003	< 0.003
1&2-Chloronaphthalene	g/m^3	-	-	-	< 0.0013	< 0.0013
Chrysene	g/m^3	-	-	-	< 0.0013	< 0.0013
Dibenzo[a,h]anthracene	g/m^3	-	-	-	< 0.003	< 0.003
Fluoranthene	g/m^3	-	-	-	< 0.0013	< 0.0013
Fluorene	g/m^3	-	-	-	< 0.0013	< 0.0013
Indeno(1,2,3-c,d)pyrene	g/m^3	-	-	-	< 0.003	< 0.003
2-Methylnaphthalene	g/m^3	-	-	-	< 0.0013	< 0.0013
Naphthalene	g/m^3	-	-	-	< 0.0013	0.0020
Phenanthrene	g/m^3	-	-	-	< 0.0013	< 0.0013
Pyrene	g/m^3	-	-	-	< 0.0013	< 0.0013
Polycyclic Aromatic Hydrocarbons in SVOC Water Samples by GC-MS						
Acenaphthene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Acenaphthylene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Anthracene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Benzo[a]anthracene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Benzo[a]pyrene (BAP)	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Benzo[g,h,i]perylene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Benzo[k]fluoranthene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
1&2-Chloronaphthalene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Chrysene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Dibenzo[a,h]anthracene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Fluoranthene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Fluorene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Indeno(1,2,3-c,d)pyrene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
2-Methylnaphthalene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Naphthalene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Phenanthrene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Pyrene	g/m^3	< 0.003	< 0.003	< 0.003	-	-
Phenols in SVOC Water Samples by GC-MS						
4-Chloro-3-methylphenol	g/m^3	< 0.010	< 0.010	< 0.010	-	-
2-Chlorophenol	g/m^3	< 0.005	< 0.005	< 0.005	-	-
2,4-Dichlorophenol	g/m^3	< 0.005	< 0.005	< 0.005	-	-
2,4-Dimethylphenol	g/m^3	< 0.005	< 0.005	< 0.005	-	-
3 & 4-Methylphenol (m- + p-cresol)	g/m^3	< 0.010	< 0.010	< 0.010	-	-
2-Methylphenol (o-Cresol)	g/m^3	< 0.005	< 0.005	< 0.005	-	-
2-Nitrophenol	g/m^3	< 0.010	< 0.010	< 0.010	-	-

