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Eastland Port

EASTLAND PORT UPPER LOGYARD WATER QUALITY SAMPLING REPORT – QUARTER 3 2021

For Eastland Port Limited

November 2021

REPORT INFORMATION AND QUALITY CONTROL

Prepared for:	Eastland Port Limited

Author:	Marie Knue Ecology Consultant	
Reviewer and Approved for Release:	Mark Poynter Technical Director	

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SITE SAFE MEMBER

Telarc. Registered Telarc Q-Base Code

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1 INTRODUCTION

In accordance with consents LR-2011-105808-00 and DW-2011-105049-00 held by Eastland Port Limited (hereafter, Eastland), water quality monitoring is required at the Upper Logyard (ULY). Sampling is completed quarterly at five locations as specified in Condition 26(i) to (iv):

- Site 1 – Logyard discharge from the second settling basin (swale);
- Site 2 – Logyard discharge from the lamella clarifier outflow;
- Site 3 – Kopuawhakapata Stream at the mixing zone boundary 20 m downstream of the discharge[1];
- Site 4 – Kopuawhakapata Stream 10 m upstream of discharge; and
- Site 5 – The inner harbour within 20 m of the Kopuawhakapata Stream outlet to the marina.

Refer to Appendix A for a plan of the sample sites.

The third quarter sampling was undertaken by Linnaeus on 17 September 2021. The last sample round was 13 May 2021 (quarter 2 2021). Unless otherwise stated, all sampling was undertaken in accordance with the Environmental Management Plan, Sampling Protocols, and Standard Operating Procedures prepared by 4Sight Consulting Ltd (4Sight).

This report has been prepared for Eastland Port Limited.

2 SAMPLING DETAILS

The time and date of sample collection is presented in Table 1.

Table 1: Sample times and date.

Location	Sample type	Date	Time (24hrs)
ULY Site 1	Water quality	17/09/2021	09:11
ULY Site 2	Water quality	17/09/2021	09:17
ULY Site 3	Water quality	17/09/2021	09:45
ULY Site 4	Water quality	17/09/2021	09:35
ULY Site 5	Water quality	17/09/2021	10:00

Observed conditions at the sampling sites are recorded in Table 2.

Appendix B provides the Chain of Custody forms. Field Sheets are provided in Appendix C. Appendix D and Appendix E respectively, provide the Hill Laboratories and Scion analytical reports for the sampling round. The calibration record for the Dissolved Oxygen meter is provided in Appendix F. Photographs are provided in Appendix G.

[1] It is noted that the resource consent Condition 26 (iii) states this monitoring site as '…The Kopuawhakapata Stream 20m downstream of the mixing zone…'. This is assumed to be incorrect wording and the monitoring site is actually at the mixing zone edge.

Table 2: Sampling site information for the 17 September 2021 sampling round.

Location	Rainfall event (mm)	No. of dry days prior to sampling	Clarity	Obvious of visual features
ULY Site 1	40	0	Very turbid	Little to no foam and debris
ULY Site 2	40	0	Lightly turbid	No debris, foam or scum
ULY Site 3	40	0	Lightly turbid	No debris, light foam from discharge point
ULY Site 4	40	0	Lightly turbid	No debris, foam or scum
ULY Site 5	40	0	Lightly turbid	No debris, foam or scum

3 ANALYSIS OF LABORATORY RESULTS

3.1 Results

Table 3 shows the results from the 17 September 2021 sampling. It is noted that as of 29 August 2018 the ANZECC (2000)[2] guidelines (upon which the consent trigger levels are based) were superseded by the ANZG (2018)[3] default guideline values. However, none of the guideline values for the parameters reported here have changed.

The dissolved copper and zinc analysis for Site 4 (background) were re-run upon request due to higher than expected, and somewhat anomalous, saline interference in the sample.

[2] Australian and New Zealand Environment and Conservation Council & ARMCANZ, "Australian and New Zealand Guidelines for Fresh and Marine Water Quality" (ANZECC, Canberra, 2000) vol 1.

[3] ANZG, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian State and Territory Governments* (2018), https://www.waterquality.gov.au/anz-guidelines.

Table 3: 17 September 2021 sample results, (n.d = not detected, a dash (-) = not measured. Site 3 and 4 cells are highlighted red if the recorded value exceeds the consent trigger limit.

Parameter	Units	EMP trigger limits	Site 1 Swale	Site 2 Discharge	Site 3 Compliance	Site 4 Upstream/ Background	Site 5 Marina
pH	-log(H^+)	6.5 – 8.5	6.7	6.6	7.4	7.8	7.4
Temperature	^oC	Not more than 3^oC above background (Site 4)	11.9	11.3	11.7	11.8	12.5
Dissolved Oxygen	g/m^3	Not less than 4	8.91	8.81	10.1	10.09	9.85
Hardness	g/m^3	n/a	-	-	104	4200	-
VSS	g/m^3	n/a	210	84	<15	-	-
TSS	g/m^3	Not more than 100 g/m^3 above background (Site 4)	630	156	65	57	61
Settleable Solids	g/m^3	n/a	10	<1.0	<1.0	<1.0	<1.0
Dissolved Aluminium	g/m^3	Not specified in consent	0.39	0.4	0.087	<0.3	0.075
Total Aluminium	g/m^3	Not specified in consent	8.3	3.8	1.5	0.71	1.73
Dissolved Copper	g/m^3	0.0025 average of 4 quarterly samples	0.0013	0.0013	0.0037	0.0014	0.0038
Dissolved Zinc	g/m^3	0.031 average of 4 quarterly samples	0.0107	0.0132	0.057	0.011	0.059
Soluble Inorganic Nitrogen	g/m^3	0.4	<0.011	<0.011	1.37	0.22	1.34
Total Nitrogen	g/m^3	0.4	1.3	0.72	2.7	0.32	2.6
$cBOD_5$	g/m^3	20 above background	-	-	2	<2	-
Total Phenols	g/m^3	0.72	0.02	0.03	<0.02	<0.02	<0.02
Total Tannins	g/m^3	n/a	49	31	1.5	1.4	2
Absorbance at 440 nm	AU cm^{-1}	n/a	-	-	0.059	0.004	0.057
TPH	g/m^3	15	2.1	1	<0.7	<0.7	<0.7
Dehydroabietic Acid	g/m^3	0.025	2.1912	1.8072	n.d.	n.d.	n.d.

3.2 Findings on Consent Condition Compliance

3.2.1 pH

pH levels were within the trigger limit range for Site 3 (compliance point) and compliant.

3.2.2 Temperature

Temperature did not increase more than 3°C above background and was compliant.

3.2.3 Dissolved oxygen (DO)

DO was 10.1 g/m^3 at Site 3, which is well above and compliant with the consent trigger limit of not less than 4 g/m^3.

3.2.4 Hardness

Total hardness was considerably higher at Site 4 (background) compared to Site 3 sampling sites. There is no trigger limit for hardness.

3.2.5 Total Suspended Solids (TSS), Settleable Solids (SS), Volatile Suspended Solids (VSS)

TSS at Site 3 was compliant with the consent trigger limit of not more than 100 g/m^3 above background. TSS in the discharge was only marginally above background suggesting the treating system is performing to expectations. TSS results from November 2015 to September 2021 are shown in Figure 1.

Settleable Solids were recorded as <1 g/m^3 at the compliance point, there is no applicable trigger limit.

The levels of VSS show that 33%, 54% and 23% of the TSS is organic material at Sites 1, 2 and 3, respectively.

3.2.6 Aluminium

Aluminium (measured as dissolved aluminium) was added to the sampling suite in response to the introduction of the dosing system that uses aluminium based compounds. There is currently no consent trigger for dissolved aluminium in the Kopuawhakapata Stream at Site 3.

80% protection limits are applied to this short section of Kopuawhakapata Stream in recognition of its state in response to broader catchment influences. ANZG 2018 provides a freshwater 80% protection default guideline value of 0.15 g/m^3 for dissolved aluminium. The Site 3 concentration for dissolved aluminium of 0.087 g/m^3 is below this level and is lower than the background value recorded.

3.2.7 Metals (Copper and Zinc)

The dissolved copper concentration at the compliance site (Site 3) was 0.0037 g/m^3. This contributes to an average of 0.0026 g/m^3 based on the last four quarterly samples, which is very marginally above the trigger value of 0.0025 g/m^3. This is not a significant exceedance.

Dissolved copper levels at the background site (Site 4) were 0.0014 g/m^3. This contributes to an average dissolved copper concentration at Site 4 based on the last four quarterly samples of 0.0023 g/m^3, which is slightly below the Site 3 average. Dissolved copper results are shown in Figure 2.

Dissolved zinc at Site 3 was 0.057 g/m^3, which is higher than recent previous sampling results. This contributes to an average of 0.045 g/m^3 based on the last four quarterly samples, which is above the trigger value of 0.031 g/m^3.

Dissolved zinc at the background site (Site 4) was 0.011 g/m^3. This contributes to an average based on the last four quarterly samples of 0.039 g/m^3 at the background site, which is above the Site 3 average and the compliance trigger value of 0.031 g/m^3. Dissolved zinc results are shown in Figure 3.

3.2.8 Soluble Inorganic Nitrogen (SIN)

SIN at Site 3 was 1.37 g/m^3, above the trigger limit of 0.4 g/m^3. SIN at Site 4 (background) was 0.22 g/m^3. The discharge concentration was low and could have had little if any influence on receiving environment SIN concentration. SIN concentration is typically governed by background influences at this location.

3.2.9 Total Nitrogen (TN)

Site 3 TN (2.7 g/m^3) was above the trigger limit of 0.4 g/m^3, and higher than the background Site 4 TN result of 0.32 g/m^3. TN at the discharge (Site 2) was 0.72 g/m^3, which is also above the trigger limit and would require dilution factor of about 56% (<2 times) to meet the compliance point trigger. Downstream effects are unlikely.

TN results are shown in Figure 4.

3.2.10 BOD

BOD at Site 3 was 2 g/m^3 and under the detection limit of <2 g/m^3 at Site 4, well below the trigger value of 'not more than 20 g/m^3 above background'.

3.2.11 Total Phenols

Total Phenols at Site 3 were less than 0.02 g/m^3, which is below the consent trigger value of 0.72 g/m^3 and therefore compliant.

3.2.12 Tannin

Tannin concentration at Site 3 was 1.5 g/m^3, which was similar to the Site 4 concentration of 1.4 g/m^3. There is no consent trigger value for tannin.

3.2.13 Colour

Colour is measured by a proxy, in this case absorbance at 440 nm. Absorbance Units (AU) are a logarithmic scale measure of light transmittance, at 440 nm wavelength. A value of 1 AU and 2 AU would be transmittance of 10% and 1% respectively. That is, as absorbance increases transmittance decreases. Here, the relationship between absorbance and transmittance is being used as a proxy for colour. A reduced transmittance is interpreted as increased colour (or is at least consistent with increased colour). The relationship expected is for greater colour at Site 3 (compliance) than at Site 4 (background), due to the influence of dissolved organic compounds in the discharge. Therefore, the absorbance value should be higher at Site 3 than at Site 4. There is no quantitative consent trigger value for absorbance.

The sampling showed absorbance was slightly higher at Site 3 (0.059 AU cm-1) compared to Site 4 (0.004 AU cm-1). This suggests there was less colour at Site 4, that is in the background water.

3.2.14 Total Petroleum Hydrocarbons (TPH)

TPH levels were below method detection limits at Site 3 and therefore compliant.

3.2.15 Dehydroabietic Acid (DHAA)

DHAA result at Site 3 was less than the analytical detection limit and below the consent trigger value of 0.025 g/m^3.

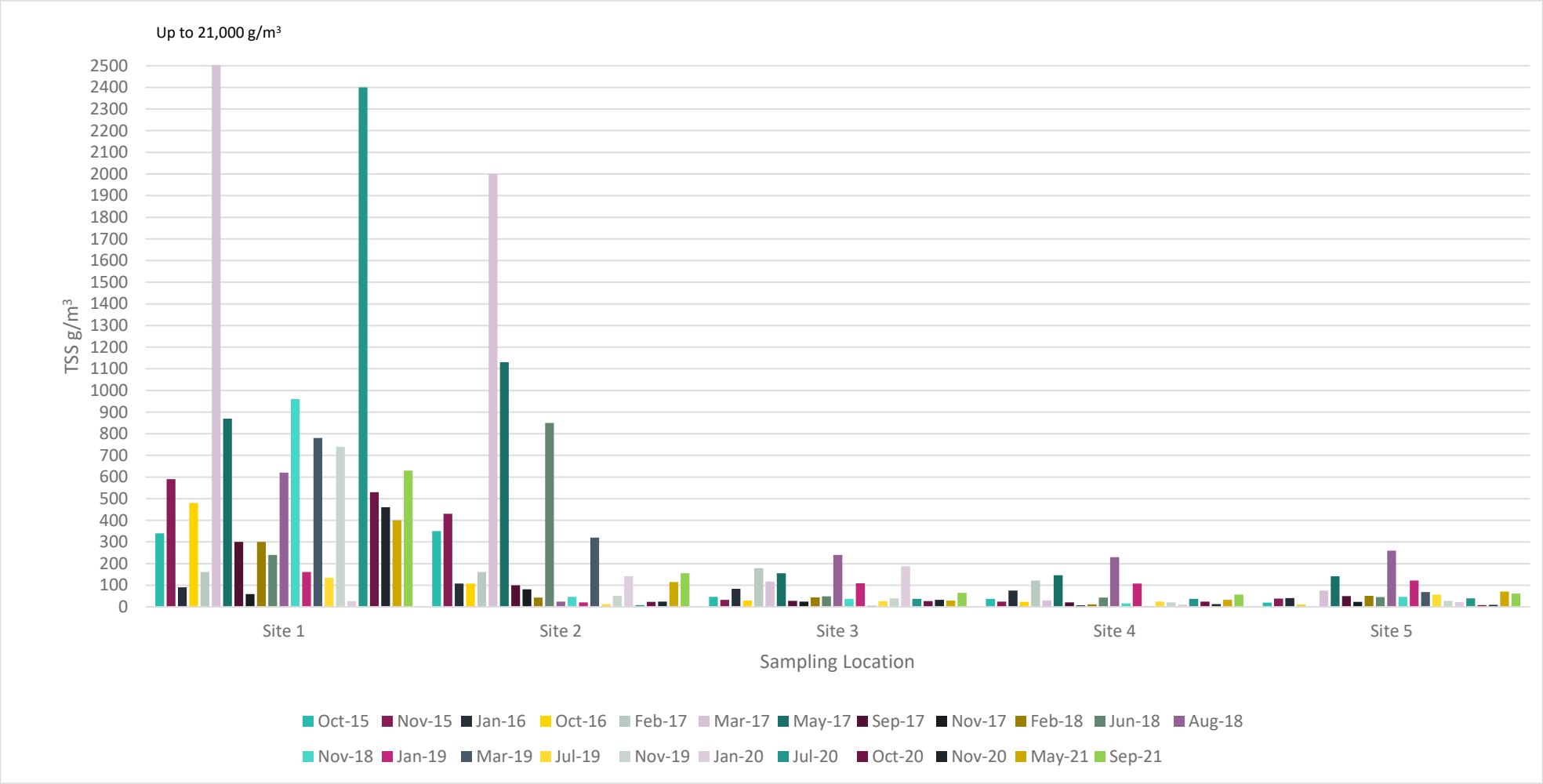


Figure 1: Total Suspended Solids results for November 2015 to September 2021.

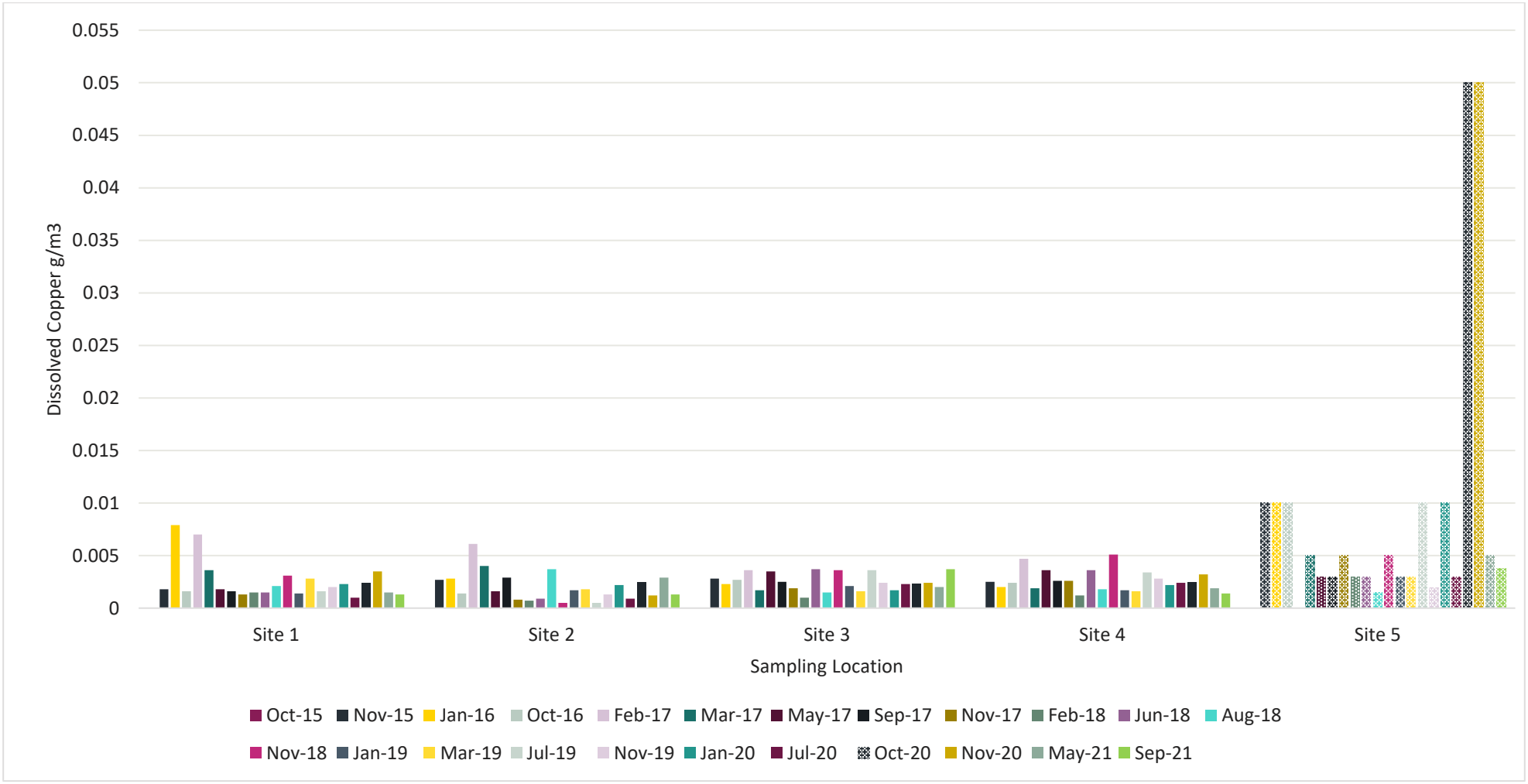


Figure 2: Dissolved Copper results for November 2015 to September 2021 (Site 5 results are the laboratory detection limit).

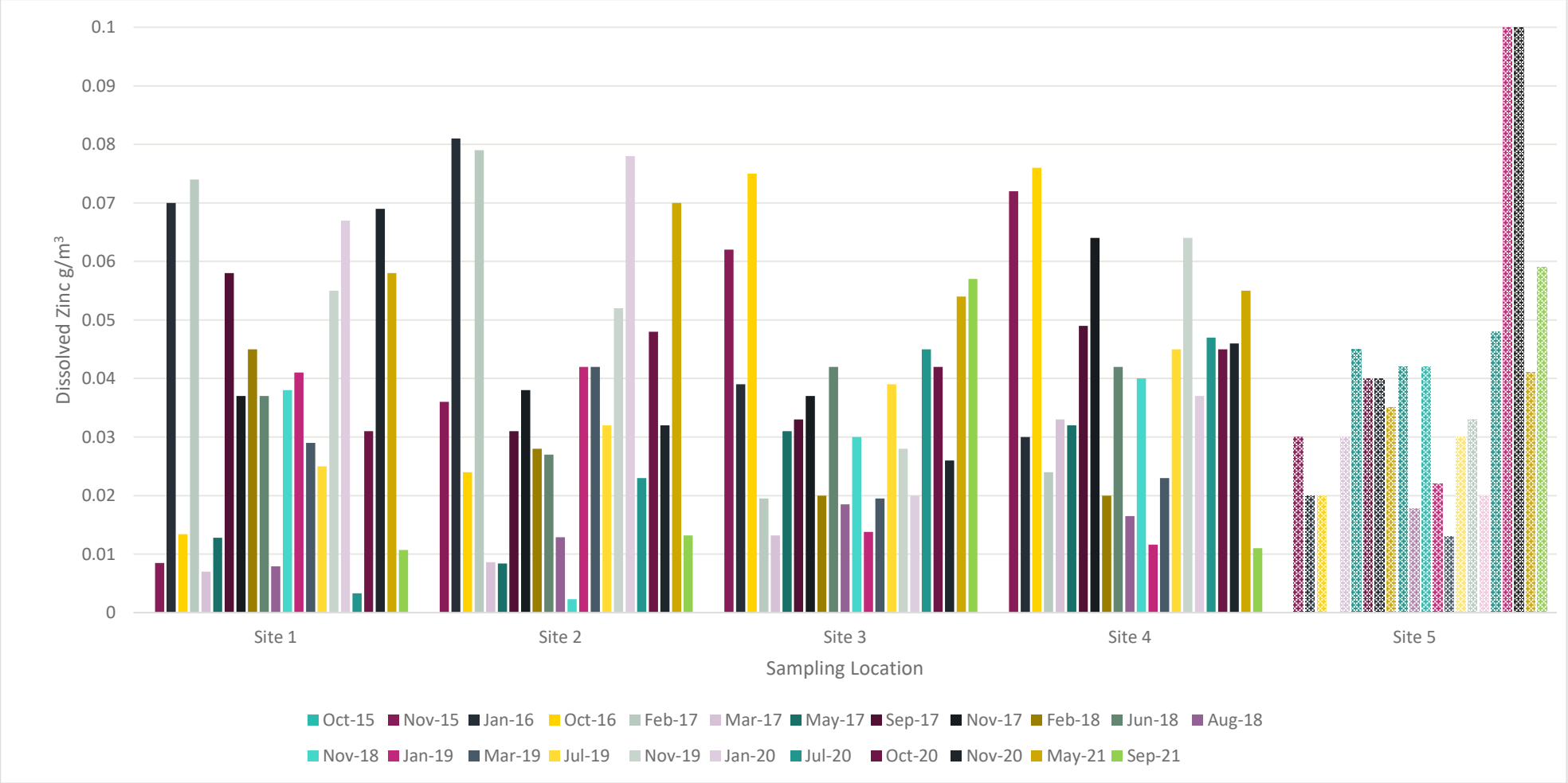


Figure 3: Dissolved Zinc results for November 2015 to September 2021 (some Site 5 results are laboratory detection limits).

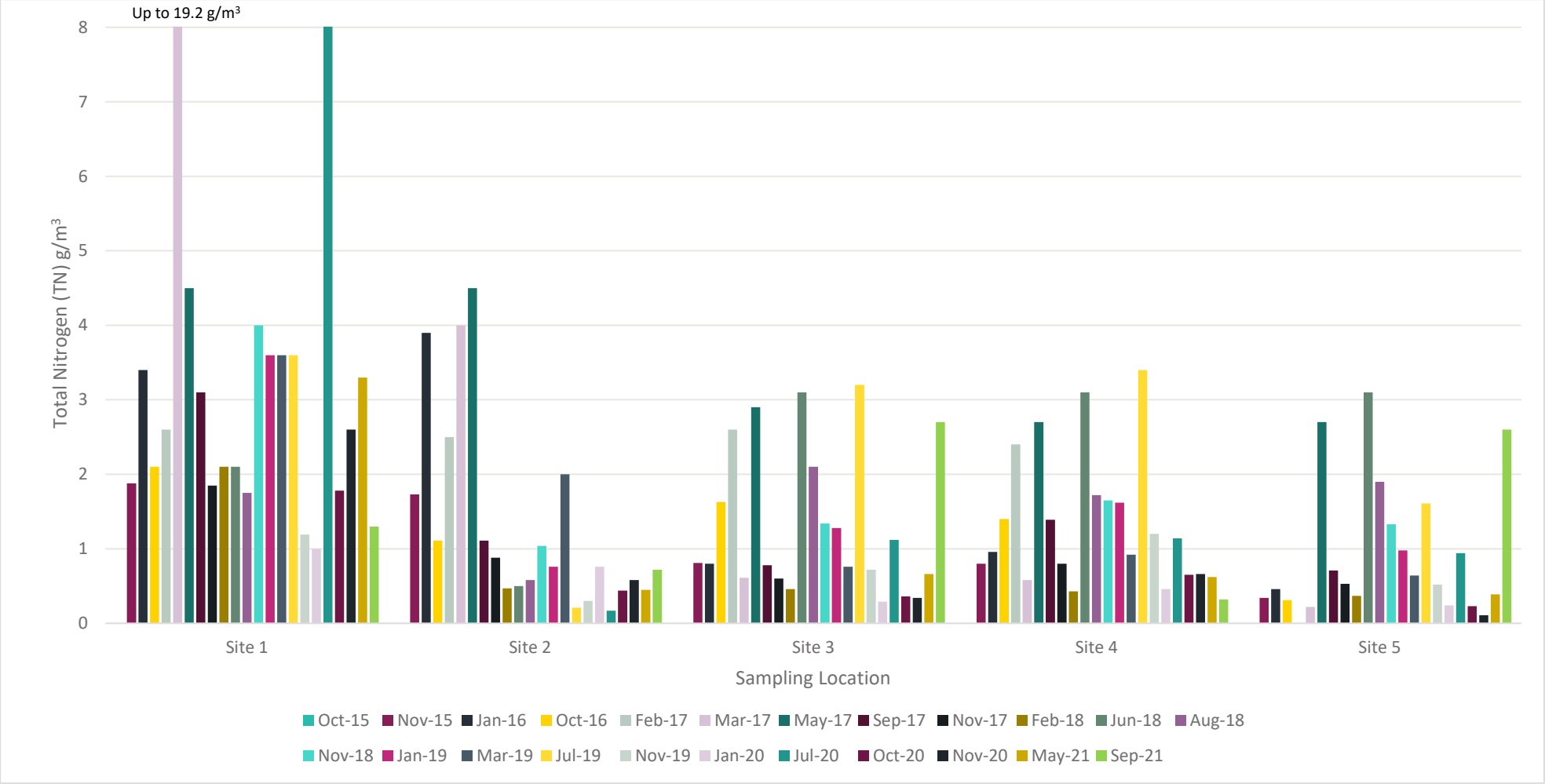


Figure 4: Total Nitrogen results for November 2015 to September 2021.

3.3 Particle size

Particle size analysis at each of the sampling locations was undertaken. Refer to Appendix D for analysis report. A summary of the results is shown in Table 4 and Figure 5.

Table 4: Particle size distribution at 10%, 50% and 90%

Percentage volume under	Site 1 Swale	Site 2 Discharge	Site 3 Compliance	Site 4 Background	Site 5 Marina
10%	5.37µm	2.34µm	3.45µm	3.22µm	2.97µm
50%	19.7µm	12.0µm	13.4µm	8.66µm	11.8µm
90%	67.9µm	175µm	93.4µm	90.2µm	79.9µm

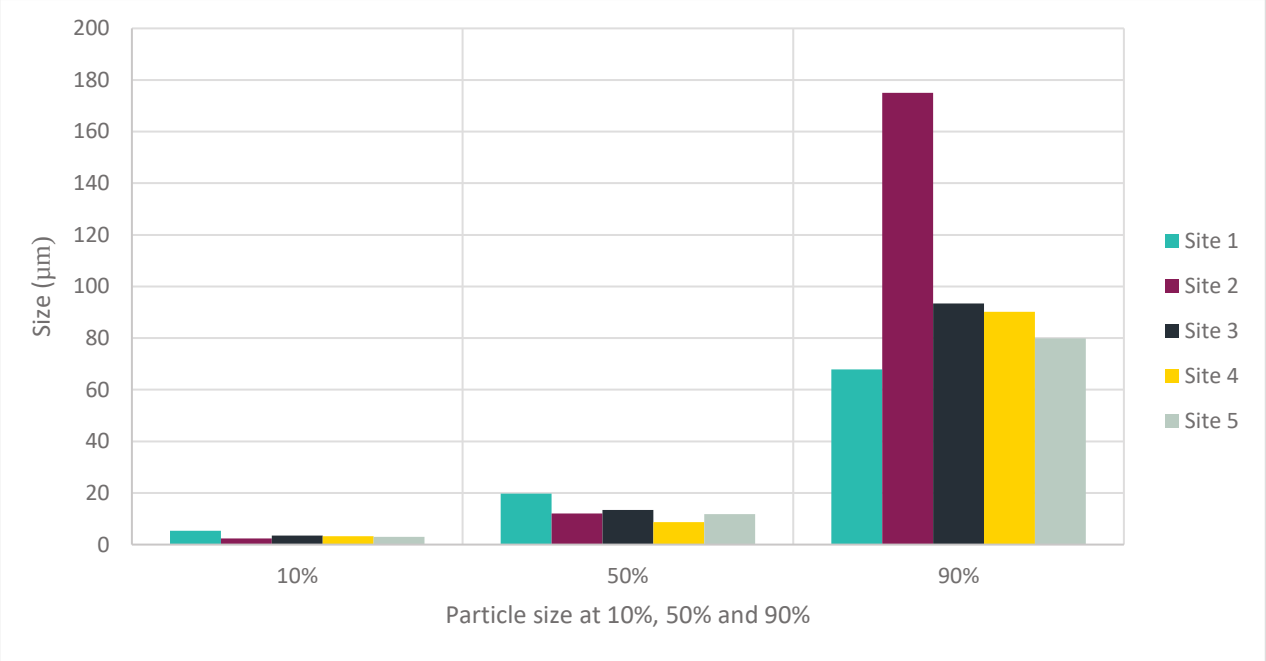


Figure 5: Particle size distribution at 10%, 50% and 90%.

The particle size results at Site 1 and Site 2 indicate that a larger range of particle sizes were present on site prior to treatment compared to the post treatment discharge. Taken with the reduction is TSS through the system, this suggests that the dosing of chemical flocculant and use of lamellar clarifiers is reducing the load of both fine and coarse sediments in the discharge.

3.4 Further Actions Required

No further actions are required.

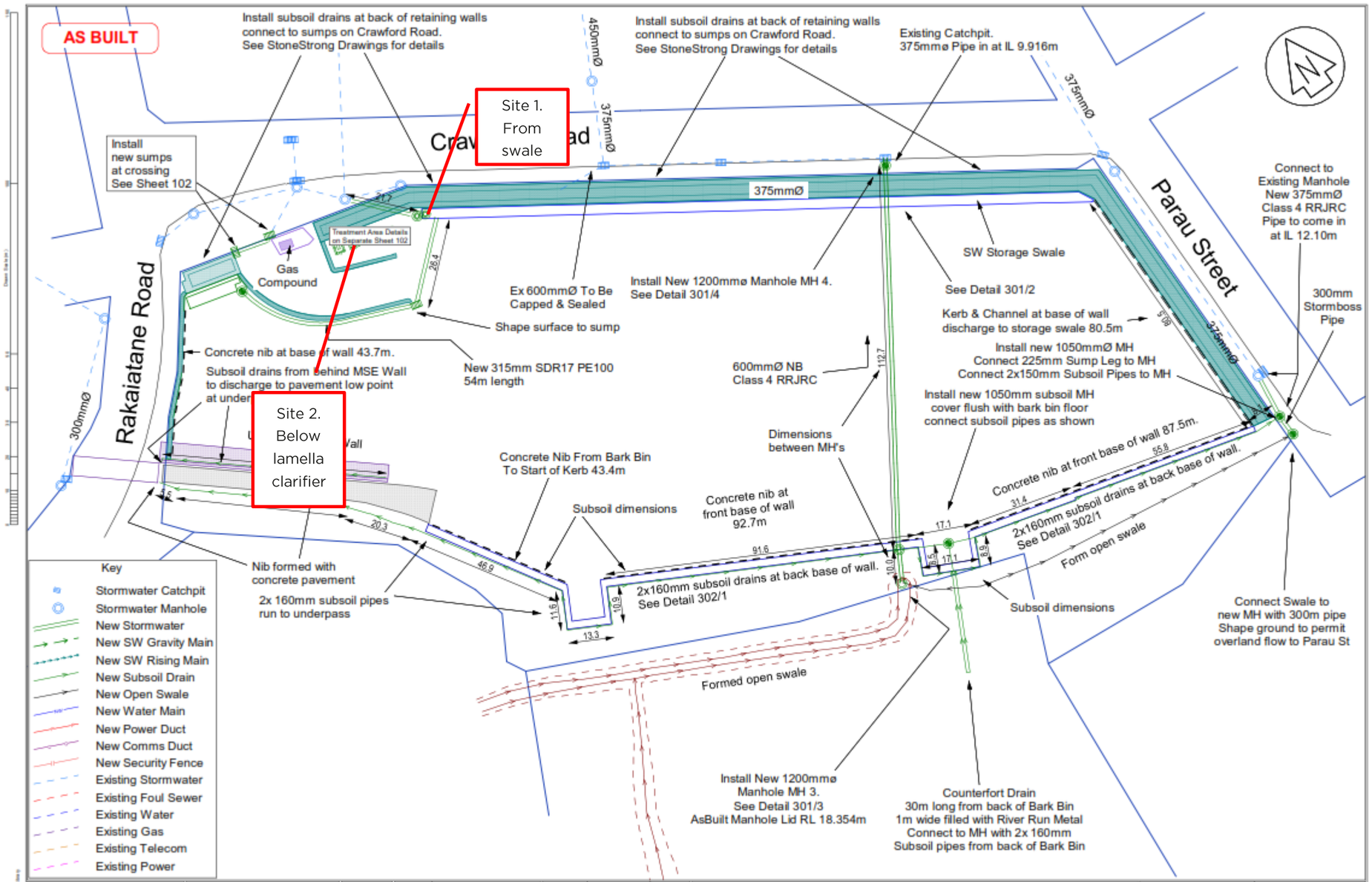
4 CONCLUSIONS

- The results show tested water quality parameters were mostly compliant with or close to consent requirements. Dissolved zinc concentration was somewhat higher at the downstream site relative to background than expected based on previous results. This needs to be assessed after the next sampling. Low concentrations of total nitrogen and soluble inorganic nitrogen in the discharge suggest downstream concentrations at Site 3 are governed by background conditions;

- Total suspended solids concentrations in the discharge were relatively low compared to Swale concentrations suggesting the treatment system was performing effectively;
- Total nitrogen contribution from background sources above the discharge point are likely controlling nitrogen levels in the stream and the TN in the discharge is of minor ecological or water quality significance;
- No further actions are required; and
- The next quarterly sampling round is to be undertaken in Quarter 4 2021.

Appendix A:

Sampling Locations


AS BUILT
Install subsoil drains at back of retaining walls connect to sumps on Crawford Road. See StoneStrong Drawings for details
Site 1. From swale
Install subsoil drains at back of retaining walls connect to sumps on Crawford Road. See StoneStrong Drawings for details
Existing Catchpit. 375mmø Pipe in at IL 9.916m
Install new sumps at crossing See Sheet 102
Gas Compound
Treatment Area Details on Separate Sheet 102
375mmØ
Ex 600mmØ To Be Capped & Sealed
Install New 1200mmø Manhole MH 4. See Detail 301/4
SW Storage Swale
See Detail 301/2
Parau Street
Connect to Existing Manhole New 375mmØ Class 4 RRJRC Pipe to come in at IL 12.10m
300mm Stormboss Pipe
Kerb & Channel at base of wall discharge to storage swale 80.5m
Shape surface to sump
Concrete nib at base of wall 43.7m.
Subsoil drains from behind MSE Wall to discharge to pavement low point at under
New 315mm SDR17 PE100 54m length
600mmØ NB Class 4 RRJRC
Install new 1050mmØ MH Connect 225mm Sump Leg to MH Connect 2x150mm Subsoil Pipes to MH
Rakaiatane Road
300mmØ
Site 2. Below lamella clarifier
Dimensions between MH's
Install new 1050mm subsoil MH cover flush with bark bin floor connect subsoil pipes as shown
Concrete Nib From Bark Bin To Start of Kerb 43.4m
Subsoil dimensions
Concrete nib at front base of wall 92.7m
Concrete nib at front base of wall 87.5m.
2x160mm subsoil drains at back base of wall. See Detail 302/1
Form open swale
Nib formed with concrete pavement
2x 160mm subsoil pipes run to underpass
2x160mm subsoil drains at back base of wall. See Detail 302/1
Subsoil dimensions
Connect Swale to new MH with 300m pipe Shape ground to permit overland flow to Parau St
Formed open swale
Install New 1200mmø Manhole MH 3. See Detail 301/3 AsBuilt Manhole Lid RL 18.354m
Counterfort Drain 30m long from back of Bark Bin 1m wide filled with River Run Metal Connect to MH with 2x 160mm Subsoil pipes from back of Bark Bin
Key
Stormwater Catchpit
Stormwater Manhole
New Stormwater
New SW Gravity Main
New SW Rising Main
New Subsoil Drain
New Open Swale
New Water Main
New Power Duct
New Comms Duct
New Security Fence
Existing Stormwater
Existing Foul Sewer
Existing Water
Existing Gas
Existing Telecom
Existing Power
Downer
Eastland Port
Issued
Amendments
22/05/2015 1: Add Retaining Wall Subsoils
12/08/2015 2: Crawford Entrance & Notes
12/08/2015 2: Concrete Nibs to Walls
12/08/2015 2: Concrete Swale Section Change
08/10/2015 Include As Built Dimensions
Name
Date
Design/Drawn C Gates 28/09/2015
Checked C Langdale 28/09/2015
Approved R Sharpe 08/10/2015
Client Appr.
Eastland Port
Upper Log Yard Development
Site Stormwater and Drainage Plan
SCALES 1:1000 @ A3
JOB # 551761
PLOT DATE 8 Oct 2015
SHEET 005
REVISION AB


Site #5
Site #3
Site #4
Site #2
Site #1
Reads Quay
Pitt St
Waiwai Rd
35
Stevenson St
Esplanade
Iliili St
Harris St
Paiau St
Dickson St
Ropata St
Kaiti Beach Rd
Crawford Rd
Bartlett St
Image © 2016 DigitalGlobe
Google Earth

Appendix B:

Chain of Custody Form

Hill Laboratories
TRIED, TESTED AND TRUSTED

ANALYSIS REQUEST

R J Hill Laboratories Limited
28 Duke Street Hamilton 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

Job No: **270 8281**

Date Recv: 18-Sep-21 08:22

Received by: Sumayyah Gordon

3127082810

Quote No 67123

Primary Contact ~~Christine Oakey~~ Marie Knue 207121

Submitted By ~~Shanna Hickling~~ Kyrsle Barton 201555

Client Name ~~4SIGHT Consulting Limited~~ Linneaus Ltd 95478

Address ~~PO Box 911340~~ 4 Banks st, Gisborne ~~Auckland 1142, New Zealand~~ 4010, NZ

Phone ~~09 303 0311~~ *Mobile* 06 8678512

Email Kyrsle@linneaus.co.nz

Charge To ~~4SIGHT Consulting Limited~~ accounts@linneaus.co.nz 95478

Client Reference AA1146 Upper Logyard Crawford Rd

Additional Client Ref

Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

☐ Email Primary Contact ☑ Email Submitter ☐ Email Client

☑ Email Other Stephanie@linneaus.co.nz

☑ Other Libby@linneaus.co.nz

Dates of testing are not routinely included in the Certificates of Analysis. Please inform the laboratory if you would like this information reported.