Sample Type: Aqueous						
Sample Name:		OP1 [TCLP Extract]	OP2 [TCLP Extract]	OP3 [TCLP Extract]	OP1 [SPLP Extract]	OP2 [SPLP Extract]
Lab Number:		1969553.4	1969553.5	1969553.6	1969553.10	1969553.11
Phenols in SVOC Water Samples by GC-MS						
Pentachlorophenol (PCP)	g/m^3	< 0.10	< 0.10	< 0.10	-	-
Phenol	g/m^3	0.036	0.032	0.017	-	-
2,4,5-Trichlorophenol	g/m^3	< 0.010	< 0.010	< 0.010	-	-
2,4,6-Trichlorophenol	g/m^3	< 0.010	< 0.010	< 0.010	-	-
Phenols Trace (drinkingwater) in SVOC Water Samples by GC-MS						
2-Chlorophenol	g/m^3	-	-	-	< 0.003	< 0.003
2,4-Dichlorophenol	g/m^3	-	-	-	< 0.003	< 0.003
2,4,6-Trichlorophenol	g/m^3	-	-	-	< 0.005	< 0.005
Phenols Trace (non-drinkingwater) in SVOC Water Samples by GC-MS						
4-Chloro-3-methylphenol	g/m^3	-	-	-	< 0.005	< 0.005
2,4-Dimethylphenol	g/m^3	-	-	-	< 0.003	< 0.003
3 & 4-Methylphenol (m- + p-cresol)	g/m^3	-	-	-	< 0.005	< 0.005
2-Methylphenol (o-Cresol)	g/m^3	-	-	-	< 0.003	< 0.003
2-Nitrophenol	g/m^3	-	-	-	< 0.005	< 0.005
Pentachlorophenol (PCP)	g/m^3	-	-	-	< 0.05	< 0.05
Phenol	g/m^3	-	-	-	< 0.005	< 0.005
2,4,5-Trichlorophenol	g/m^3	-	-	-	< 0.005	< 0.005
Plasticisers Trace (non-drinkingwater) in SVOC Water by GCMS						
Butylbenzylphthalate	g/m^3	-	-	-	< 0.005	< 0.005
Diethylphthalate	g/m^3	-	-	-	0.011	0.013
Dimethylphthalate	g/m^3	-	-	-	0.010	0.007
Di-n-butylphthalate	g/m^3	-	-	-	< 0.005	< 0.005
Di-n-octylphthalate	g/m^3	-	-	-	< 0.005	< 0.005
Plasticisers in SVOC Water Samples by GC-MS						
Bis(2-ethylhexyl)phthalate	g/m^3	< 0.03	< 0.03	< 0.03	-	-
Butylbenzylphthalate	g/m^3	< 0.010	< 0.010	< 0.010	-	-
Di(2-ethylhexyl)adipate	g/m^3	< 0.005	< 0.005	< 0.005	-	-
Diethylphthalate	g/m^3	< 0.010	< 0.010	< 0.010	-	-
Dimethylphthalate	g/m^3	< 0.010	< 0.010	< 0.010	-	-
Di-n-butylphthalate	g/m^3	< 0.010	< 0.010	< 0.010	-	-
Di-n-octylphthalate	g/m^3	< 0.010	< 0.010	< 0.010	-	-
Plasticisers Trace (drinkingwater) in SVOC Water Samples by GCMS						
Bis(2-ethylhexyl)phthalate	g/m^3	-	-	-	< 0.010	< 0.010
Di(2-ethylhexyl)adipate	g/m^3	-	-	-	< 0.003	< 0.003
Other Halogenated compounds in SVOC Water Samples by GC-MS						
1,2-Dichlorobenzene	g/m^3	< 0.010	< 0.010	< 0.010	-	-
1,3-Dichlorobenzene	g/m^3	< 0.010	< 0.010	< 0.010	-	-
1,4-Dichlorobenzene	g/m^3	< 0.010	< 0.010	< 0.010	-	-
Hexachlorobutadiene	g/m^3	< 0.010	< 0.010	< 0.010	-	-
Hexachloroethane	g/m^3	< 0.010	< 0.010	< 0.010	-	-
1,2,4-Trichlorobenzene	g/m^3	< 0.005	< 0.005	< 0.005	-	-
Other Halogenated compounds Trace (drinkingwater) in SVOC Water						
1,2-Dichlorobenzene	g/m^3	-	-	-	< 0.005	< 0.005
1,3-Dichlorobenzene	g/m^3	-	-	-	< 0.005	< 0.005
1,4-Dichlorobenzene	g/m^3	-	-	-	< 0.005	< 0.005
Other Halogenated compounds Trace (non-drinkingwater) in SVOC						
Hexachlorobutadiene	g/m^3	-	-	-	< 0.005	< 0.005
Hexachloroethane	g/m^3	-	-	-	< 0.005	< 0.005
1,2,4-Trichlorobenzene	g/m^3	-	-	-	< 0.003	< 0.003
Other SVOC Trace in SVOC Water Samples by GC-MS						
Benzyl alcohol	g/m^3	-	-	-	< 0.03	< 0.03
Carbazole	g/m^3	-	-	-	< 0.003	< 0.003
Dibenzofuran	g/m^3	-	-	-	< 0.003	< 0.003
Isophorone	g/m^3	-	-	-	< 0.003	< 0.003