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories

☐ *Tick if you require COC to be emailed back*

Date & Time: 17.9.21 15:30

Name: Kyrsle Barton

Signature: KBarton

Received at Hill Laboratories

Date & Time:

Name:

Signature:

Condition ☐ Room Temp ☐ Chilled ☐ Frozen

Temp: 9.8

☐ Sample & Analysis details checked

Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

Priority ☐ Low ☑ Normal ☐ High

☐ **Urgent** (ASAP, *extra charge applies, please contact lab first*)

Requested Reporting Date:

Quoted Sample Types

Surface Water (SURFACW|SW)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	ULY SW Site 1 2021004330	17.9.21 09:11	SURFACW|SW	SS, SetSol, Tan, DIN, TN|W, PSizeLaser_subWai, Phenols, pH|W, VSS, AlDt, CuDt, ZnDt, AlTt_L, CuTt_L, ZnTt_L, TPHOI_L
2	ULY SW Site 2 2021004331	17.9.21 09:17	SURFACW|SW	SS, SetSol, Tan, DIN, TN|W, PSizeLaser_subWai, Phenols, pH|W, VSS, AlDt, CuDt, ZnDt, AlTt_L, CuTt_L, ZnTt_L, TPHOI_L
3	ULY SW Site 3 2021004332	17.9.21 09:45	SURFACW|SW	SS, SetSol, Tan, Hard, DIN, TN|W, CBOD5_L, PSizeLaser_subWai, Phenols, pH|W, VSS, AlDt, CuDt, ZnDt, AlTt_L, CuTt_L, ZnTt_L, A440, TPHOI_L
4	ULY SW Site 4 2021004333	17.9.21 09:35	SURFACW|SW	SS, SetSol, Tan, Hard, DIN, TN|W, CBOD5_L, PSizeLaser_subWai, Phenols, pH|W, AlDt, CuDt, ZnDt, AlTt_L, CuTt_L, ZnTt_L, A440, TPHOI_L
5	ULY SW Site 5 2021004334	17.9.21 10:00	SURFACW|SW	SS, SetSol, Tan, DIN, TN|W, PSizeLaser_subWai, Phenols, pH|W, AlDt, CuDt, ZnDt, AlTt_L, CuTt_L, ZnTt_L, A440, TPHOI_L
6				

Hill Laboratories
TRIED, TESTED AND TRUSTED

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Hamilton 3240 New Zealand

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T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job Information Summary

Client:	Linnaeus Limited	**Lab No:**	2708281
Contact:	Marie Knue	**Date Registered:**	18-Sep-2021 2:33 pm
	C/- 4SIGHT Consulting Limited	**Priority:**	Normal
	PO Box 402053	**Quote No:**	67123
	Tutukaka 0153	**Order No:**	AA1146
		Client Reference:	AA1146 Upper Logyard Crawford Rd
		Add. Client Ref:	
		Submitted By:	Kyrste Barton
		Charge To:	Linnaeus Limited
		Target Date:	08-Oct-2021 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	2021004330 - ULY SW Site 1 17-Sep-2021 9:11 am	Surface Water	UP1L, SubWaikato1Lup, UP500, TPH250, UPte100, N100, S100	Total Suspended Solids; Settleable Solids; Dissolved Inorganic Nitrogen; Total Nitrogen; Tannin; Particle size analysis; Total Phenols; pH; Volatile Suspended Solids; Dissolved Aluminium; Dissolved Copper; Dissolved Zinc; Total Aluminium; Total Copper; Total Zinc; Total Petroleum Hydrocarbons in Water
2	2021004331 - ULY SW Site 2 17-Sep-2021 9:17 am	Surface Water	SubWaikato1Lup, UP1L, UP500, TPH250, UPte100, N100, S100	Particle size analysis; Total Suspended Solids; Settleable Solids; Dissolved Inorganic Nitrogen; Total Nitrogen; Tannin; Total Phenols; pH; Volatile Suspended Solids; Dissolved Aluminium; Dissolved Copper; Dissolved Zinc; Total Aluminium; Total Copper; Total Zinc; Total Petroleum Hydrocarbons in Water
3	2021004332 - ULY SW Site 3 17-Sep-2021 9:45 am	Surface Water	SubWaikato1Lup, UP1L, BOD, UP500, TPH250, UPte100, N100, S100	Particle size analysis; Total Hardness; Total Suspended Solids; Settleable Solids; Dissolved Inorganic Nitrogen; Total Nitrogen; Tannin; Carbonaceous Biochemical Oxygen Demand ($cBOD_5$); Total Phenols; pH; Volatile Suspended Solids; Dissolved Aluminium; Dissolved Copper; Dissolved Zinc; Total Aluminium; Total Copper; Total Zinc; Absorbance at 440 nm; Total Petroleum Hydrocarbons in Water
4	2021004333 - ULY SW Site 4 17-Sep-2021 9:35 am	Surface Water	UP1L, SubWaikato1Lup, UP500, TPH250, UPte100, N100, S100	Total Hardness; Total Suspended Solids; Settleable Solids; Dissolved Inorganic Nitrogen; Total Nitrogen; Tannin; Particle size analysis; Total Phenols; pH; Dissolved Aluminium; Dissolved Copper; Dissolved Zinc; Total Aluminium; Total Copper; Total Zinc; Carbonaceous Biochemical Oxygen Demand ($cBOD_5$); Absorbance at 440 nm; Total Petroleum Hydrocarbons in Water
5	2021004334 - ULY SW Site 5 17-Sep-2021 10:00 am	Surface Water	SubWaikato1Lup, UP1L, UP500, BOD, TPH250, UPte100, N100, S100	Particle size analysis; Total Suspended Solids; Settleable Solids; Dissolved Inorganic Nitrogen; Total Nitrogen; Tannin; Total Phenols; pH; Dissolved Aluminium; Dissolved Copper; Dissolved Zinc; Total Aluminium; Total Copper; Total Zinc; Absorbance at 440 nm; Total Petroleum Hydrocarbons in Water

Summary of Methods

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

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Glass Fibre	Sample filtration through glass fibre filter.	-	3-5
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-5
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	1-5

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
pH	pH meter. APHA 4500-H^+ B 23rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-5
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	3-4
Volatile Suspended Solids	Filtration (GF/C, 1.2 µm). Ashing 550°C, 30 min. Gravimetric. APHA 2540 E (modified) 23rd ed. 2017.	3 g/m³	1-3
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m³	1-5
Settleable Solids	Volumetric using an Imhoff cone. Settled 1 hr. APHA 2540 F 23rd ed. 2017.	0.5 mL/L	1-5
Particle size analysis	Malvern Laser Sizer particle size analysis from 0.05 microns to 3.4 mm. Samples are measured in volume %. Subcontracted to Earth Sciences Department, Waikato University, Hamilton.	-	1-5
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	1-5
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.003 g/m³	1-5
Total Aluminium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.0032 g/m³	1-5
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.05 g/m³	3-4
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0005 g/m³	1-5
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.00053 g/m³	1-5
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.02 g/m³	3-4
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	1-5
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.0011 g/m³	1-5
Dissolved Inorganic Nitrogen	Calculation: NH_4-N + NO_3-N + NO_2-N. In-house calculation.	0.010 g/m³	1-5
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m³ is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m³, the Default Detection Limit for Total Nitrogen will be 0.11 g/m³. In-house calculation.	0.05 g/m³	1-5
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH_4-N = NH_4^+-N + NH_3-N). APHA 4500-NH_3 H (modified) 23rd ed. 2017.	0.010 g/m³	1-5
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m³	1-5
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N_{org} D (modified) 4500 NH_3 F (modified) 23rd ed. 2017.	0.10 g/m³	1-5
Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) 23rd ed. 2017.	2 g O_2/m³	3-4
Total Phenols	In-line distillation, segmented flow colorimetry. NB: Does not detect 4-methylphenol. APHA 5530 B & D (modified) 23rd ed. 2017 & Skalar Method I497-001 (modified).	0.02 g/m³	1-5
Tannin	Colorimetric with Folin phenol reagent, tannic acid used for calibration. APHA 5550 B (modified) 23rd ed. 2017.	0.10 g/m³	1-5
Absorbance at 440 nm	Filtered sample. Spectrophotometry, 1cm cell. APHA 5910 B 23rd ed. 2017.	0.002 AU cm^{-1}	3-5
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1-5
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1-5

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1-5
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1-5

Appendix C:

Field Sheets

Eastland Port

4SIGHT CONSULTING

Surface Water (Fresh) Sampling Form

Job Information			Equipment			
Date: 17.9.21	**Time:** Arrive: 0900 Depart: 1015		**Water quality equipment description:** YSI Pro	Calibration Records Filed?	Y N NA	
Project Name: EPL Outsourced Compliance Programme	**Project Number:** AA1146		**Interface Probe Number:** 138	Calibration Records Filed?	Y N NA	
Site Location: Upper Log Yard	**Operator:** DW		**Sampling Equipment Type:**			
Weather: Raining Lightly	**Rainfall event start time/date:**		**Event Rainfall Depth:**	**Number of dry days before sampling:**	0	
Reason for sampling: Standard Compliance Programme (Circle frequency: Monthly/2 Monthly/**Quarterly**/6 Monthly) or Additional Monitoring (describe):						

Sample Details						Water Quality Parameters				Observations			
EPL Site Number	**Lab Sample ID**	**Sample Time**	**Approx Depth (m)**	**Approx Stream Flow Rate**	**Temp (°C)**	**DO (%)**	**DO (mg/L)**	**EC (µS/cm)**	**pH**	**Debris Present** (Y/N: type)	**Foams/Scums** (Y/N)	**Clarity** (Clear/Lightly Turbid/Turbid/Very Turbid)	**Photos Reference**
Site 1	4330	0911		NA	11.9	82.5	8.91	172	7.3	Y	Y	Very Turbid	
Site 2	4331	0917	NA	NA	11.3	80.6	8.81	167	7.1	N	N	Lightly Turbid	
Site 3	4332	0945			11.7	93.0	10.10	335	7.6	N	Y	Lightly Turbid	
Site 4	4333	0935			11.8	93.1	10.09	330	7.6	N	N	Lightly Turbid	
Site 5	4334	1000	NA		12.5	92.5	9.85	3350	7.9	N	N	Lightly Turbid	

Additional Comments:

Field Quality Control Checks					
Was pre-cleaning sampling equipment used for these samples?	Y	N	Consistent with COC form?	Y	N
Was pre-cleaning sampling equipment properly protected from contamination?	Y	N	COC Filled out?	Y	N
Sampling has been undertaken in accordance with the Site Specific Sampling Protocol and SOPs?	Y	N	Signed:		

Eastland Port

Daily Summary Sheet

4SIGHT CONSULTING

Site Name: Upper Log Yard Quarterly	
Operator: DW	**Date:** 17.9.21
Reason for Visit: Quarterly	**Weather Conditions:** Light Rain.

Time	Comments
0911	Site 1 - Swale 1/4 full. Turbid Colour but not really foamy or much Debri
0917	Site 2. Top of Lamella, Lightly flowing Not to Cloudy.
0945	Site 3 - Medium flow of stream, only a Light foam coming down stream from discharge Point.
0935	Site 4 - Medium flow, stream level up a little.
1000	Site 5 - Water turbid Coming into the harbour, but General stream was turbid so not really any different.

Appendix D:

Laboratory Analysis Reports

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

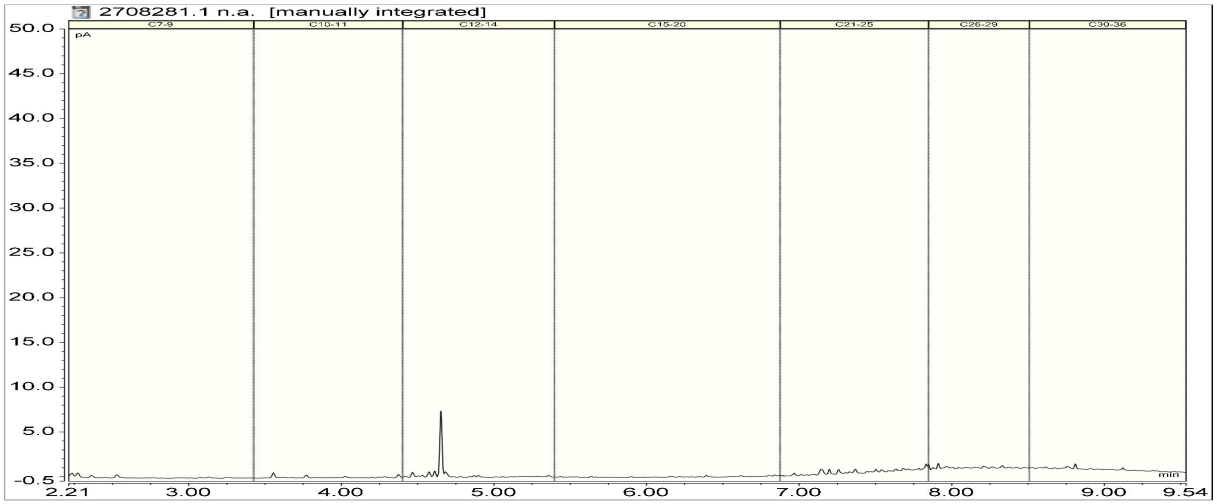
Client:	4SIGHT Consulting Limited	**Lab No:**	2708281 SPv1
Contact:	Marie Knue C/- 4SIGHT Consulting Limited PO Box 402053 Tutukaka 0153	**Date Received:**	18-Sep-2021
		Date Reported:	30-Sep-2021
		Quote No:	67123
		Order No:	AA1146
		Client Reference:	AA1146 Upper Logyard Crawford Rd
		Submitted By:	Kyrste Barton

Sample Type: Aqueous

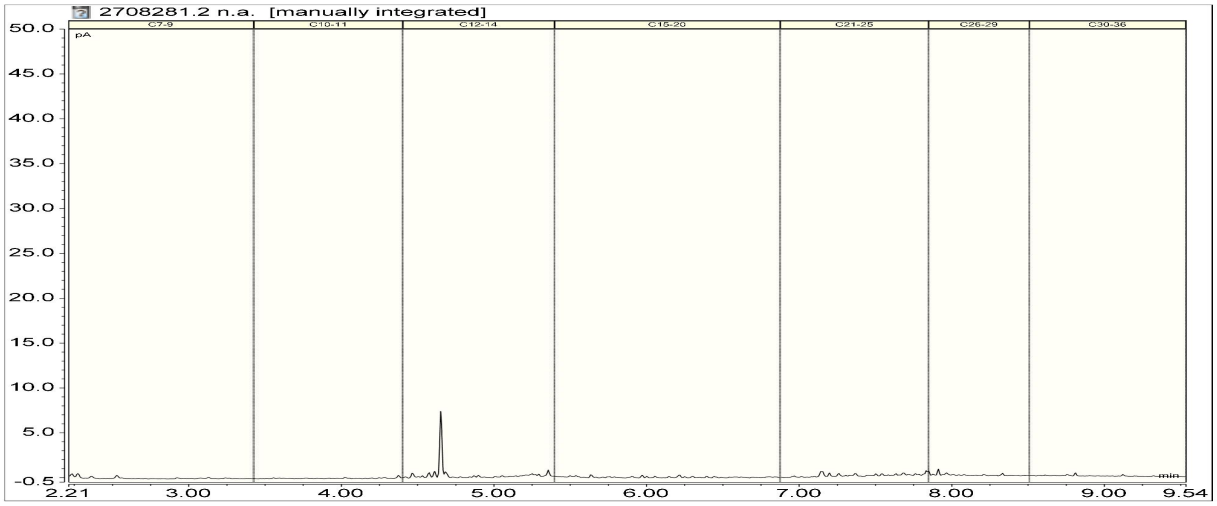
Sample Name:		2021004330 - ULY SW Site 1 17-Sep-2021 9:11 am	2021004331 - ULY SW Site 2 17-Sep-2021 9:17 am	2021004332 - ULY SW Site 3 17-Sep-2021 9:45 am	2021004333 - ULY SW Site 4 17-Sep-2021 9:35 am	2021004334 - ULY SW Site 5 17-Sep-2021 10:00 am
Lab Number:		2708281.1	2708281.2	2708281.3	2708281.4	2708281.5
Individual Tests						
pH	pH Units	6.7	6.6	7.4	7.8	7.4
Total Hardness	g/m³ as $CaCO_3$	-	-	104	4,200	-
Volatile Suspended Solids	g/m³	210	84	< 15 #2	-	-
Total Suspended Solids	g/m³	630	156	65	57	61
Settleable Solids*	mL/L	10.0	< 1.0	< 1.0	< 1.0	< 1.0
Particle size analysis*‡		See attached report	See attached report	See attached report	See attached report	See attached report
Dissolved Aluminium	g/m³	0.39	0.40	0.087	< 0.3	0.075
Total Aluminium	g/m³	8.3	3.8	1.50	0.71	1.73
Dissolved Calcium	g/m³	-	-	33	280	-
Dissolved Copper	g/m³	0.0013	0.0013	0.0037	< 0.05	0.0038
Total Copper	g/m³	0.0078	0.0044	0.0061	< 0.053	0.0064
Dissolved Magnesium	g/m³	-	-	5.2	860	-
Dissolved Zinc	g/m³	0.0107	0.0132	0.057	< 0.10	0.059
Total Zinc	g/m³	0.088	0.044	0.097	< 0.11	0.096
Dissolved Inorganic Nitrogen*	g/m³	< 0.011	< 0.011	1.37	0.22	1.34
Total Nitrogen	g/m³	1.30	0.72	2.7	0.32	2.6
Total Ammoniacal-N	g/m³	< 0.010	< 0.010	< 0.010	< 0.10 #4	< 0.010
Nitrate-N + Nitrite-N	g/m³	< 0.002	< 0.002	1.37	0.169	1.33
Total Kjeldahl Nitrogen (TKN)	g/m³	1.30	0.72	1.30	0.15	1.29
Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	g O_2/m³	-	-	2 #1	< 2 #1	-
Total Phenols	g/m³	0.02	0.03	< 0.02	< 0.02	< 0.02
Tannin	g/m³	49	31	1.5	1.4 #3	2.0
Absorbance at 440 nm	AU cm^{-1}	-	-	0.059	0.004	0.057
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
C10 - C14	g/m³	0.2	0.3	< 0.2	< 0.2	< 0.2
C15 - C36	g/m³	1.9	0.7	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C7 - C36)	g/m³	2.1	1.0	< 0.7	< 0.7	< 0.7

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

2708281.1
2021004330 - ULY SW Site 1 17-Sep-2021 9:11 am
Client Chromatogram for TPH by FID



2708281.2
2021004331 - ULY SW Site 2 17-Sep-2021 9:17 am
Client Chromatogram for TPH by FID



Analyst's Comments

‡ Analysis subcontracted to an external provider. Refer to the Summary of Methods section for more details.

#1 Due to unexpected sample numbers and limited resources, we were unable to commence the carbonaceous Biochemical Oxygen Demand(cBOD5) analyses on the day that they arrived at the laboratory. The analysis was performed, as soon as possible, on the frozen sample.

#2 Due to the nature of the sample , it was not possible to filter the usual volume for the Volatile Suspended Solids analysis. As the volume filtered was less than usual, the detection limit achieved is greater than normal.

#3 Severe matrix interferences required that a dilution be performed prior to analysis , resulting in a detection limit higher than that normally achieved for the Tannin analysis.

#4 Severe matrix interferences required that a dilution be performed prior to analysis of this sample, resulting in a detection limit higher than that normally achieved for the NH4N analysis.

Appendix No.1 - Waikato University Report

Summary of Methods

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

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Glass Fibre	Sample filtration through glass fibre filter.	-	3-5
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-5
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	1-5
pH	pH meter. APHA 4500-H^+ B 23rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-5
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	3-4
Volatile Suspended Solids	Filtration (GF/C, 1.2 µm). Ashing 550°C, 30 min. Gravimetric. APHA 2540 E (modified) 23rd ed. 2017.	3 g/m³	1-3
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m³	1-5
Settleable Solids*	Volumetric using an Imhoff cone. Settled 1 hr. APHA 2540 F 23rd ed. 2017.	0.5 mL/L	1-5
Particle size analysis*	Malvern Laser Sizer particle size analysis from 0.05 microns to 3.4 mm. Samples are measured in volume %. Subcontracted to Earth Sciences Department, Waikato University, Hamilton.	-	1-5
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	1-5
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.003 g/m³	1-5
Total Aluminium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.0032 g/m³	1-5
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.05 g/m³	3-4
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0005 g/m³	1-5
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.00053 g/m³	1-5
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.02 g/m³	3-4
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	1-5
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.0011 g/m³	1-5
Dissolved Inorganic Nitrogen*	Calculation: NH_4-N + NO_3-N + NO_2-N. In-house calculation.	0.010 g/m³	1-5
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m³ is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m³, the Default Detection Limit for Total Nitrogen will be 0.11 g/m³. In-house calculation.	0.05 g/m³	1-5
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH_4-N = NH_4^+-N + NH_3-N). APHA 4500-NH_3 H (modified) 23rd ed. 2017.	0.010 g/m³	1-5
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m³	1-5
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N_{org} D (modified) 4500 NH_3 F (modified) 23rd ed. 2017.	0.10 g/m³	1-5
Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) 23rd ed. 2017.	2 g O_2/m³	3-4
Total Phenols	In-line distillation, segmented flow colorimetry. NB: Does not detect 4-methylphenol. APHA 5530 B & D (modified) 23rd ed. 2017 & Skalar Method I497-001 (modified).	0.02 g/m³	1-5
Tannin	Colorimetric with Folin phenol reagent, tannic acid used for calibration. APHA 5550 B (modified) 23rd ed. 2017.	0.10 g/m³	1-5

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Absorbance at 440 nm	Filtered sample. Spectrophotometry, 1cm cell. APHA 5910 B 23rd ed. 2017.	0.002 AU cm^{-1}	3-5
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m^3	1-5
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m^3	1-5
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m^3	1-5
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m^3	1-5

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

Testing was completed between 21-Sep-2021 and 30-Sep-2021. For completion dates of individual analyses please contact the laboratory.

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

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

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Analysis - Under

Malvern Instruments

Malvern

Measurement Details

Sample Name	2708281.1
SOP File Name	HydroLV.cfg
Lab Number	2021220/1
Operator Name	hharveyw

Measurement Details

Analysis Date Time	23/09/2021 11:13:01 AM
Measurement Date Time	23/09/2021 11:13:01 AM
Result Source	Measurement

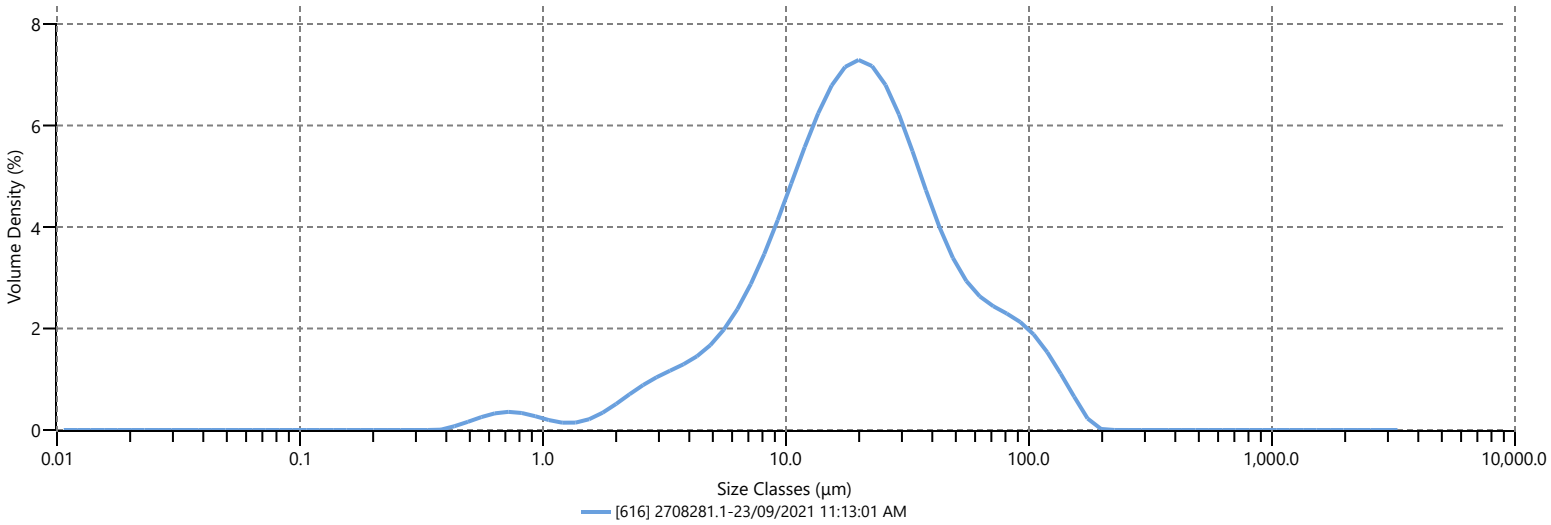
Analysis

Particle Name	Water
Particle Refractive Index	1.500
Particle Absorption Index	0.010
Dispersant Name	Water
Dispersant Refractive Index	1.330
Scattering Model	Mie
Analysis Model	General Purpose
Weighted Residual	0.64 %
Laser Obscuration	13.51 %

Result

Concentration	0.0197 %
Span	3.180
Uniformity	0.938
Specific Surface Area	607.4 m^2/kg
D [3,2]	9.88 µm
D [4,3]	29.1 µm
Dv (10)	5.37 µm
Dv (50)	19.7 µm
Dv (90)	67.9 µm
Volume Below (10) µm	22.41 %
Volume Below (20) µm	50.82 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0100	0.00	0.0597	0.00	0.357	0.00	2.13	2.77	12.7	30.65	76.0	91.80	454	100.00	2710	100.00
0.0114	0.00	0.0679	0.00	0.405	0.00	2.42	3.36	14.5	35.86	86.4	93.71	516	100.00	3080	100.00
0.0129	0.00	0.0771	0.00	0.460	0.06	2.75	4.10	16.4	41.53	98.1	95.49	586	100.00	3500	100.00
0.0147	0.00	0.0876	0.00	0.523	0.20	3.12	4.97	18.7	47.51	111	97.07	666	100.00		
0.0167	0.00	0.0995	0.00	0.594	0.41	3.55	5.94	21.2	53.61	127	98.35	756	100.00		
0.0189	0.00	0.113	0.00	0.675	0.69	4.03	7.02	24.1	59.61	144	99.28	859	100.00		
0.0215	0.00	0.128	0.00	0.767	0.99	4.58	8.22	27.4	65.29	163	99.83	976	100.00		
0.0244	0.00	0.146	0.00	0.872	1.27	5.21	9.61	31.1	70.48	186	100.00	1110	100.00		
0.0278	0.00	0.166	0.00	0.991	1.50	5.92	11.25	35.3	75.07	211	100.00	1260	100.00		
0.0315	0.00	0.188	0.00	1.13	1.66	6.72	13.23	40.1	79.00	240	100.00	1430	100.00		
0.0358	0.00	0.214	0.00	1.28	1.78	7.64	15.62	45.6	82.33	272	100.00	1630	100.00		
0.0407	0.00	0.243	0.00	1.45	1.89	8.68	18.51	51.8	85.15	310	100.00	1850	100.00		
0.0463	0.00	0.276	0.00	1.65	2.06	9.86	21.95	58.9	87.58	352	100.00	2100	100.00		
0.0526	0.00	0.314	0.00	1.88	2.35	11.2	26.00	66.9	89.77	400	100.00	2390	100.00		

Analysis - Under

Malvern Instruments

Malvern

Measurement Details

Sample Name 2708281.2
SOP File Name HydroLV.cfg
Lab Number 2021220/2
Operator Name hharveyw

Measurement Details

Analysis Date Time 23/09/2021 11:24:16 AM
Measurement Date Time 23/09/2021 11:24:16 AM
Result Source Measurement

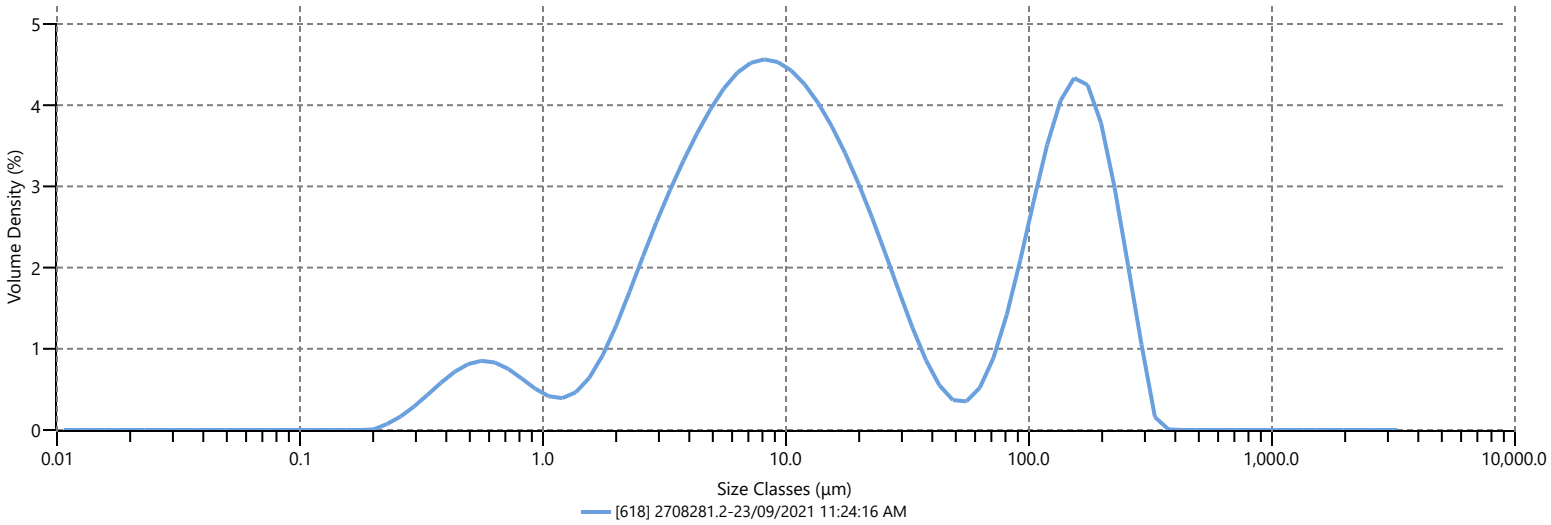
Analysis

Particle Name Water
Particle Refractive Index 1.500
Particle Absorption Index 0.010
Dispersant Name Water
Dispersant Refractive Index 1.330
Scattering Model Mie
Analysis Model General Purpose
Weighted Residual 1.48 %
Laser Obscuration 14.31 %

Result

Concentration 0.0126 %
Span 14.393
Uniformity 3.890
Specific Surface Area 1359 m^2/kg
D [3,2] 4.41 µm
D [4,3] 52.0 µm
Dv (10) 2.34 µm
Dv (50) 12.0 µm
Dv (90) 175 µm
Volume Below (10) µm 44.83 %
Volume Below (20) µm 62.36 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0100	0.00	0.0597	0.00	0.357	0.80	2.13	8.94	12.7	51.66	76.0	72.87	454	100.00	2710	100.00
0.0114	0.00	0.0679	0.00	0.405	1.28	2.42	10.36	14.5	55.02	86.4	74.04	516	100.00	3080	100.00
0.0129	0.00	0.0771	0.00	0.460	1.88	2.75	12.15	16.4	58.14	98.1	75.78	586	100.00	3500	100.00
0.0147	0.00	0.0876	0.00	0.523	2.56	3.12	14.28	18.7	60.99	111	78.13	666	100.00		
0.0167	0.00	0.0995	0.00	0.594	3.27	3.55	16.75	21.2	63.52	127	81.07	756	100.00		
0.0189	0.00	0.113	0.00	0.675	3.97	4.03	19.52	24.1	65.71	144	84.48	859	100.00		
0.0215	0.00	0.128	0.00	0.767	4.60	4.58	22.56	27.4	67.51	163	88.11	976	100.00		
0.0244	0.00	0.146	0.00	0.872	5.13	5.21	25.86	31.1	68.94	186	91.68	1110	100.00		
0.0278	0.00	0.166	0.00	0.991	5.55	5.92	29.37	35.3	69.98	211	94.86	1260	100.00		
0.0315	0.00	0.188	0.00	1.13	5.89	6.72	33.04	40.1	70.69	240	97.36	1430	100.00		
0.0358	0.00	0.214	0.00	1.28	6.21	7.64	36.82	45.6	71.14	272	99.05	1630	100.00		
0.0407	0.00	0.243	0.06	1.45	6.59	8.68	40.63	51.8	71.44	310	99.93	1850	100.00		
0.0463	0.00	0.276	0.20	1.65	7.12	9.86	44.41	58.9	71.72	352	100.00	2100	100.00		
0.0526	0.00	0.314	0.44	1.88	7.88	11.2	48.11	66.9	72.14	400	100.00	2390	100.00		

Analysis - Under

Malvern Instruments

Malvern

Measurement Details

Sample Name	2708281.3
SOP File Name	HydroLV.cfg
Lab Number	2021220/3
Operator Name	hharveyw

Measurement Details

Analysis Date Time	23/09/2021 11:35:34 AM
Measurement Date Time	23/09/2021 11:35:34 AM
Result Source	Measurement

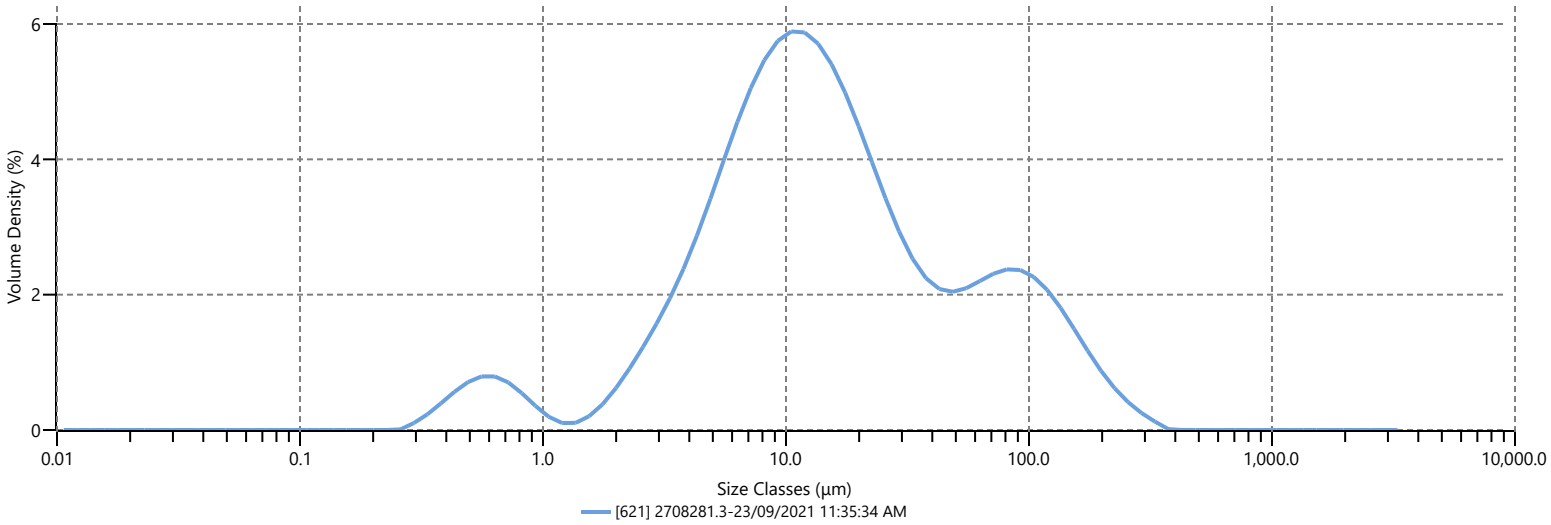
Analysis

Particle Name	Water
Particle Refractive Index	1.500
Particle Absorption Index	0.010
Dispersant Name	Water
Dispersant Refractive Index	1.330
Scattering Model	Mie
Analysis Model	General Purpose
Weighted Residual	0.71 %
Laser Obscuration	6.46 %

Result

Concentration	0.0067 %
Span	6.723
Uniformity	1.892
Specific Surface Area	1060 m^2/kg
D [3,2]	5.66 µm
D [4,3]	32.1 µm
Dv (10)	3.45 µm
Dv (50)	13.4 µm
Dv (90)	93.4 µm
Volume Below (10) µm	38.84 %
Volume Below (20) µm	63.59 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0100	0.00	0.0597	0.00	0.357	0.28	2.13	5.66	12.7	48.12	76.0	86.80	454	100.00	2710	100.00
0.0114	0.00	0.0679	0.00	0.405	0.61	2.42	6.41	14.5	52.89	86.4	88.78	516	100.00	3080	100.00
0.0129	0.00	0.0771	0.00	0.460	1.08	2.75	7.43	16.4	57.40	98.1	90.76	586	100.00	3500	100.00
0.0147	0.00	0.0876	0.00	0.523	1.67	3.12	8.74	18.7	61.57	111	92.65	666	100.00		
0.0167	0.00	0.0995	0.00	0.594	2.34	3.55	10.36	21.2	65.31	127	94.38	756	100.00		
0.0189	0.00	0.113	0.00	0.675	3.00	4.03	12.34	24.1	68.61	144	95.89	859	100.00		
0.0215	0.00	0.128	0.00	0.767	3.59	4.58	14.73	27.4	71.46	163	97.13	976	100.00		
0.0244	0.00	0.146	0.00	0.872	4.05	5.21	17.58	31.1	73.90	186	98.11	1110	100.00		
0.0278	0.00	0.166	0.00	0.991	4.35	5.92	20.90	35.3	76.01	211	98.84	1260	100.00		
0.0315	0.00	0.188	0.00	1.13	4.50	6.72	24.70	40.1	77.87	240	99.35	1430	100.00		
0.0358	0.00	0.214	0.00	1.28	4.58	7.64	28.92	45.6	79.60	272	99.69	1630	100.00		
0.0407	0.00	0.243	0.00	1.45	4.67	8.68	33.49	51.8	81.29	310	99.90	1850	100.00		
0.0463	0.00	0.276	0.00	1.65	4.83	9.86	38.29	58.9	83.04	352	100.00	2100	100.00		
0.0526	0.00	0.314	0.09	1.88	5.14	11.2	43.21	66.9	84.87	400	100.00	2390	100.00		

Analysis - Under

Malvern Instruments

Malvern

Measurement Details

Sample Name 2708281.4
SOP File Name HydroLV.cfg
Lab Number 2021220/4
Operator Name hharveyw

Measurement Details

Analysis Date Time 23/09/2021 11:55:55 AM
Measurement Date Time 23/09/2021 11:55:55 AM
Result Source Measurement

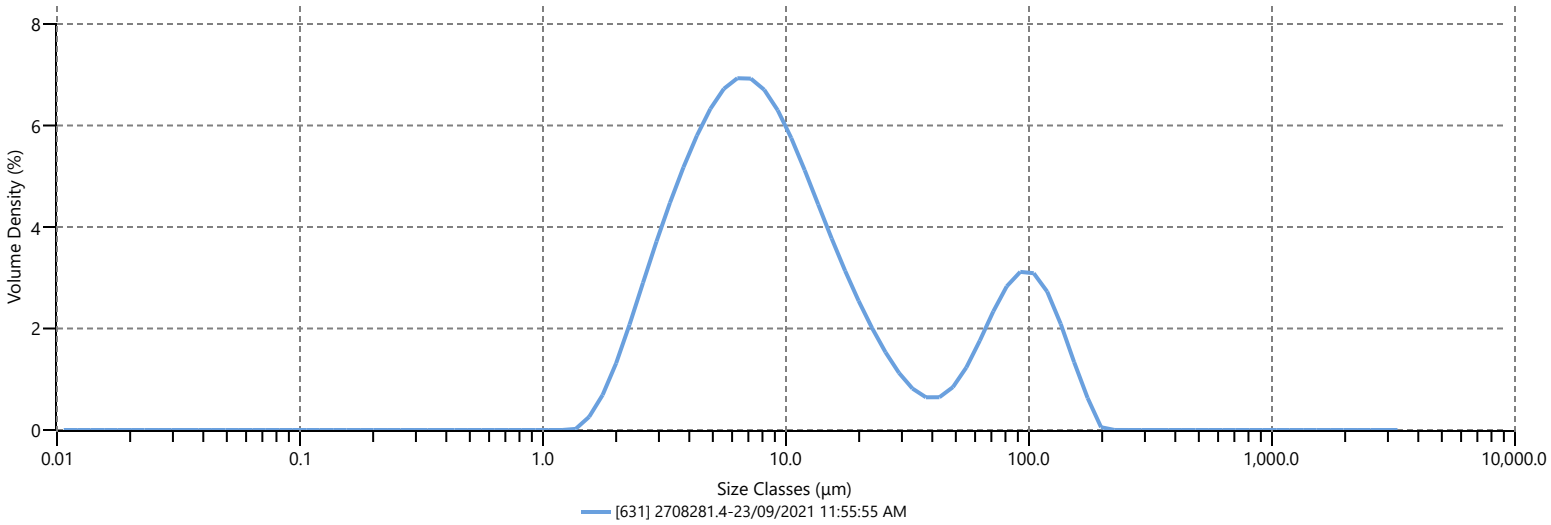
Analysis

Particle Name Water
Particle Refractive Index 1.500
Particle Absorption Index 0.010
Dispersant Name Water
Dispersant Refractive Index 1.330
Scattering Model Mie
Analysis Model General Purpose
Weighted Residual 1.33 %
Laser Obscuration 3.76 %