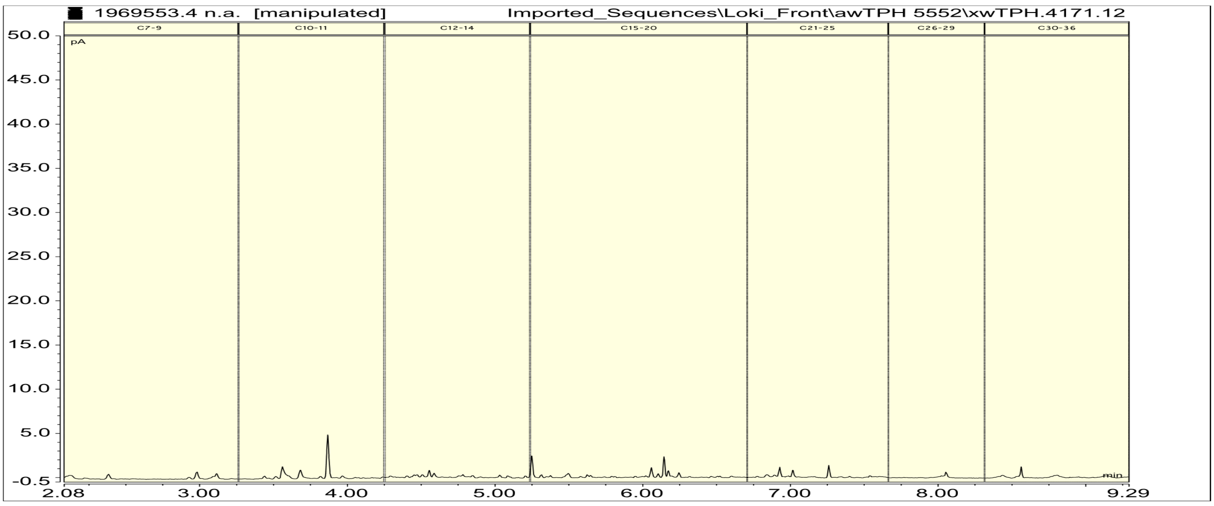
Sample Type: Aqueous						
Sample Name:		OP1 [TCLP Extract]	OP2 [TCLP Extract]	OP3 [TCLP Extract]	OP1 [SPLP Extract]	OP2 [SPLP Extract]
Lab Number:		1969553.4	1969553.5	1969553.6	1969553.10	1969553.11
Other compounds in SVOC Water Samples by GC-MS						
Benzyl alcohol	g/m³	< 0.05	< 0.05	< 0.05	-	-
Carbazole	g/m³	< 0.005	< 0.005	< 0.005	-	-
Dibenzofuran	g/m³	< 0.005	< 0.005	< 0.005	-	-
Isophorone	g/m³	< 0.005	< 0.005	< 0.005	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	0.06	0.11	< 0.06	< 0.06	0.13
C10 - C14	g/m³	0.3	< 0.2	< 0.2	< 0.2	0.3
C15 - C36	g/m³	< 0.4	< 0.4	< 0.4	1.6	1.2
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	< 0.7	< 0.7	1.6	1.7

Sample Name:		OP3 [SPLP Extract]				
Lab Number:		1969553.12				
Individual Tests						
Total Aluminium	g/m³	0.048	-	-	-	-
Total Antimony	g/m³	0.0139	-	-	-	-
Total Barium	g/m³	0.130	-	-	-	-
Total Beryllium	g/m³	< 0.00011	-	-	-	-
Total Boron	g/m³	0.46	-	-	-	-
Total Calcium	g/m³	47	-	-	-	-
Total Lithium	g/m³	0.099	-	-	-	-
Total Magnesium	g/m³	4.9	-	-	-	-
Total Mercury	g/m³	< 0.00008	-	-	-	-
Total Molybdenum	g/m³	0.066	-	-	-	-
Total Potassium	g/m³	5.7	-	-	-	-
Total Selenium	g/m³	< 0.0011	-	-	-	-
Total Silver	g/m³	< 0.00011	-	-	-	-
Total Sodium	g/m³	25	-	-	-	-
Total Tin	g/m³	0.00156	-	-	-	-
Total Uranium	g/m³	< 0.000021	-	-	-	-
Heavy metals, totals, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Arsenic	g/m³	0.0013	-	-	-	-
Total Cadmium	g/m³	0.00054	-	-	-	-
Total Chromium	g/m³	0.00178	-	-	-	-
Total Copper	g/m³	0.078	-	-	-	-
Total Lead	g/m³	0.044	-	-	-	-
Total Nickel	g/m³	0.050	-	-	-	-
Total Zinc	g/m³	1.11	-	-	-	-
Ethylene Glycol in Water						
Ethylene glycol*	g/m³	5	-	-	-	-
Propylene Glycol in Water						
Propylene glycol*	g/m³	< 4	-	-	-	-
Methanol in Water - Aqueous Solvents						
Methanol*	g/m³	< 2	-	-	-	-
Polychlorinated Bipheyls Trace in Water, By Liq/Liq						
Total PCB (Sum of 35 congeners)	g/m³	< 0.0005	-	-	-	-
Haloethers Trace in SVOC Water Samples by GC-MS						
Bis(2-chloroethoxy) methane	g/m³	< 0.003	-	-	-	-
Bis(2-chloroethyl)ether	g/m³	< 0.003	-	-	-	-
Bis(2-chloroisopropyl)ether	g/m³	< 0.003	-	-	-	-
4-Bromophenyl phenyl ether	g/m³	< 0.003	-	-	-	-
4-Chlorophenyl phenyl ether	g/m³	< 0.003	-	-	-	-
Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS						
2,4-Dinitrotoluene	g/m³	< 0.005	-	-	-	-
2,6-Dinitrotoluene	g/m³	< 0.005	-	-	-	-