Result

Concentration 0.0030 %
Span 10.047
Uniformity 2.361
Specific Surface Area 850.7 m^2/kg
D [3,2] 7.05 µm
D [4,3] 25.5 µm
Dv (10) 3.22 µm
Dv (50) 8.66 µm
Dv (90) 90.2 µm
Volume Below (10) µm 55.89 %
Volume Below (20) µm 75.04 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0100	0.00	0.0597	0.00	0.357	0.00	2.13	1.85	12.7	64.43	76.0	86.73	454	100.00	2710	100.00
0.0114	0.00	0.0679	0.00	0.405	0.00	2.42	3.58	14.5	68.13	86.4	89.10	516	100.00	3080	100.00
0.0129	0.00	0.0771	0.00	0.460	0.00	2.75	6.00	16.4	71.28	98.1	91.72	586	100.00	3500	100.00
0.0147	0.00	0.0876	0.00	0.523	0.00	3.12	9.10	18.7	73.89	111	94.32	666	100.00		
0.0167	0.00	0.0995	0.00	0.594	0.00	3.55	12.84	21.2	76.01	127	96.61	756	100.00		
0.0189	0.00	0.113	0.00	0.675	0.00	4.03	17.16	24.1	77.68	144	98.37	859	100.00		
0.0215	0.00	0.128	0.00	0.767	0.00	4.58	22.00	27.4	78.95	163	99.48	976	100.00		
0.0244	0.00	0.146	0.00	0.872	0.00	5.21	27.29	31.1	79.88	186	100.00	1110	100.00		
0.0278	0.00	0.166	0.00	0.991	0.00	5.92	32.91	35.3	80.55	211	100.00	1260	100.00		
0.0315	0.00	0.188	0.00	1.13	0.00	6.72	38.70	40.1	81.08	240	100.00	1430	100.00		
0.0358	0.00	0.214	0.00	1.28	0.00	7.64	44.49	45.6	81.60	272	100.00	1630	100.00		
0.0407	0.00	0.243	0.00	1.45	0.00	8.68	50.09	51.8	82.29	310	100.00	1850	100.00		
0.0463	0.00	0.276	0.00	1.65	0.20	9.86	55.35	58.9	83.31	352	100.00	2100	100.00		
0.0526	0.00	0.314	0.00	1.88	0.77	11.2	60.16	66.9	84.77	400	100.00	2390	100.00		

Analysis - Under

Malvern Instruments

Malvern

Measurement Details

Sample Name	2708281.5
SOP File Name	HydroLV.cfg
Lab Number	2021220/5
Operator Name	hharveyw

Measurement Details

Analysis Date Time	23/09/2021 12:06:19 PM
Measurement Date Time	23/09/2021 12:06:19 PM
Result Source	Measurement

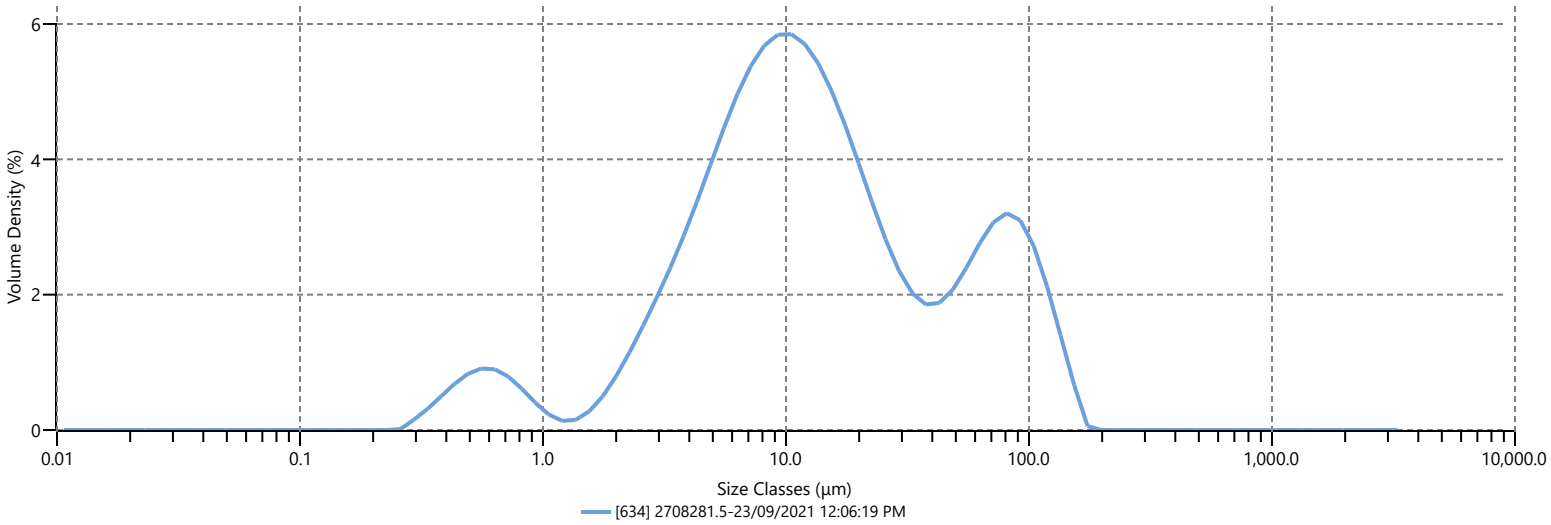
Analysis

Particle Name	Water
Particle Refractive Index	1.500
Particle Absorption Index	0.010
Dispersant Name	Water
Dispersant Refractive Index	1.330
Scattering Model	Mie
Analysis Model	General Purpose
Weighted Residual	0.67 %
Laser Obscuration	6.21 %

Result

Concentration	0.0058 %
Span	6.507
Uniformity	1.710
Specific Surface Area	1209 m^2/kg
D [3,2]	4.96 µm
D [4,3]	26.2 µm
Dv (10)	2.97 µm
Dv (50)	11.8 µm
Dv (90)	79.9 µm
Volume Below (10) µm	43.63 %
Volume Below (20) µm	66.98 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0100	0.00	0.0597	0.00	0.357	0.39	2.13	6.79	12.7	52.73	76.0	88.94	454	100.00	2710	100.00
0.0114	0.00	0.0679	0.00	0.405	0.80	2.42	7.74	14.5	57.26	86.4	91.63	516	100.00	3080	100.00
0.0129	0.00	0.0771	0.00	0.460	1.37	2.75	9.02	16.4	61.44	98.1	94.23	586	100.00	3500	100.00
0.0147	0.00	0.0876	0.00	0.523	2.06	3.12	10.65	18.7	65.20	111	96.52	666	100.00		
0.0167	0.00	0.0995	0.00	0.594	2.83	3.55	12.63	21.2	68.49	127	98.29	756	100.00		
0.0189	0.00	0.113	0.00	0.675	3.58	4.03	15.02	24.1	71.29	144	99.45	859	100.00		
0.0215	0.00	0.128	0.00	0.767	4.25	4.58	17.83	27.4	73.64	163	100.00	976	100.00		
0.0244	0.00	0.146	0.00	0.872	4.76	5.21	21.09	31.1	75.59	186	100.00	1110	100.00		
0.0278	0.00	0.166	0.00	0.991	5.09	5.92	24.82	35.3	77.26	211	100.00	1260	100.00		
0.0315	0.00	0.188	0.00	1.13	5.28	6.72	28.96	40.1	78.79	240	100.00	1430	100.00		
0.0358	0.00	0.214	0.00	1.28	5.38	7.64	33.45	45.6	80.35	272	100.00	1630	100.00		
0.0407	0.00	0.243	0.00	1.45	5.50	8.68	38.20	51.8	82.07	310	100.00	1850	100.00		
0.0463	0.00	0.276	0.00	1.65	5.72	9.86	43.08	58.9	84.06	352	100.00	2100	100.00		
0.0526	0.00	0.314	0.13	1.88	6.13	11.2	47.97	66.9	86.37	400	100.00	2390	100.00		

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W www.hill-laboratories.com

Certificate of Analysis

Client:	4SIGHT Consulting Limited	**Lab No:**	2708281 SPv2
Contact:	Marie Knue	**Date Received:**	18-Sep-2021
	C/- 4SIGHT Consulting Limited	**Date Reported:**	20-Oct-2021 **(Amended)**
	PO Box 402053	**Quote No:**	67123
	Tutukaka 0153	**Order No:**	AA1146
		Client Reference:	AA1146 Upper Logyard Crawford Rd
		Submitted By:	Kyrste Barton

Sample Type: Saline

Sample Name:		2021004333 - ULY SW Site 4 [Sal] 17-Sep-2021 9:35 am				
Lab Number:		2708281.6				
Individual Tests						
Dissolved Copper	g/m³	0.0014	-	-	-	-
Dissolved Zinc	g/m³	0.011	-	-	-	-

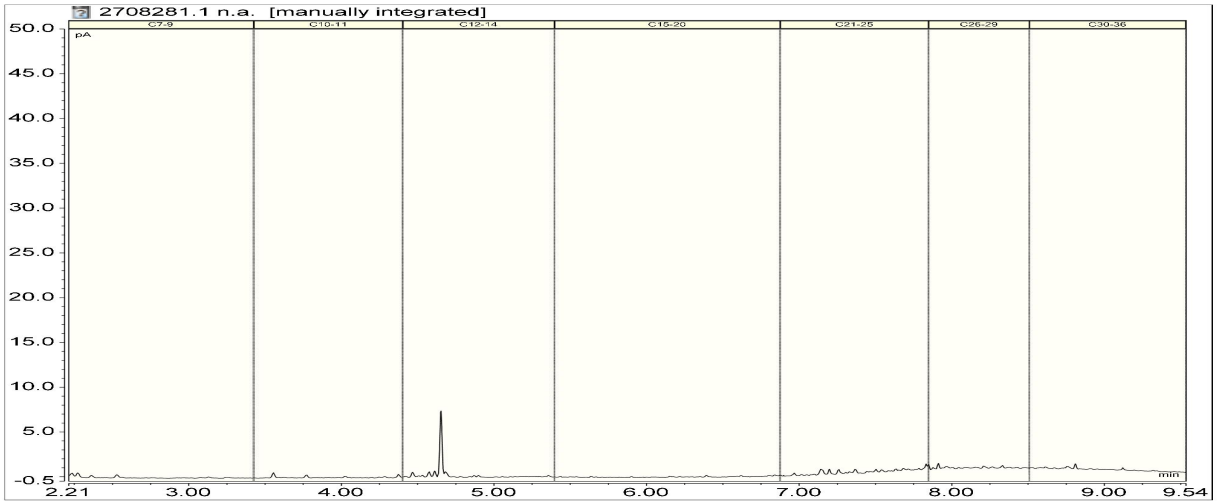
Sample Type: Aqueous

Sample Name:		2021004330 - ULY SW Site 1 17-Sep-2021 9:11 am	2021004331 - ULY SW Site 2 17-Sep-2021 9:17 am	2021004332 - ULY SW Site 3 17-Sep-2021 9:45 am	2021004333 - ULY SW Site 4 17-Sep-2021 9:35 am	2021004334 - ULY SW Site 5 17-Sep-2021 10:00 am
Lab Number:		2708281.1	2708281.2	2708281.3	2708281.4	2708281.5
Individual Tests						
pH	pH Units	6.7	6.6	7.4	7.8	7.4
Total Hardness	g/m³ as $CaCO_3$	-	-	104	4,200	-
Volatile Suspended Solids	g/m³	210	84	< 15 #2	-	-
Total Suspended Solids	g/m³	630	156	65	57	61
Settleable Solids*	mL/L	10.0	< 1.0	< 1.0	< 1.0	< 1.0
Particle size analysis*‡		See attached report	See attached report	See attached report	See attached report	See attached report
Dissolved Aluminium	g/m³	0.39	0.40	0.087	< 0.3	0.075
Total Aluminium	g/m³	8.3	3.8	1.50	0.71	1.73
Dissolved Calcium	g/m³	-	-	33	280	-
Dissolved Copper	g/m³	0.0013	0.0013	0.0037	< 0.05	0.0038
Total Copper	g/m³	0.0078	0.0044	0.0061	< 0.053	0.0064
Dissolved Magnesium	g/m³	-	-	5.2	860	-
Dissolved Zinc	g/m³	0.0107	0.0132	0.057	< 0.10	0.059
Total Zinc	g/m³	0.088	0.044	0.097	< 0.11	0.096
Dissolved Inorganic Nitrogen*	g/m³	< 0.011	< 0.011	1.37	0.22	1.34
Total Nitrogen	g/m³	1.30	0.72	2.7	0.32	2.6
Total Ammoniacal-N	g/m³	< 0.010	< 0.010	< 0.010	< 0.10 #4	< 0.010
Nitrate-N + Nitrite-N	g/m³	< 0.002	< 0.002	1.37	0.169	1.33
Total Kjeldahl Nitrogen (TKN)	g/m³	1.30	0.72	1.30	0.15	1.29
Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	g O_2/m³	-	-	2 #1	< 2 #1	-
Total Phenols	g/m³	0.02	0.03	< 0.02	< 0.02	< 0.02
Tannin	g/m³	49	31	1.5	1.4 #3	2.0
Absorbance at 440 nm	AU cm^{-1}	-	-	0.059	0.004	0.057

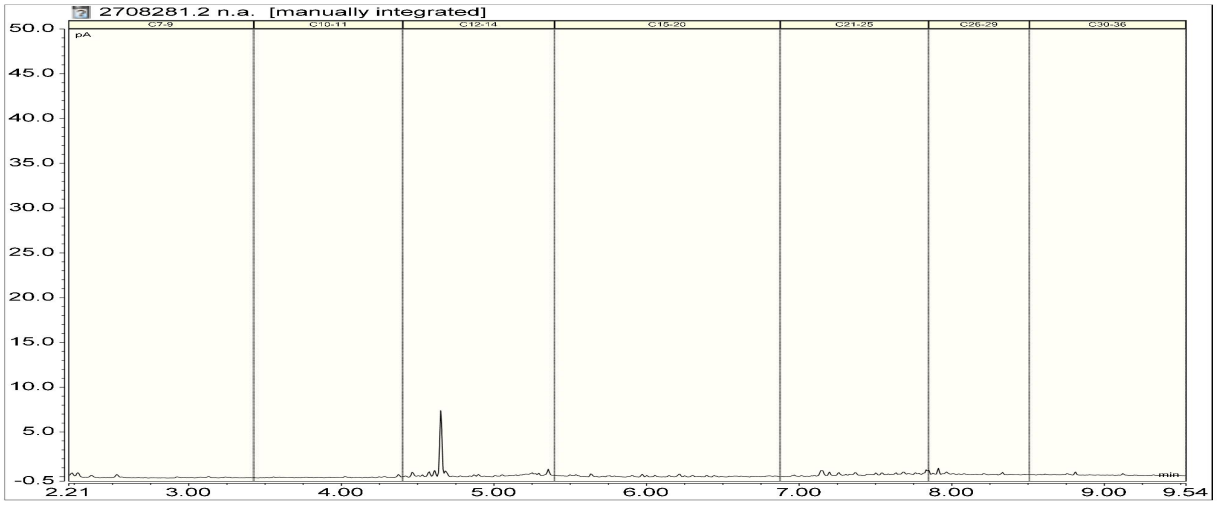
This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Aqueous						
Sample Name:		2021004330 - ULY SW Site 1 17-Sep-2021 9:11 am	2021004331 - ULY SW Site 2 17-Sep-2021 9:17 am	2021004332 - ULY SW Site 3 17-Sep-2021 9:45 am	2021004333 - ULY SW Site 4 17-Sep-2021 9:35 am	2021004334 - ULY SW Site 5 17-Sep-2021 10:00 am
Lab Number:		2708281.1	2708281.2	2708281.3	2708281.4	2708281.5
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
C10 - C14	g/m³	0.2	0.3	< 0.2	< 0.2	< 0.2
C15 - C36	g/m³	1.9	0.7	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C7 - C36)	g/m³	2.1	1.0	< 0.7	< 0.7	< 0.7

2708281.1
2021004330 - ULY SW Site 1 17-Sep-2021 9:11 am
Client Chromatogram for TPH by FID



2708281.2
2021004331 - ULY SW Site 2 17-Sep-2021 9:17 am
Client Chromatogram for TPH by FID



Analyst's Comments

‡ Analysis subcontracted to an external provider. Refer to the Summary of Methods section for more details.

#1 Due to unexpected sample numbers and limited resources, we were unable to commence the carbonaceous Biochemical Oxygen Demand(cBOD5) analyses on the day that they arrived at the laboratory. The analysis was performed, as soon as possible, on the frozen sample.

#2 Due to the nature of the sample , it was not possible to filter the usual volume for the Volatile Suspended Solids analysis. As the volume filtered was less than usual, the detection limit achieved is greater than normal.

#3 Severe matrix interferences required that a dilution be performed prior to analysis , resulting in a detection limit higher than that normally achieved for the Tannin analysis.

#4 Severe matrix interferences required that a dilution be performed prior to analysis of this sample, resulting in a detection limit higher than that normally achieved for the NH4N analysis.

Amended Report: This certificate of analysis replaces report '2708281-SPv1' issued on 30-Sep-2021 at 1:55 pm. Reason for amendment: Testing has been added.

Appendix No.1 - Waikato University Report

Summary of Methods

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

Sample Type: Saline

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	6
Dissolved Zinc	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m³	6

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Glass Fibre	Sample filtration through glass fibre filter.	-	3-5
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-5
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	1-5
pH	pH meter. APHA 4500-H^+ B 23rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-5
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	3-4
Volatile Suspended Solids	Filtration (GF/C, 1.2 µm). Ashing 550°C, 30 min. Gravimetric. APHA 2540 E (modified) 23rd ed. 2017.	3 g/m³	1-3
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m³	1-5
Settleable Solids*	Volumetric using an Imhoff cone. Settled 1 hr. APHA 2540 F 23rd ed. 2017.	0.5 mL/L	1-5
Particle size analysis*	Malvern Laser Sizer particle size analysis from 0.05 microns to 3.4 mm. Samples are measured in volume %. Subcontracted to Earth Sciences Department, Waikato University, Hamilton.	-	1-5
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	1-6
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.003 g/m³	1-5
Total Aluminium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.0032 g/m³	1-5
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.05 g/m³	3-4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0005 g/m^3	1-5
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.00053 g/m^3	1-5
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.02 g/m^3	3-4
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0010 g/m^3	1-5
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.0011 g/m^3	1-5
Dissolved Inorganic Nitrogen*	Calculation: NH_4-N + NO_3-N + NO_2-N. In-house calculation.	0.010 g/m^3	1-5
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m^3 is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m^3, the Default Detection Limit for Total Nitrogen will be 0.11 g/m^3. In-house calculation.	0.05 g/m^3	1-5
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH_4-N = NH_4^+-N + NH_3-N). APHA 4500-NH_3 H (modified) 23rd ed. 2017.	0.010 g/m^3	1-5
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m^3	1-5
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N_{org} D (modified) 4500 NH_3 F (modified) 23rd ed. 2017.	0.10 g/m^3	1-5
Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) 23rd ed. 2017.	2 g O_2/m^3	3-4
Total Phenols	In-line distillation, segmented flow colorimetry. NB: Does not detect 4-methylphenol. APHA 5530 B & D (modified) 23rd ed. 2017 & Skalar Method I497-001 (modified).	0.02 g/m^3	1-5
Tannin	Colorimetric with Folin phenol reagent, tannic acid used for calibration. APHA 5550 B (modified) 23rd ed. 2017.	0.10 g/m^3	1-5
Absorbance at 440 nm	Filtered sample. Spectrophotometry, 1cm cell. APHA 5910 B 23rd ed. 2017.	0.002 AU cm^{-1}	3-5
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m^3	1-5
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m^3	1-5
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m^3	1-5
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m^3	1-5

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

Testing was completed between 21-Sep-2021 and 20-Oct-2021. For completion dates of individual analyses please contact the laboratory.