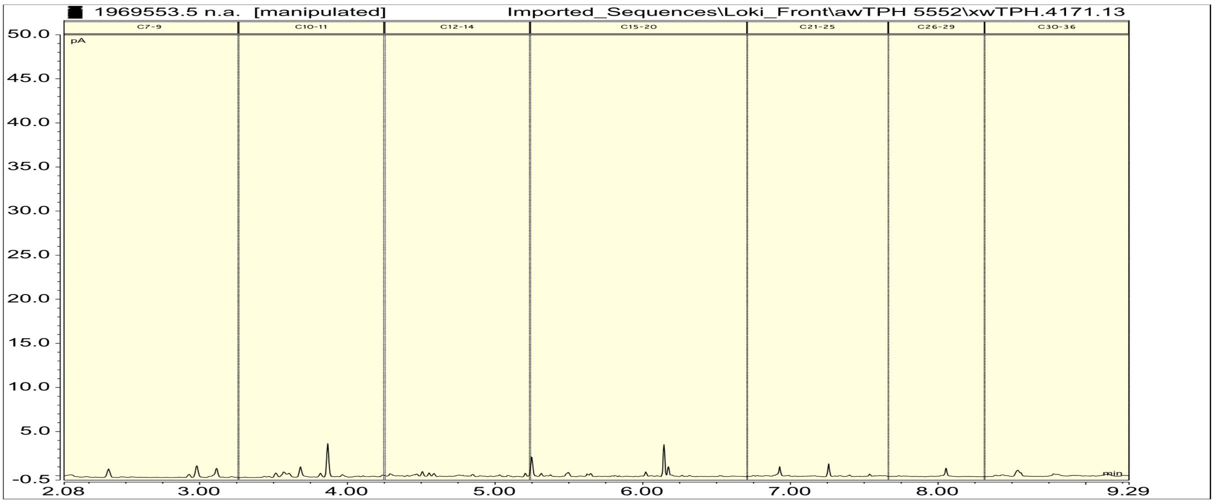
Sample Type: Aqueous						
Sample Name:		OP3 [SPLP Extract]				
Lab Number:		1969553.12				
Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS						
Nitrobenzene	g/m^3	< 0.003	-	-	-	-
N-Nitrosodi-n-propylamine	g/m^3	< 0.005	-	-	-	-
N-Nitrosodiphenylamine + Diphenylamine	g/m3	< 0.005	-	-	-	-
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
Aldrin	g/m^3	< 0.003	-	-	-	-
alpha-BHC	g/m^3	< 0.003	-	-	-	-
beta-BHC	g/m^3	< 0.003	-	-	-	-
delta-BHC	g/m^3	< 0.003	-	-	-	-
gamma-BHC (Lindane)	g/m^3	< 0.003	-	-	-	-
4,4'-DDD	g/m^3	< 0.003	-	-	-	-
4,4'-DDE	g/m^3	< 0.003	-	-	-	-
4,4'-DDT	g/m^3	< 0.005	-	-	-	-
Dieldrin	g/m^3	< 0.003	-	-	-	-
Endosulfan I	g/m^3	< 0.005	-	-	-	-
Endosulfan II	g/m^3	< 0.005	-	-	-	-
Endosulfan sulfate	g/m^3	< 0.005	-	-	-	-
Endrin	g/m^3	< 0.005	-	-	-	-
Endrin ketone	g/m^3	< 0.005	-	-	-	-
Heptachlor	g/m^3	< 0.003	-	-	-	-
Heptachlor epoxide	g/m^3	< 0.003	-	-	-	-
Hexachlorobenzene	g/m^3	< 0.003	-	-	-	-
Polycyclic Aromatic Hydrocarbons Trace in SVOC Water Samples						
Acenaphthene	g/m^3	< 0.0013	-	-	-	-
Acenaphthylene	g/m^3	< 0.0013	-	-	-	-
Anthracene	g/m^3	< 0.0013	-	-	-	-
Benzo[a]anthracene	g/m^3	< 0.0013	-	-	-	-
Benzo[a]pyrene (BAP)	g/m^3	< 0.003	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m^3	< 0.003	-	-	-	-
Benzo[g,h,i]perylene	g/m^3	< 0.003	-	-	-	-
Benzo[k]fluoranthene	g/m^3	< 0.003	-	-	-	-
1&2-Chloronaphthalene	g/m^3	< 0.0013	-	-	-	-
Chrysene	g/m^3	< 0.0013	-	-	-	-
Dibenzo[a,h]anthracene	g/m^3	< 0.003	-	-	-	-
Fluoranthene	g/m^3	< 0.0013	-	-	-	-
Fluorene	g/m^3	< 0.0013	-	-	-	-
Indeno(1,2,3-c,d)pyrene	g/m^3	< 0.003	-	-	-	-
2-Methylnaphthalene	g/m^3	< 0.0013	-	-	-	-
Naphthalene	g/m^3	< 0.0013	-	-	-	-
Phenanthrene	g/m^3	< 0.0013	-	-	-	-
Pyrene	g/m^3	< 0.0013	-	-	-	-
Phenols Trace (drinkingwater) in SVOC Water Samples by GC-MS						
2-Chlorophenol	g/m^3	< 0.003	-	-	-	-
2,4-Dichlorophenol	g/m^3	< 0.003	-	-	-	-
2,4,6-Trichlorophenol	g/m^3	< 0.005	-	-	-	-
Phenols Trace (non-drinkingwater) in SVOC Water Samples by GC-MS						
4-Chloro-3-methylphenol	g/m^3	< 0.005	-	-	-	-
2,4-Dimethylphenol	g/m^3	< 0.003	-	-	-	-
3 & 4-Methylphenol (m- + p-cresol)	g/m^3	< 0.005	-	-	-	-
2-Methylphenol (o-Cresol)	g/m^3	< 0.003	-	-	-	-
2-Nitrophenol	g/m^3	< 0.005	-	-	-	-
Pentachlorophenol (PCP)	g/m^3	< 0.05	-	-	-	-
Phenol	g/m^3	< 0.005	-	-	-	-
2,4,5-Trichlorophenol	g/m^3	< 0.005	-	-	-	-

Sample Type: Aqueous						
Sample Name:		OP3 [SPLP Extract]				
Lab Number:		1969553.12				
Plasticisers Trace (non-drinkingwater) in SVOC Water by GCMS						
Butylbenzylphthalate	g/m³	< 0.005	-	-	-	-
Diethylphthalate	g/m³	< 0.005	-	-	-	-
Dimethylphthalate	g/m³	< 0.005	-	-	-	-
Di-n-butylphthalate	g/m³	< 0.005	-	-	-	-
Di-n-octylphthalate	g/m³	< 0.005	-	-	-	-
Plasticisers Trace (drinkingwater) in SVOC Water Samples by GCMS						
Bis(2-ethylhexyl)phthalate	g/m³	< 0.010	-	-	-	-
Di(2-ethylhexyl)adipate	g/m³	< 0.003	-	-	-	-
Other Halogenated compounds Trace (drinkingwater) in SVOC Water						
1,2-Dichlorobenzene	g/m³	< 0.005	-	-	-	-
1,3-Dichlorobenzene	g/m³	< 0.005	-	-	-	-
1,4-Dichlorobenzene	g/m³	< 0.005	-	-	-	-
Other Halogenated compounds Trace (non-drinkingwater) in SVOC						
Hexachlorobutadiene	g/m³	< 0.005	-	-	-	-
Hexachloroethane	g/m³	< 0.005	-	-	-	-
1,2,4-Trichlorobenzene	g/m³	< 0.003	-	-	-	-
Other SVOC Trace in SVOC Water Samples by GC-MS						
Benzyl alcohol	g/m³	< 0.03	-	-	-	-
Carbazole	g/m³	< 0.003	-	-	-	-
Dibenzofuran	g/m³	< 0.003	-	-	-	-
Isophorone	g/m³	< 0.003	-	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.06	-	-	-	-
C10 - C14	g/m³	< 0.2	-	-	-	-
C15 - C36	g/m³	< 0.4	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	-	-	-	-