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

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

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Analysis - Under

Malvern Instruments

Malvern

Measurement Details

Sample Name	2708281.1
SOP File Name	HydroLV.cfg
Lab Number	2021220/1
Operator Name	hharveyw

Measurement Details

Analysis Date Time	23/09/2021 11:13:01 AM
Measurement Date Time	23/09/2021 11:13:01 AM
Result Source	Measurement

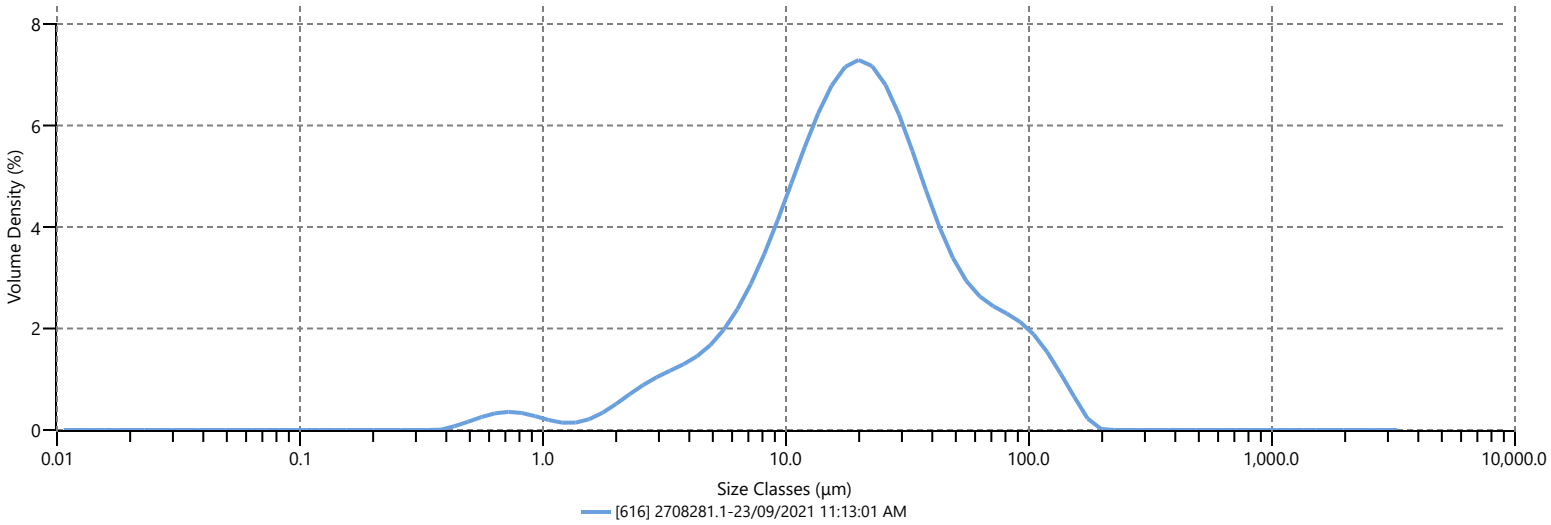
Analysis

Particle Name	Water
Particle Refractive Index	1.500
Particle Absorption Index	0.010
Dispersant Name	Water
Dispersant Refractive Index	1.330
Scattering Model	Mie
Analysis Model	General Purpose
Weighted Residual	0.64 %
Laser Obscuration	13.51 %

Result

Concentration	0.0197 %
Span	3.180
Uniformity	0.938
Specific Surface Area	607.4 m^2/kg
D [3,2]	9.88 µm
D [4,3]	29.1 µm
Dv (10)	5.37 µm
Dv (50)	19.7 µm
Dv (90)	67.9 µm
Volume Below (10) µm	22.41 %
Volume Below (20) µm	50.82 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0100	0.00	0.0597	0.00	0.357	0.00	2.13	2.77	12.7	30.65	76.0	91.80	454	100.00	2710	100.00
0.0114	0.00	0.0679	0.00	0.405	0.00	2.42	3.36	14.5	35.86	86.4	93.71	516	100.00	3080	100.00
0.0129	0.00	0.0771	0.00	0.460	0.06	2.75	4.10	16.4	41.53	98.1	95.49	586	100.00	3500	100.00
0.0147	0.00	0.0876	0.00	0.523	0.20	3.12	4.97	18.7	47.51	111	97.07	666	100.00		
0.0167	0.00	0.0995	0.00	0.594	0.41	3.55	5.94	21.2	53.61	127	98.35	756	100.00		
0.0189	0.00	0.113	0.00	0.675	0.69	4.03	7.02	24.1	59.61	144	99.28	859	100.00		
0.0215	0.00	0.128	0.00	0.767	0.99	4.58	8.22	27.4	65.29	163	99.83	976	100.00		
0.0244	0.00	0.146	0.00	0.872	1.27	5.21	9.61	31.1	70.48	186	100.00	1110	100.00		
0.0278	0.00	0.166	0.00	0.991	1.50	5.92	11.25	35.3	75.07	211	100.00	1260	100.00		
0.0315	0.00	0.188	0.00	1.13	1.66	6.72	13.23	40.1	79.00	240	100.00	1430	100.00		
0.0358	0.00	0.214	0.00	1.28	1.78	7.64	15.62	45.6	82.33	272	100.00	1630	100.00		
0.0407	0.00	0.243	0.00	1.45	1.89	8.68	18.51	51.8	85.15	310	100.00	1850	100.00		
0.0463	0.00	0.276	0.00	1.65	2.06	9.86	21.95	58.9	87.58	352	100.00	2100	100.00		
0.0526	0.00	0.314	0.00	1.88	2.35	11.2	26.00	66.9	89.77	400	100.00	2390	100.00		

Analysis - Under

Malvern Instruments

Malvern

Measurement Details

Sample Name 2708281.2
SOP File Name HydroLV.cfg
Lab Number 2021220/2
Operator Name hharveyw

Measurement Details

Analysis Date Time 23/09/2021 11:24:16 AM
Measurement Date Time 23/09/2021 11:24:16 AM
Result Source Measurement

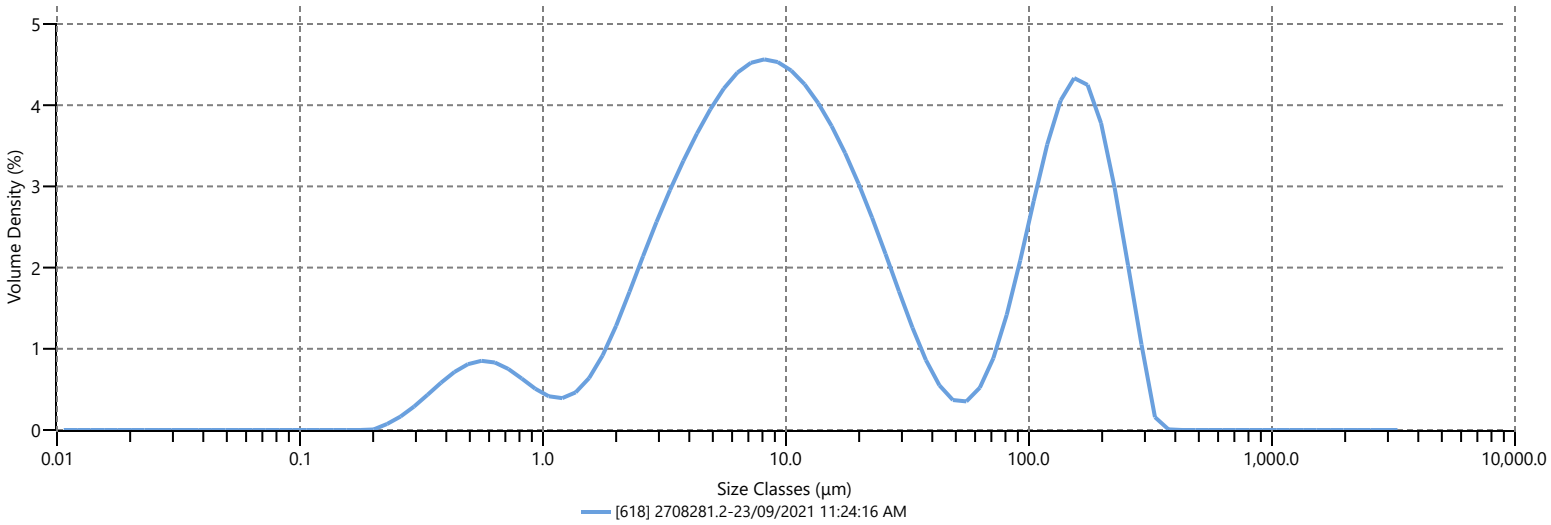
Analysis

Particle Name Water
Particle Refractive Index 1.500
Particle Absorption Index 0.010
Dispersant Name Water
Dispersant Refractive Index 1.330
Scattering Model Mie
Analysis Model General Purpose
Weighted Residual 1.48 %
Laser Obscuration 14.31 %

Result

Concentration 0.0126 %
Span 14.393
Uniformity 3.890
Specific Surface Area 1359 m^2/kg
D [3,2] 4.41 µm
D [4,3] 52.0 µm
Dv (10) 2.34 µm
Dv (50) 12.0 µm
Dv (90) 175 µm
Volume Below (10) µm 44.83 %
Volume Below (20) µm 62.36 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0100	0.00	0.0597	0.00	0.357	0.80	2.13	8.94	12.7	51.66	76.0	72.87	454	100.00	2710	100.00
0.0114	0.00	0.0679	0.00	0.405	1.28	2.42	10.36	14.5	55.02	86.4	74.04	516	100.00	3080	100.00
0.0129	0.00	0.0771	0.00	0.460	1.88	2.75	12.15	16.4	58.14	98.1	75.78	586	100.00	3500	100.00
0.0147	0.00	0.0876	0.00	0.523	2.56	3.12	14.28	18.7	60.99	111	78.13	666	100.00		
0.0167	0.00	0.0995	0.00	0.594	3.27	3.55	16.75	21.2	63.52	127	81.07	756	100.00		
0.0189	0.00	0.113	0.00	0.675	3.97	4.03	19.52	24.1	65.71	144	84.48	859	100.00		
0.0215	0.00	0.128	0.00	0.767	4.60	4.58	22.56	27.4	67.51	163	88.11	976	100.00		
0.0244	0.00	0.146	0.00	0.872	5.13	5.21	25.86	31.1	68.94	186	91.68	1110	100.00		
0.0278	0.00	0.166	0.00	0.991	5.55	5.92	29.37	35.3	69.98	211	94.86	1260	100.00		
0.0315	0.00	0.188	0.00	1.13	5.89	6.72	33.04	40.1	70.69	240	97.36	1430	100.00		
0.0358	0.00	0.214	0.00	1.28	6.21	7.64	36.82	45.6	71.14	272	99.05	1630	100.00		
0.0407	0.00	0.243	0.06	1.45	6.59	8.68	40.63	51.8	71.44	310	99.93	1850	100.00		
0.0463	0.00	0.276	0.20	1.65	7.12	9.86	44.41	58.9	71.72	352	100.00	2100	100.00		
0.0526	0.00	0.314	0.44	1.88	7.88	11.2	48.11	66.9	72.14	400	100.00	2390	100.00		

Analysis - Under

Malvern Instruments

Malvern

Measurement Details

Sample Name	2708281.3
SOP File Name	HydroLV.cfg
Lab Number	2021220/3
Operator Name	hharveyw

Measurement Details

Analysis Date Time	23/09/2021 11:35:34 AM
Measurement Date Time	23/09/2021 11:35:34 AM
Result Source	Measurement

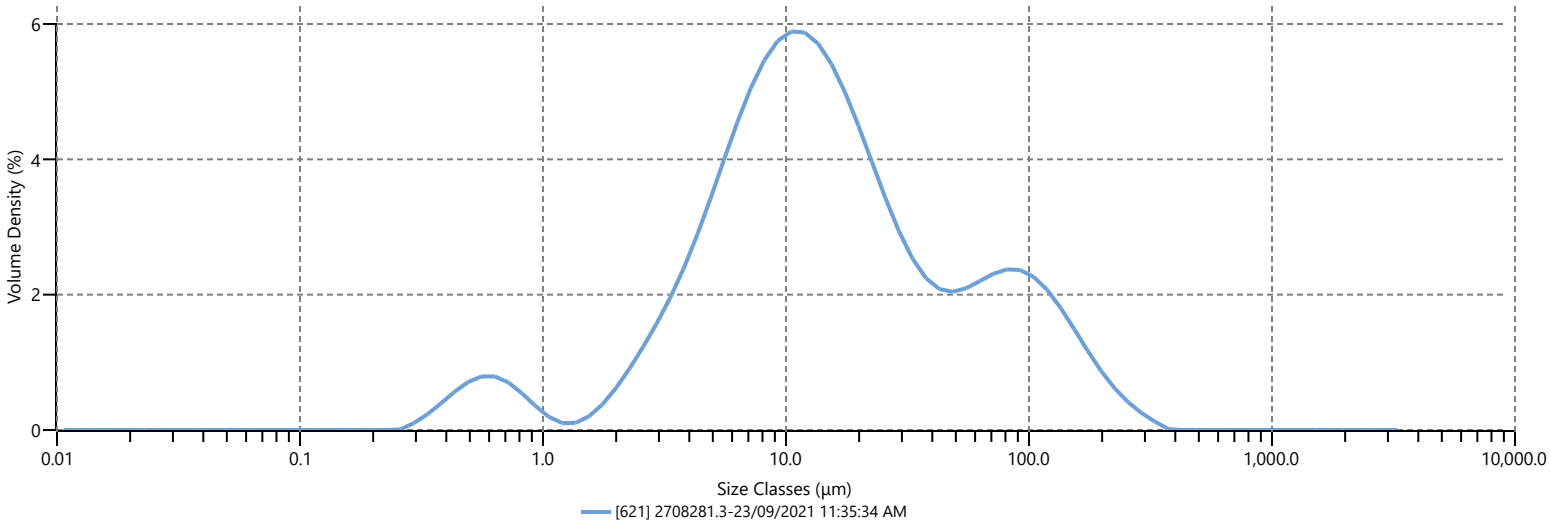
Analysis

Particle Name	Water
Particle Refractive Index	1.500
Particle Absorption Index	0.010
Dispersant Name	Water
Dispersant Refractive Index	1.330
Scattering Model	Mie
Analysis Model	General Purpose
Weighted Residual	0.71 %
Laser Obscuration	6.46 %

Result

Concentration	0.0067 %
Span	6.723
Uniformity	1.892
Specific Surface Area	1060 m^2/kg
D [3,2]	5.66 µm
D [4,3]	32.1 µm
Dv (10)	3.45 µm
Dv (50)	13.4 µm
Dv (90)	93.4 µm
Volume Below (10) µm	38.84 %
Volume Below (20) µm	63.59 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0100	0.00	0.0597	0.00	0.357	0.28	2.13	5.66	12.7	48.12	76.0	86.80	454	100.00	2710	100.00
0.0114	0.00	0.0679	0.00	0.405	0.61	2.42	6.41	14.5	52.89	86.4	88.78	516	100.00	3080	100.00
0.0129	0.00	0.0771	0.00	0.460	1.08	2.75	7.43	16.4	57.40	98.1	90.76	586	100.00	3500	100.00
0.0147	0.00	0.0876	0.00	0.523	1.67	3.12	8.74	18.7	61.57	111	92.65	666	100.00		
0.0167	0.00	0.0995	0.00	0.594	2.34	3.55	10.36	21.2	65.31	127	94.38	756	100.00		
0.0189	0.00	0.113	0.00	0.675	3.00	4.03	12.34	24.1	68.61	144	95.89	859	100.00		
0.0215	0.00	0.128	0.00	0.767	3.59	4.58	14.73	27.4	71.46	163	97.13	976	100.00		
0.0244	0.00	0.146	0.00	0.872	4.05	5.21	17.58	31.1	73.90	186	98.11	1110	100.00		
0.0278	0.00	0.166	0.00	0.991	4.35	5.92	20.90	35.3	76.01	211	98.84	1260	100.00		
0.0315	0.00	0.188	0.00	1.13	4.50	6.72	24.70	40.1	77.87	240	99.35	1430	100.00		
0.0358	0.00	0.214	0.00	1.28	4.58	7.64	28.92	45.6	79.60	272	99.69	1630	100.00		
0.0407	0.00	0.243	0.00	1.45	4.67	8.68	33.49	51.8	81.29	310	99.90	1850	100.00		
0.0463	0.00	0.276	0.00	1.65	4.83	9.86	38.29	58.9	83.04	352	100.00	2100	100.00		
0.0526	0.00	0.314	0.09	1.88	5.14	11.2	43.21	66.9	84.87	400	100.00	2390	100.00		

Analysis - Under

Malvern Instruments

Malvern

Measurement Details

Sample Name 2708281.4
SOP File Name HydroLV.cfg
Lab Number 2021220/4
Operator Name hharveyw

Measurement Details

Analysis Date Time 23/09/2021 11:55:55 AM
Measurement Date Time 23/09/2021 11:55:55 AM
Result Source Measurement

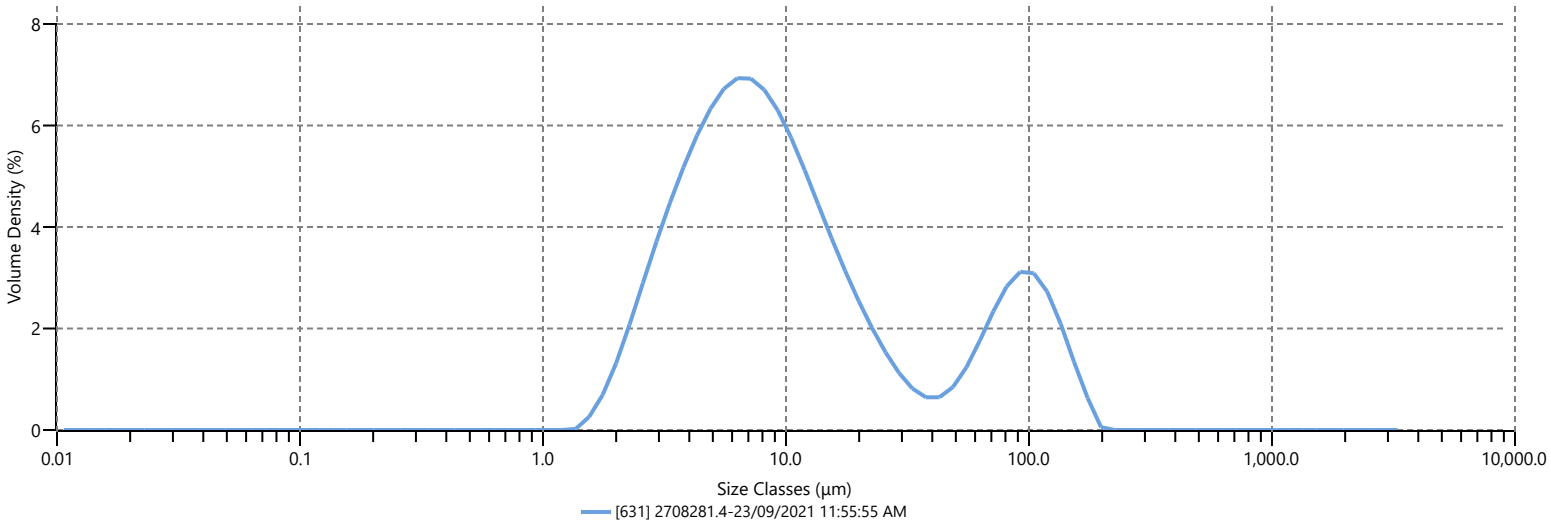
Analysis

Particle Name Water
Particle Refractive Index 1.500
Particle Absorption Index 0.010
Dispersant Name Water
Dispersant Refractive Index 1.330
Scattering Model Mie
Analysis Model General Purpose
Weighted Residual 1.33 %
Laser Obscuration 3.76 %

Result

Concentration 0.0030 %
Span 10.047
Uniformity 2.361
Specific Surface Area 850.7 m^2/kg
D [3,2] 7.05 µm
D [4,3] 25.5 µm
Dv (10) 3.22 µm
Dv (50) 8.66 µm
Dv (90) 90.2 µm
Volume Below (10) µm 55.89 %
Volume Below (20) µm 75.04 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0100	0.00	0.0597	0.00	0.357	0.00	2.13	1.85	12.7	64.43	76.0	86.73	454	100.00	2710	100.00
0.0114	0.00	0.0679	0.00	0.405	0.00	2.42	3.58	14.5	68.13	86.4	89.10	516	100.00	3080	100.00
0.0129	0.00	0.0771	0.00	0.460	0.00	2.75	6.00	16.4	71.28	98.1	91.72	586	100.00	3500	100.00
0.0147	0.00	0.0876	0.00	0.523	0.00	3.12	9.10	18.7	73.89	111	94.32	666	100.00		
0.0167	0.00	0.0995	0.00	0.594	0.00	3.55	12.84	21.2	76.01	127	96.61	756	100.00		
0.0189	0.00	0.113	0.00	0.675	0.00	4.03	17.16	24.1	77.68	144	98.37	859	100.00		
0.0215	0.00	0.128	0.00	0.767	0.00	4.58	22.00	27.4	78.95	163	99.48	976	100.00		
0.0244	0.00	0.146	0.00	0.872	0.00	5.21	27.29	31.1	79.88	186	100.00	1110	100.00		
0.0278	0.00	0.166	0.00	0.991	0.00	5.92	32.91	35.3	80.55	211	100.00	1260	100.00		
0.0315	0.00	0.188	0.00	1.13	0.00	6.72	38.70	40.1	81.08	240	100.00	1430	100.00		
0.0358	0.00	0.214	0.00	1.28	0.00	7.64	44.49	45.6	81.60	272	100.00	1630	100.00		
0.0407	0.00	0.243	0.00	1.45	0.00	8.68	50.09	51.8	82.29	310	100.00	1850	100.00		
0.0463	0.00	0.276	0.00	1.65	0.20	9.86	55.35	58.9	83.31	352	100.00	2100	100.00		
0.0526	0.00	0.314	0.00	1.88	0.77	11.2	60.16	66.9	84.77	400	100.00	2390	100.00		

Analysis - Under

Malvern Instruments

Malvern

Measurement Details

Sample Name	2708281.5
SOP File Name	HydroLV.cfg
Lab Number	2021220/5
Operator Name	hharveyw

Measurement Details

Analysis Date Time	23/09/2021 12:06:19 PM
Measurement Date Time	23/09/2021 12:06:19 PM
Result Source	Measurement

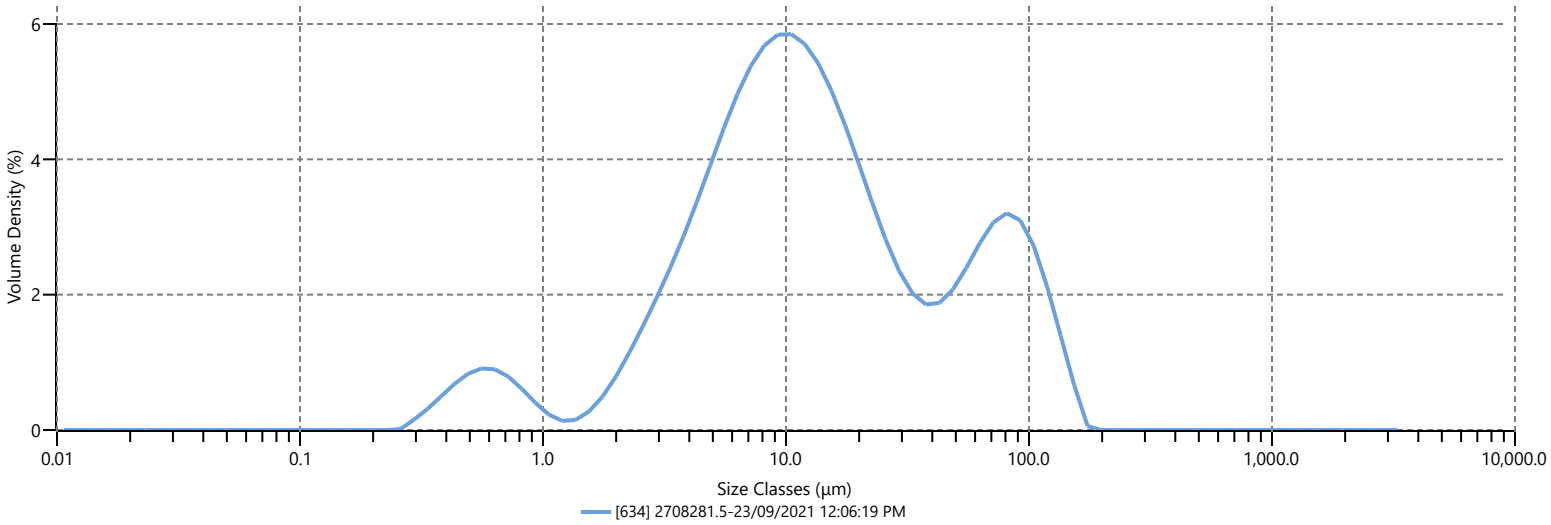
Analysis

Particle Name	Water
Particle Refractive Index	1.500
Particle Absorption Index	0.010
Dispersant Name	Water
Dispersant Refractive Index	1.330
Scattering Model	Mie
Analysis Model	General Purpose
Weighted Residual	0.67 %
Laser Obscuration	6.21 %

Result

Concentration	0.0058 %
Span	6.507
Uniformity	1.710
Specific Surface Area	1209 m^2/kg
D [3,2]	4.96 µm
D [4,3]	26.2 µm
Dv (10)	2.97 µm
Dv (50)	11.8 µm
Dv (90)	79.9 µm
Volume Below (10) µm	43.63 %
Volume Below (20) µm	66.98 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0100	0.00	0.0597	0.00	0.357	0.39	2.13	6.79	12.7	52.73	76.0	88.94	454	100.00	2710	100.00
0.0114	0.00	0.0679	0.00	0.405	0.80	2.42	7.74	14.5	57.26	86.4	91.63	516	100.00	3080	100.00
0.0129	0.00	0.0771	0.00	0.460	1.37	2.75	9.02	16.4	61.44	98.1	94.23	586	100.00	3500	100.00
0.0147	0.00	0.0876	0.00	0.523	2.06	3.12	10.65	18.7	65.20	111	96.52	666	100.00		
0.0167	0.00	0.0995	0.00	0.594	2.83	3.55	12.63	21.2	68.49	127	98.29	756	100.00		
0.0189	0.00	0.113	0.00	0.675	3.58	4.03	15.02	24.1	71.29	144	99.45	859	100.00		
0.0215	0.00	0.128	0.00	0.767	4.25	4.58	17.83	27.4	73.64	163	100.00	976	100.00		
0.0244	0.00	0.146	0.00	0.872	4.76	5.21	21.09	31.1	75.59	186	100.00	1110	100.00		
0.0278	0.00	0.166	0.00	0.991	5.09	5.92	24.82	35.3	77.26	211	100.00	1260	100.00		
0.0315	0.00	0.188	0.00	1.13	5.28	6.72	28.96	40.1	78.79	240	100.00	1430	100.00		
0.0358	0.00	0.214	0.00	1.28	5.38	7.64	33.45	45.6	80.35	272	100.00	1630	100.00		
0.0407	0.00	0.243	0.00	1.45	5.50	8.68	38.20	51.8	82.07	310	100.00	1850	100.00		
0.0463	0.00	0.276	0.00	1.65	5.72	9.86	43.08	58.9	84.06	352	100.00	2100	100.00		
0.0526	0.00	0.314	0.13	1.88	6.13	11.2	47.97	66.9	86.37	400	100.00	2390	100.00		

4SIGHT CONSULTING

Appendix E:

Scion Analysis Report

Te Papa Tipu Innovation Park,
49 Sala Street, Rotorua
Private Bag 3020, Rotorua 3046,
New Zealand

Telephone +64 7 343 5899
Facsimile +64 7 348 0952
Email enquiries@scionresearch.com
www.scionresearch.com

SCION
FORESTS ▪ PRODUCTS ▪ INNOVATION

Wednesday, 6 October 2021

4Sight Consulting (on behalf of Eastland Port).
Auckland Office.

Attn: Marie Knue

TRACE RESIN ACID ANALYSIS – ULY SW Site1-5 – 20 September 2021.

CLIENT'S ORDER NUMBER:	AA1146 EPL Compliance Programme.
WORK PERFORMED BY:	Murray Robinson & Michael Robertson
WORK CHECKED BY:	Kim McGrouther
APPROVED BY:	**(SIGN)**
DATE OF ISSUE:	6 October 2021
DISTRIBUTION:	**CLIENT:** 1 copy **SCION Files:** 1 copy

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DATE SAMPLES RECEIVED 22/09/2021

SAMPLE DESCRIPTION Five water samples in 1L glass bottles (450°C muffled bottles supplied by Scion) – sent to Scion by Stephanie Brew 22/09/2021.

SAMPLE IDENTIFICATION

ULY SW Site 1 - 20/09/21 - 9:11 - 1L
2021004330
Brown murky water, dark brown sediment.

ULY SW Site 2 - 20/09/21 - 9:17 - 1L
2021004331
Brown murky water, some brown sediment.

ULY SW Site 3 - 20/09/21 - 9:45 - 1L
2021004332
Brown water, some brown sediment.

ULY SW Site 4 - 20/09/21 - 9:35 - 1L
2021004333
Light brown water, some brown sediment.

ULY SW Site 5 - 20/09/21 – 10:00 - 1L
2021004334
Clear water, some sediment.

SAMPLING PROCEDURE

This report relates only to the items tested as received and therefore does not necessarily represent the sample from which it was taken.

DATE OF TESTING 22/09/2021

METHODS

In-house method using unfiltered, pH 9-buffered liquid/liquid extraction with dichloromethane (DCM), followed by gas chromatography - mass spectrometry (GC/MS) analysis.

RESULTS:

RESIN ACIDS (µg/L)

Sample name	**2021004330 ULY SW Site 1 20/09/2021**	**2021004331 ULY SW Site 2 20/09/2021**	**2021004332 ULY SW Site 3 20/09/2021**	**2021004333 ULY SW Site 4 20/09/2021**	**2021004334 ULY SW Site 5 20/09/2021**
Pimaric acid	681.2	462.6	n.d.	n.d.	n.d.
Sandaracopimaric acid	36.3	26.0	n.d.	n.d.	n.d.
Isopimaric acid	171.8	118.1	n.d.	n.d.	n.d.
Palustric acid	26.4	70.7	n.d.	n.d.	n.d.
Levopimaric Acid	116.8	90.0	n.d.	n.d.	n.d.
Dehydroabietic acid	2,191.2	1,807.2	n.d.	n.d.	n.d.
Abietic acid	571.0	364.8	n.d.	n.d.	n.d.
Neoabietic acid	76.1	107.7	n.d.	n.d.	n.d.
Pimarenic acid	n.d.	n.d.	n.d.	n.d.	n.d.
Sandaracopimarenic acid	n.d.	n.d.	n.d.	n.d.	n.d.
Isopimarenic acid	n.d.	n.d.	n.d.	n.d.	n.d.
13-Abietenic acid	n.d.	n.d.	n.d.	n.d.	n.d.
Pimaranic acid	n.d.	n.d.	n.d.	n.d.	n.d.
Isopimaranic acid	n.d.	n.d.	n.d.	n.d.	n.d.
Abietanic acid	n.d.	n.d.	n.d.	n.d.	n.d.
Seco-1-dehydroabietic acid	36.6	27.3	n.d.	n.d.	n.d.
Seco-2-dehydroabietic acid	32.3	26.3	n.d.	n.d.	n.d.
12-Chlorodehydroabietic acid	n.d.	n.d.	n.d.	n.d.	n.d.
14-Chlorodehydroabietic acid	n.d.	n.d.	n.d.	n.d.	n.d.
12,14-Dichlorodehydroabietic acid	n.d.	n.d.	n.d.	n.d.	n.d.
7-Oxodehydroabietic acid	36.3	34.1	n.d.	n.d.	n.d.
Total Resin Acids	**3,975.9**	**3,134.8**	**n.d.**	**n.d.**	**n.d.**

n.d. = not detected, method detection limit is 0.1µg/L
All results presented are from duplicate sample analysis and concentrations are in µg/L. Compounds are quantified if they have a response 2.5 times higher than the average blank.

Appendix F:

Photographs

ULY Site 1 – Swale (17/09/2021)


ULY site 2

ULY Sampling Site 2 – Discharge (top of lamella clarifier) (17/09/2021)

ULY Site 3 – Downstream (17/09/2021)

ULY Site 4 – Upstream (17/09/2021)

ULY Site 5 – Kopuawhakapata stream discharge to marina (17/09/2021)

Appendix G:

Upper Logyard Sampling Protocol

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Eastland Port

Upper Logyard Sampling Protocol

For Eastland Port

June 2019

REPORT INFORMATION AND QUALITY CONTROL

Prepared for:	Martin Bayley Logistics Infrastructure Manager Eastland Port Limited

Author:	4Sight Consulting

Document Name	Eastland Port Upper Logyard Sampling Protocols_v1.4

Version History:	Version 1.2	12 June 2018
	Version 1.3	29 May 2019
	Version 1.4	20 June 2019

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1 BASIS OF THE MONITORING PROGRAMME AND FREQUENCY OF MONITORING

The stormwater monitoring programme will be undertaken in accordance with Conditions 23 - 25 of the stormwater discharge permit. The monitoring is intended to verify that the stormwater system is operating effectively and the discharges from the site do not contain contaminant concentrations elevated above prescribed acceptable levels. The monitoring programme involves weekly visual inspections, as required under Conditions 23, to ensure that the treatment system is maintained in working order and that there are no unauthorised discharges. It also involves collection and analysis of stormwater samples to be carried out quarterly for the first two years and then annually thereafter, as required under Conditions 24 and 25.

Should weather and other environmental conditions exist such that there is either no significant runoff, or it is not practicable to collect samples within a three-month period, an additional sampling round will be undertaken at the next available opportunity, as required by Condition 24. Condition 25 sets out the nature of the water quality monitoring programme after the first two-year period, including the need for the previous quarterly sampling to resume if compliance is not achieved with any annual sample and compliance is to be achieved for two consecutive monitoring quarterly occasions.

2 SAMPLING METHODOLOGY

Five grab water samples are to be collected on each sampling run. Two grab stormwater samples will be collected from the Upper log yard, two grab samples from the Kopuawhakapata Stream and one from the CMA below the Kopuawhakapata Stream outlet.

The samples should cover a range of runoff and stream conditions including:

- Moderate rainfall of 5-10 mm/hr with stream at low flows; and
- Heavy rainfall >10 mm/hr with elevated stream flows.

The samples are to be collected during the first flush (within the first 30 minutes), which generally occurs shortly after commencement of a heavy rainfall event. There may be a significant delay between the beginning of a rainfall event and the beginning of stormwater discharge from the site. The size and intensity of rainfall events vary significantly and therefore identification of an appropriate event in which to sample is often a matter of judgment and experience.

There must be at least three days of dry weather prior to undertaking a sampling event to allow contaminants to build up on impervious surfaces. Rainfall data will be taken from reported values from Paraone Rd gauge (http://www.gdc.govt.nz/sites-list/showSite/170/rainfall). This gauge is located approximately 2.3 km from the site.

The water samples are to be collected and handled according to accepted sampling procedures these being:

- Standard Operating Procedure for Surface Water Sampling;
- Standard Operating Procedure for Stormwater Sampling;
- Standard Operating Procedure for Sample Handling, Storage, Shipping, Recordkeeping, and Chain of Custody; and
- Standard Operating Procedure for Equipment Decontamination.

All sampling will be conducted under the Sampling Contractor's Health and Safety Plan (HASP) that is specific to the sampling activities and the site, and approved by Eastland Port. Sample bottles used should be acquired from the testing laboratory (where the samples are to be analysed). Care should be taken to avoid cross contamination during handling and storage of the samples and to avoid personal contact with sample or the interior surfaces of sample container/lid.

3 STORMWATER SAMPLING LOCATIONS & PARAMETERS

Each quarterly sampling event will involve collecting samples from the five sites shown in **Figure 1** and described in Table 2. The sampling sites are also presented in **Appendix A:**. The figure and table of the sampling sites are drawn

from Appendix 1 of the consent and the related Condition 26 of the stormwater discharge permit, which generally describes them.

The water quality parameters to be sampled at the five sites are outlined in Table 3. The parameters noted in this table except colour, are drawn from a similar table in Condition 27 of the stormwater discharge permit. Condition 27 does not require all parameters to be sampled at all sites.

Condition 27 identifies Site 3 (the stream) as the sole compliance point. Condition 27 does not identify the purpose of the CMA sampling at Site 5 (the CMA). The advice note to the condition makes reference to the Cawthron Institute report of April 2013 that was commissioned by the Council as part of the submission and hearing process for the application. This report does not identify or recommend a need for monitoring in the CMA. On this basis the Site 5 monitoring data will be used for reference, but not compliance purposes.

Condition 30 requires a repeat sample to be taken at the next available opportunity should a parameter exceed consent limits at the downstream compliance point, but not if the same variable is equal to or greater than the compliance point value at site 4 (upstream). For in-situ measurements of DO, if a non-compliant reading of less than 4 g/m^3 (that is also less than the DO concentration at the upstream site) is recorded at site 3, then repeat sampling at specified locations needs to be completed. These additional readings are to be taken at 3 points across the stream, repeated at 10m intervals down the stream (with the first 3 across the stream taken at site 3) (**Appendix B:**). The sequence should be repeated (moving downstream at 10 m intervals) until the point at which DO recovers to > 4.0 g/m^3 (or the upstream site 4 value, whichever is lowest) is established. The purpose of this repeat sampling is to confirm the accuracy and representativeness of any recorded non-compliant DO measurement and to determine at what distance from the discharge DO returns to the specified consented trigger limits.

Condition 27 requires water hardness (the amount of dissolved calcium and magnesium in the water) to be measured at each site. However, the purpose of this measurement is in interpreting the bioavailability of metals and hence their potential receiving environment toxicity in freshwater. On this basis hardness is proposed to be measured only at Sites 3 and 4 (downstream and upstream of the stormwater discharge).

Figure 1: Sampling Site Locations

Condition 27 also does not identify water colour as a parameter to be assessed. However, Condition 28 does require a method and compliance limit measure to be proposed to assess water colour to meet the requirements on this

matter in Section 107 (1) (d) of the RMA. Specifically, that section requires that after reasonable mixing there must not be any conspicuous change in the colour or visual clarity.

There is no recognised NZ standard or guideline on water colour. The Cawthron Institute report notes that the use of comparative colour scales (such as the Munsell scale) is uncommon and spectrophotometric absorbance of light at 440nm is one measure linked to dissolved organic matter (or 'yellow substance') generated from log storage yards. On that basis this measure is proposed for logyard monitoring purposes, but no compliance value can be offered. As the discharge consent is to freshwater and given that Site 3 for all other parameters is specified in the consent as the compliance point, it is proposed to measure colour via absorbance at Site 3 and compare that value with absorbance at Site 4 for a relative assessment of colour change within the stream. This approach is proposed taking in to account the RMA provision is focused on 'conspicuous change'. Additionally, because there is wider interest in colour effects in the CMA, colour will also be measured at Site 5, but only for reference purposes. The body of absorbance data generated at sites 3, 4 and 5 will be reviewed after two years of data in order to derive a defacto compliance limit at site 3.

Table 1: Sampling Site Descriptors

Site No.	Location	Comment
1	Logyard discharge from second settling basin	Increment in contaminant concentration due to discharge and secondary reference point (but not compliance)
2	Logyard discharge below lamella clarifier (prior to point of discharge to stream)	Upstream (background) contaminant levels in stream
3	Kopuawhakapata Stream 20m downstream of discharge point to stream	Increment in contaminant concentration due to discharge after mixing and sole compliance measurement point as stated in Consent Condition 27
4	Kopuawhakapata Stream 10m up stream of discharge	Upstream (background) contaminant levels in stream
5	The inner harbour within 20m of the Kopuawhakapata Stream outlet to the marina	Increment in contaminant concentration due to discharge and secondary reference point (but not compliance)

Table 2: Sampling Site Parameters

Site No.	Parameters
1, 2, 3, 4 & 5	In situ: Some parameters need to be measured in situ because they will change value in a grab sample. These are: pH; Temperature; Dissolved Oxygen; Grab Sample: Other parameters are analysed in water samples removed from the water body and taken to an analytical laboratory. These are: Total Suspended Solids; Settlable Solids; Total Nitrogen; Soluble Inorganic Nitrogen; Total Petroleum Hydrocarbons; Dehydroabeitic acid; Total Phenol; Total Tannin; Dissolved copper; Dissolved zinc.
1, 2 & 3	Grab Sample: Volatile Suspended Solids
3 & 4	Grab Sample: Hardness, BOD5
3, 4 & 5	Grab Sample: Colour measured as Absorbance at 440nm ('yellow substance')

4 FIELD SHEETS

An appropriate field sheet will be filled in during each sampling event in order to have a direct record of information which will assist in interpretation of the results.

The field sheets should record the following information:

- Sample site location/identification number;
- Date and time sample is taken;
- Samplers name;
- Rainfall depth (of the rainfall event);
- Depth of flow at the sample location; and
- Any other relevant information or observations, including photographs where possible (i.e. changes in water colour, any visible sediment plumes in the receiving environment, the presence of debris or conspicuous objects etc.).