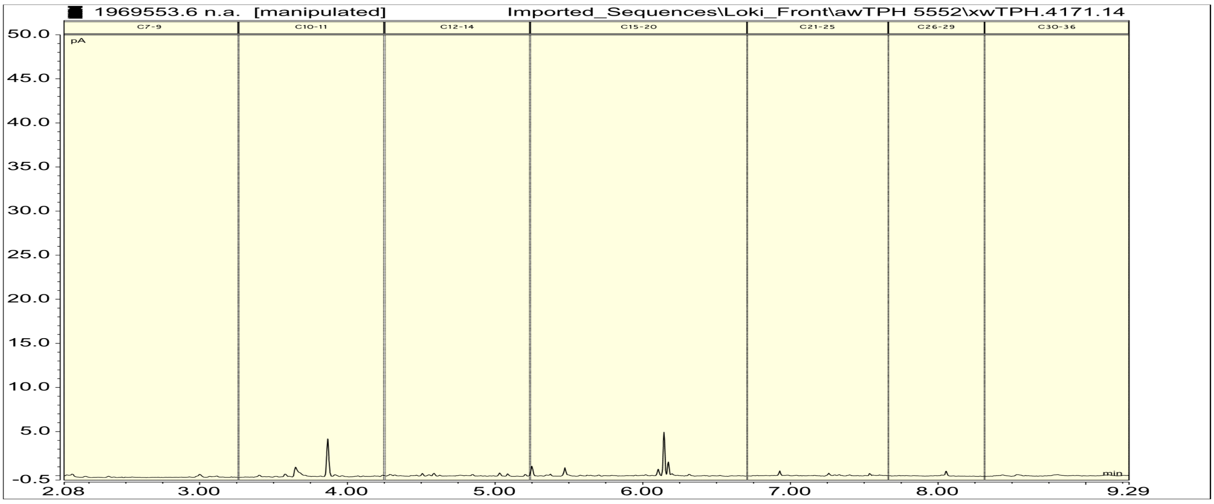
1969553.4
OP1 [TCLP Extract]
Client Chromatogram for TPH by FID



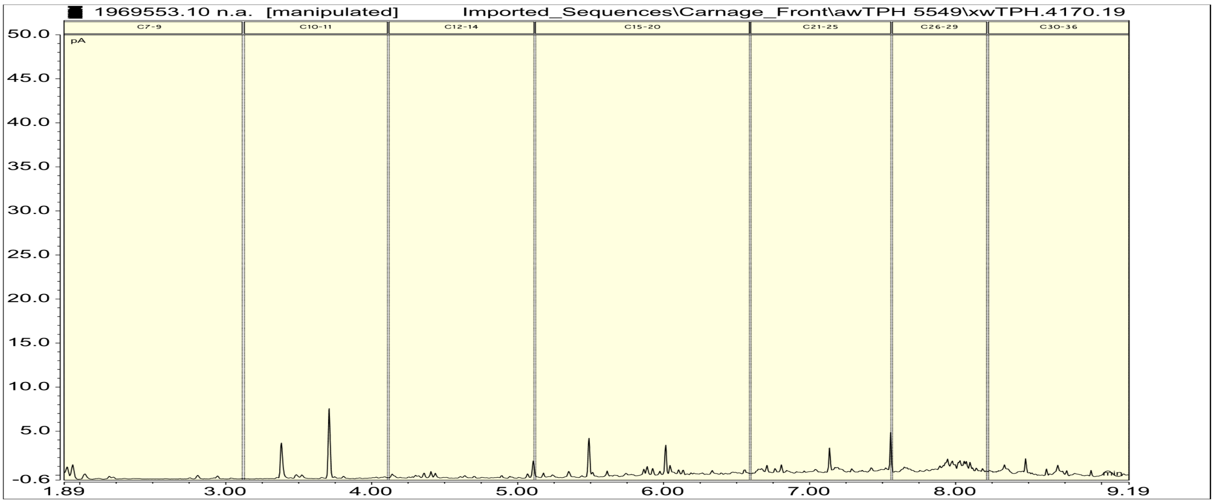
1969553.5
OP2 [TCLP Extract]
Client Chromatogram for TPH by FID



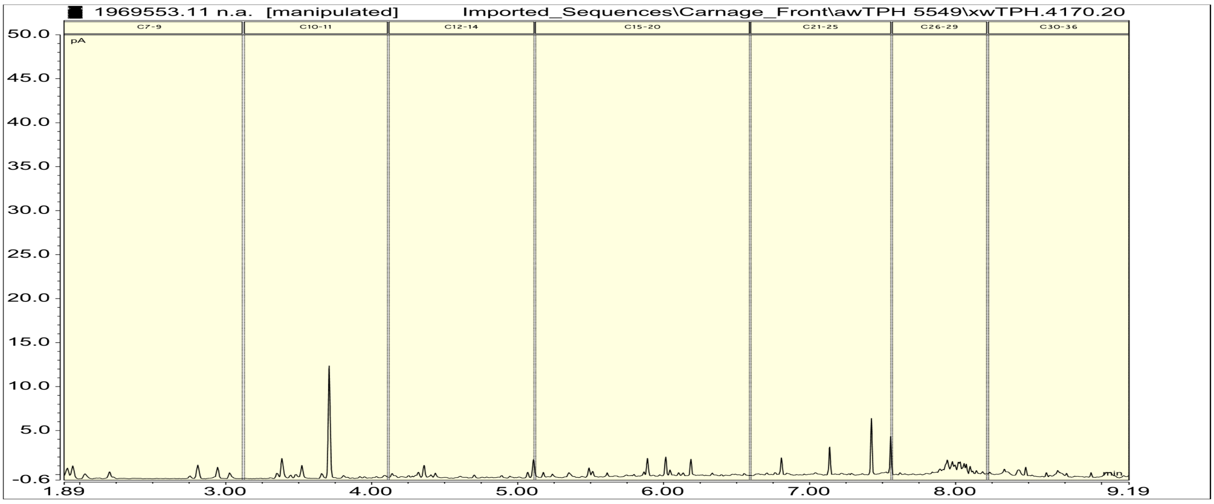
1969553.6
OP3 [TCLP Extract]
Client Chromatogram for TPH by FID



1969553.10
OP1 [SPLP Extract]
Client Chromatogram for TPH by FID



1969553.11
OP2 [SPLP Extract]
Client Chromatogram for TPH by FID



Analyst's Comments

The matrix in samples 1969553.10, .11 and .12 has affected the System Monitoring Compounds Tetrachloro-m-xylene and 3-Bromobiphenyl in the PCB analysis, whereby the recovery for sample 10 was 12% & 24%, sample 11 was 18% & 26% and sample 12 was 16% & 36% respectively. Therefore the results may be underestimated.
The analysis was done on limited sample, hence the higher detection limits reported.

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 clean 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.

Sample Type: Miscellaneous

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	3
Sample preparation by Trace Elements section*	Sample preparation as per requirement.	-	1-3
SPLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1312	-	1-3
TCLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1311	-	1-3
SPLP Profile			
SPLP Sample Weight	Gravimetric. US EPA 1312.	0.1 g	1-3
SPLP Extractant Type*	US EPA 1312 (Modified for New Zealand conditions to use De-ionised Water unless otherwise specified).	-	1-3
SPLP Final pH	pH meter. US EPA 1312.	0.1 pH Units	1-3
TCLP Profile			
TCLP Weight of Sample Taken	Gravimetric. US EPA 1311.	0.1 g	1-3
TCLP Initial Sample pH	pH meter. US EPA 1311.	0.1 pH Units	1-3
TCLP Acid Adjusted Sample pH	pH meter. US EPA 1311.	0.1 pH Units	1-3
TCLP Extractant Type*	US EPA 1311.	-	1-3
TCLP Extraction Fluid pH	pH meter. US EPA 1311.	0.1 pH Units	1-3
TCLP Post Extraction Sample pH	pH meter. US EPA 1311.	0.1 pH Units	1-3

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Total Digestion with HCl	Nitric/hydrochloric acid digestion. APHA 3030 E 22nd ed. 2012 (modified).	-	4-6
Total Digestion of Extracted Samples*	Nitric acid digestion. APHA 3030 E 22nd ed. 2012 (modified).	-	4-6, 10-12
Total acid digest for Silver analysis	Boiling nitric / hydrochloric acid digestion (5:1 ratio). APHA 3030 F (modified) 22nd ed. 2012.	-	4-6, 10-12

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Aluminium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.063 g/m^3	4-6
Total Aluminium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.0032 g/m^3	10-12
Total Antimony	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0042 g/m^3	4-6
Total Antimony	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.00021 g/m^3	10-12
Total Barium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.11 g/m^3	4-6
Total Barium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.0053 g/m^3	10-12
Total Beryllium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0021 g/m^3	4-6
Total Beryllium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.00011 g/m^3	10-12
Total Boron	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.11 g/m^3	4-6
Total Boron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.063 g/m^3	10-12
Total Calcium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	1.1 g/m^3	4-6
Total Calcium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.053 g/m^3	10-12
Total Lithium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0042 g/m^3	4-6
Total Lithium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.00021 g/m^3	10-12
Total Magnesium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.42 g/m^3	4-6
Total Magnesium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.021 g/m^3	10-12
Total Mercury	Acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0021 g/m^3	4-6
Total Mercury	Bromine Oxidation followed by Atomic Fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m^3	10-12
Total Molybdenum	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0042 g/m^3	4-6
Total Molybdenum	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.00021 g/m^3	10-12
Total Potassium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	1.1 g/m^3	4-6
Total Potassium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.053 g/m^3	10-12
Total Selenium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.021 g/m^3	4-6
Total Selenium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.0011 g/m^3	10-12
Total Silver	Boiling nitric / hydrochloric acid digestion (5:1 ratio), ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0022 g/m^3	4-6
Total Silver	Boiling nitric / hydrochloric acid digestion (5:1 ratio), ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.00011 g/m^3	10-12
Total Sodium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.021 g/m^3	10-12
Total Tin	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.011 g/m^3	4-6
Total Tin	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.00053 g/m^3	10-12
Total Uranium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.00042 g/m^3	4-6
Total Uranium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.000021 g/m^3	10-12
C7 - C9	Head Space, GCMS analysis.	0.06 g/m^3	4-6, 10-12
Heavy metals, totals, trace As,Cd,Cr,Cu,Ni,Pb,Zn	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8	0.000053 - 0.0011 g/m^3	10-12
Heavy metals, totals, screen As,Cd,Cr,Cu,Ni,Pb,Zn	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0011 - 0.021 g/m^3	4-6
Ethylene Glycol in Water*	Direct injection, dual column GC-FID	4 g/m^3	4-6, 10-12

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Propylene Glycol in Water*	Direct injection, dual column GC-FID	4 g/m³	4-6, 10-12
Methanol in Water - Aqueous Solvents*	Direct injection, dual column GC-FID	1.0 g/m³	4-6, 10-12
Polychlorinated Biphenyls Screening in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS analysis	0.00010 - 0.005 g/m³	4-6
Polychlorinated Bipheyls Trace in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS analysis	0.0002 g/m³	10-12
Semivolatile Organic Compounds Screening in Water by GC-MS	Liquid/Liquid extraction, GPC cleanup (if required), GC-MS FS analysis	-	4-6
Semivolatile Organic Compounds Trace in Water by GC-MS	Liquid/Liquid extraction, GPC cleanup (if required), GC-MS FS analysis	-	10-12
Total Petroleum Hydrocarbons in Water*	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m³	4-6, 10-12

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

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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Kim Harrison MSc
Client Services Manager - Environmental