Appendix C: contains a prepared field sheet template.

5 CHAIN OF CUSTODY

A Chain of Custody (COC) form (**Appendix D:**) provided by the analytical laboratory should also be filled in providing all relevant information required for sample identification and laboratory analyses. One copy of the COC should go to the laboratory and one copy should be retained by the sampler and logged as part of the Eastland Port record. This is described in detail in the Standard Operating Procedure: Sample Handling, Storage, and Shipping, Recordkeeping and Chain of Custody.

6 SAMPLE ANALYSIS

The samples are to be sent to an IANZ accredited laboratory for analysis. Currently, Hill Laboratories in Hamilton and Scion are distributing the required sample bottles (**Appendix E:**) to the sampler at frequencies in accordance with the current sampling plan.

As required under Condition 31 all sampling must be collected and handled according to the testing laboratories established procedures which shall be in accordance with Standard Methods for the Examination of Water and Wastewater prepared and published jointly by:

- American Public Health Association;
- American Water Works Association; and
- Water Pollution Control Federation (Twenty First or newer edition).

7 TRIGGER VALUES FOR ASSESSING EFFECTS

Condition 27 identifies the water quality parameters to be tested and the 'limits' against which the results are to be compared. The footnote to the condition (page 30) refers to the Australian and New Zealand Guidelines for Freshwater and Marine Water Quality 2000 and the limits being based on the "recommended 80% level of protection trigger values".

The 'limit' column of the table in Condition 27 notes that the compliance limits (or 'trigger levels') are set for sampling Site 3, i.e. the mixing zone site in the stream 20m downstream of the stormwater discharge.

Trigger values are not specified for a number of parameters (Volatile suspended solids, settleable solids, tannins and hardness). These parameters provide better interpretation of other parameters for which there are limits and/or will be used as relative measures between sites and trend measures over time.

Table 3: Target Concentrations at Monitoring Site 3 (Stream Mixing Zone Edge)

Parameter	Required level (At mixing zone edge 20m below discharge to stream/Site 3)
pH	6.5 – 8.5
Temperature	Not more than 3°C above background
Dissolved Oxygen	Not less than 4mg/l
Total Suspended Solids	100 mg/l above background
Settleable Solids	Not specified
Volatile Suspended Solids	Not specified
Total Nitrogen and Soluble Inorganic Nitrogen	0.4mg/l
BOD_5	20 mg/l above background
Total Petroleum Hydrocarbons	15 mg/l
Dehydroabeitic Acid	0.025 mg/l
Total Phenols	0.72 mg/l
Total Tannins	Not specified
Dissolved Copper	0.0025 mg/l as an average of 4 quarterly samples
Dissolved Zinc	0.031 mg/l as an average of 4 quarterly samples

8 QUARTERLY MONITORING REPORTS

The sampling results will be interpreted by Eastland Port's nominated environmental consultant, being a person competent to interpret water quality data. Any exceedances of the 'trigger' levels will be assessed as to the likely source of contaminant, the need for any further sampling considered (that is in addition to the quarterly sampling), and the need for any following up on-site management decided.

Any exceedances are to be reported to the Council within one month of receiving the results from the testing laboratory.

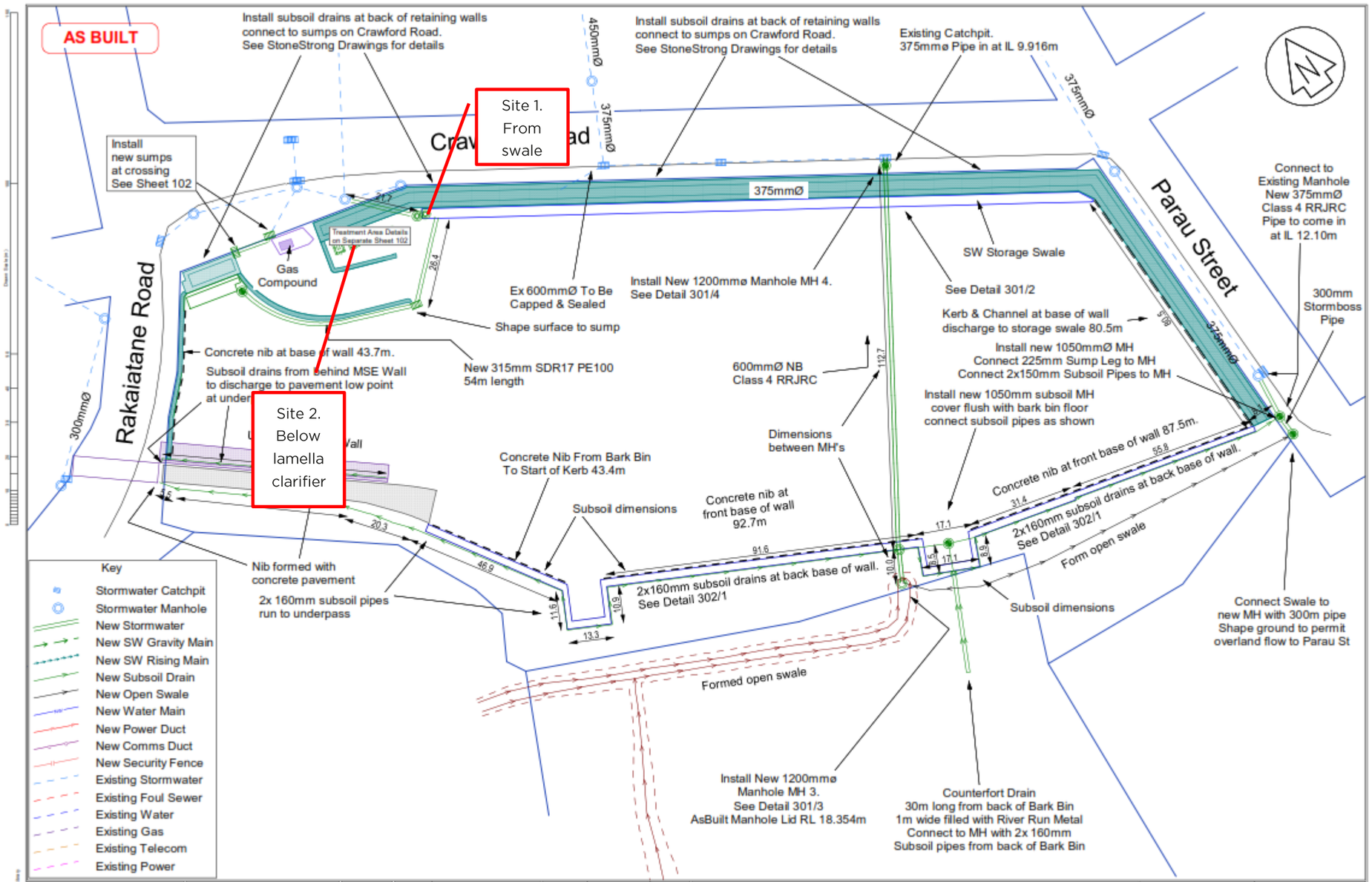
9 SOURCE IDENTIFICATION INVESTIGATION MONITORING PROGRAMME

In the event that one or more of the monitored parameters exceeds the trigger limit as specified in Consent Condition 27 at the receiving environment compliance point, due to the discharge quality (and taking into consideration the contributing influence of background water quality in the Kopuawhakapata Stream), then a source identification investigation will be undertaken in order to identify that part of the site contributing to the elevated concentrations.

The information obtained as part of this investigation will assist in both isolation and identification of the area of the site contributing to the observed exceedance and/or if a stormwater treatment device is not performing effectively. Measures would then need to be taken to address the cause of exceedance with a view to avoiding future exceedances.

Appendix A:

Sampling Locations


AS BUILT
Install subsoil drains at back of retaining walls connect to sumps on Crawford Road. See StoneStrong Drawings for details
Site 1. From swale
Install subsoil drains at back of retaining walls connect to sumps on Crawford Road. See StoneStrong Drawings for details
Existing Catchpit. 375mmø Pipe in at IL 9.916m
Install new sumps at crossing See Sheet 102
Gas Compound
Treatment Area Details on Separate Sheet 102
375mmØ
Ex 600mmØ To Be Capped & Sealed
Install New 1200mmø Manhole MH 4. See Detail 301/4
SW Storage Swale
See Detail 301/2
Parau Street
Connect to Existing Manhole New 375mmØ Class 4 RRJRC Pipe to come in at IL 12.10m
300mm Stormboss Pipe
Kerb & Channel at base of wall discharge to storage swale 80.5m
Shape surface to sump
Concrete nib at base of wall 43.7m.
Subsoil drains from behind MSE Wall to discharge to pavement low point at under
New 315mm SDR17 PE100 54m length
600mmØ NB Class 4 RRJRC
Install new 1050mmØ MH Connect 225mm Sump Leg to MH Connect 2x150mm Subsoil Pipes to MH
Rakaiatane Road
300mmØ
Site 2. Below lamella clarifier
Dimensions between MH's
Install new 1050mm subsoil MH cover flush with bark bin floor connect subsoil pipes as shown
Concrete Nib From Bark Bin To Start of Kerb 43.4m
Subsoil dimensions
Concrete nib at front base of wall 92.7m
Concrete nib at front base of wall 87.5m.
2x160mm subsoil drains at back base of wall. See Detail 302/1
Form open swale
Nib formed with concrete pavement
2x 160mm subsoil pipes run to underpass
2x160mm subsoil drains at back base of wall. See Detail 302/1
Subsoil dimensions
Connect Swale to new MH with 300m pipe Shape ground to permit overland flow to Parau St
Formed open swale
Install New 1200mmø Manhole MH 3. See Detail 301/3 AsBuilt Manhole Lid RL 18.354m
Counterfort Drain 30m long from back of Bark Bin 1m wide filled with River Run Metal Connect to MH with 2x 160mm Subsoil pipes from back of Bark Bin
Key
Stormwater Catchpit
Stormwater Manhole
New Stormwater
New SW Gravity Main
New SW Rising Main
New Subsoil Drain
New Open Swale
New Water Main
New Power Duct
New Comms Duct
New Security Fence
Existing Stormwater
Existing Foul Sewer
Existing Water
Existing Gas
Existing Telecom
Existing Power
Downer
Eastland Port
Issued
Amendments
22/05/2015 1: Add Retaining Wall Subsoils
12/08/2015 2: Crawford Entrance & Notes
12/08/2015 2: Concrete Nibs to Walls
12/08/2015 2: Concrete Swale Section Change
08/10/2015 Include As Built Dimensions
Name
Date
Design/Drawn C Gates 28/09/2015
Checked C Langdale 28/09/2015
Approved R Sharpe 08/10/2015
Client Appr.
Eastland Port
Upper Log Yard Development
Site Stormwater and Drainage Plan
SCALES 1:1000 @ A3
JOB # 551761
PLOT DATE 8 Oct 2015
SHEET 005
REVISION AB

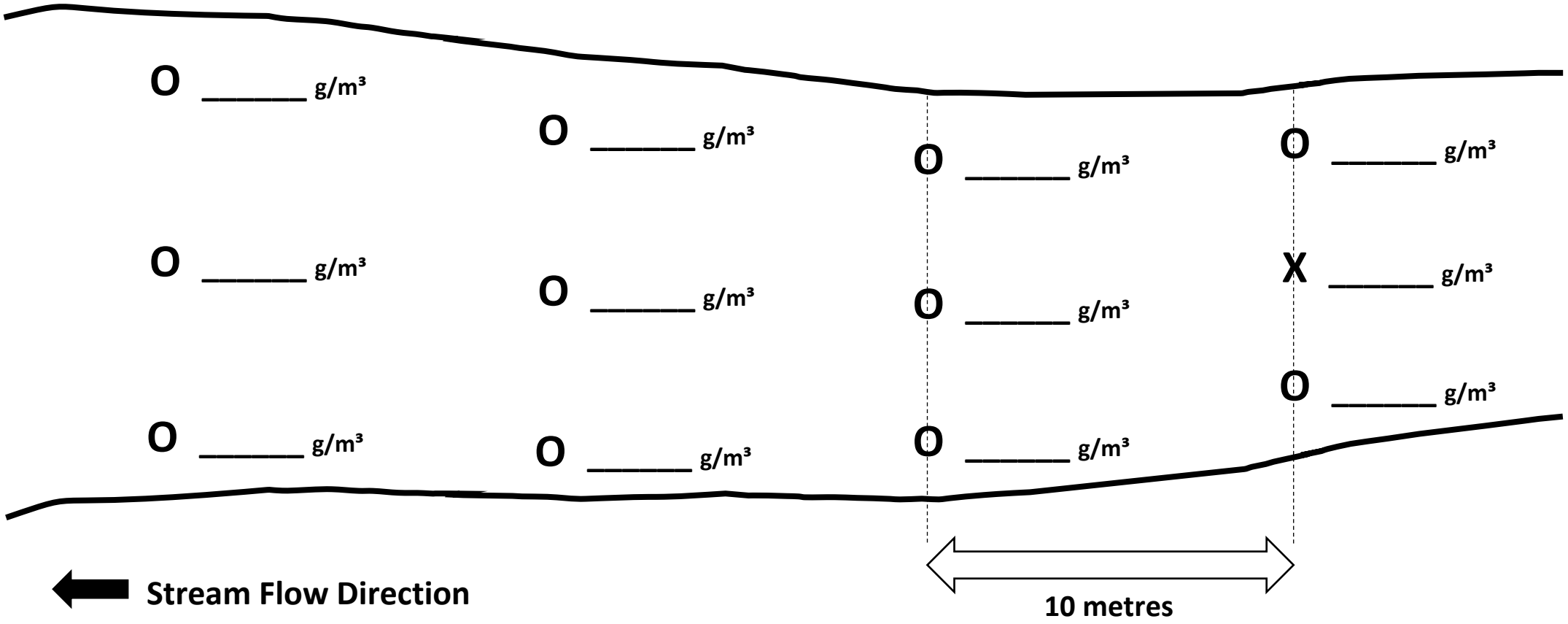

Site #5
Site #3
Site #4
Site #2
Site #1
Reads Quay
Pitt St
Waiwai Rd
35
Stevenson St
Esplanade
Iliili St
Harris St
Paiau St
Dickson St
Ropata St
Kaiti Beach Rd
Crawford Rd
Bartlett St
Image © 2016 DigitalGlobe
Google Earth

Appendix B:

Repeat DO Sampling Procedure

D.O. Procedure for Site 3 (Downstream)

- This sampling procedure only comes in to effect if the D.O. of the stream at the original sampling point (X in this diagram) is less than the D.O. at the upstream site and less than 4 g/m³.
- If this is true, then the D.O. must be sampled at 3 points across the stream where the original sampling point was, then at 10m intervals downstream.
- Once the D.O. has returned to greater than 4 g/m³, no more further points are required.



Appendix C:

Field Sheet

Surface Water (Fresh) Sampling Form

Job Information			Equipment				
Date:	**Time:** Arrive: Depart:		**Water quality equipment description:**	Calibration Records Filed?	Y	N	NA
Project Name: EPL Outsourced Compliance Programme	**Project Number:** AA1146		**Interface Probe Number:**	Calibration Records Filed?	Y	N	NA
Site Location:	**Operator:**		**Sampling Equipment Type:**				
Weather:	**Rainfall event start time/date:**		**Event Rainfall Depth:**	**Number of dry days before sampling:**			
Reason for sampling: Standard Compliance Programme (Circle frequency: Monthly/2 Monthly/Quarterly/6 Monthly) or Additional Monitoring (describe):							

Sample Details						Water Quality Parameters				Observations			
EPL Site Number	**Lab Sample ID**	**Sample Time**	**Approx Depth (m)**	**Approx Stream Flow Rate**	**Temp (°C)**	**DO (%)**	**DO (mg/L)**	**EC (µS/cm)**	**pH**	**Debris Present** (Y/N: type)	**Foams/Scums** (Y/N)	**Clarity** (Clear/Lightly Turbid/Turbid/Very Turbid)	**Photos Reference**

Additional Comments:

Field Quality Control Checks					
Was pre-cleaning sampling equipment used for these samples?	Y	N	Consistent with COC form?	Y	N
Was pre-cleaning sampling equipment properly protected from contamination?	Y	N	COC Filled out?	Y	N
Sampling has been undertaken in accordance with the Site Specific Sampling Protocol and SOPs?	Y	N	Signed:		

Appendix D:

Chain of Custody Form

Hill Laboratories
TRIED, TESTED AND TRUSTED

ANALYSIS REQUEST

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

Office use only (Job No)

Quote No 67123

Primary Contact Oliver Bone 245579

Submitted By Shanna Hickling 223146

Client Name 4SIGHT Consulting Limited 95478

Address PO Box 911310, Victoria Street West
Auckland 1142

Phone 09 303 0311 *Mobile*

Email

Charge To 4SIGHT Consulting Limited 95478

Client Reference AA1146 Upper Logyard Crawford Rd

Order No

Results To

Please refer to the Quote for a list of the Default Report Recipients

☐ *Email Other*

☐ *Other*

ADDITIONAL INFORMATION / KNOWN HAZARDS

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories
Date & Time:
Name:
Signature:
☐ *Tick if you require COC to be emailed back*

Received at Hill Laboratories
Date & Time:
Name:
Signature:

Condition
☐ *Room Temp* ☐ *Chilled* ☐ *Frozen*
Temp:

☐ Sample & Analysis details checked
Signature:

Priority ☐ **Low** ☑ **Normal** ☐ **High**
☐ **Urgent** (ASAP, extra charge applies, please contact lab first)

NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 10 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types

Surface Water (SW)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	ULY SW Site 1		SW	Phenols, SS, SetSol, Tan, DIN, TN, pH, VSS, AlDt, CuDt, ZnDt, AlTt, CuTt, ZnTt, TPHHS_C7-9
2	ULY SW Site 2		SW	Phenols, SS, SetSol, Tan, DIN, TN, pH, VSS, AlDt, CuDt, ZnDt, AlTt, CuTt, ZnTt, TPHHS_C7-9
3	ULY SW Site 3		SW	Phenols, CBOD5, SS, SetSol, Tan, Hard, DIN, TN, pH, VSS, AlDt, CuDt, ZnDt, AlTt, CuTt, ZnTt, A440, TPHHS_C7-9
4	ULY SW Site 4		SW	Phenols, CBOD5, SS, SetSol, Tan, Hard, DIN, TN, pH, AlDt, CuDt, ZnDt, AlTt, CuTt, ZnTt, A440, TPHHS_C7-9
5	ULY SW Site 5		SW	Phenols, SS, SetSol, Tan, DIN, TN, pH, AlDt, CuDt, ZnDt, AlTt, CuTt, ZnTt, A440, TPHHS_C7-9
6				
7				
8				
9				
10				

Appendix E:

Bottles Required

Upper Logyard	ULY SW Site 1	UP1L (Unpreserved; Polyethylene, ContainerSize: 1 L)	1
		NWU100 (Unpreserved; Polyethylene, rinsed with Type 1 water; Laboratory to filter, ContainerSize: 100 mL)	1
		N250 (Nitric acid pres; Polyethylene, ContainerSize: 250 mL)	1
		S250 (Sulphuric acid pres; Polyethylene, ContainerSize: 250 mL)	1
		TPH250 (Sulphuric acid pres; Amber glass, Teflon lined lid, ContainerSize: 250 mL)	1
		Scion bottle	1
	ULY SW Site 2	UP1L (Unpreserved; Polyethylene, ContainerSize: 1 L)	1
		NWU100 (Unpreserved; Polyethylene, rinsed with Type 1 water; Laboratory to filter, ContainerSize: 100 mL)	1
		N250 (Nitric acid pres; Polyethylene, ContainerSize: 250 mL)	1
		S250 (Sulphuric acid pres; Polyethylene, ContainerSize: 250 mL)	1
		TPH250 (Sulphuric acid pres; Amber glass, Teflon lined lid, ContainerSize: 250 mL)	1
		Scion bottle	1
	ULY SW Site 3	UP1L (Unpreserved; Polyethylene, ContainerSize: 1 L)	1
		NWU100 (Unpreserved; Polyethylene, rinsed with Type 1 water; Laboratory to filter, ContainerSize: 100 mL)	1
		N250 (Nitric acid pres; Polyethylene, ContainerSize: 250 mL)	1
		BOD (Unpreserved; Polyethylene, ContainerSize: 500 mL)	1
		S250 (Sulphuric acid pres; Polyethylene, ContainerSize: 250 mL)	1
		TPH250 (Sulphuric acid pres; Amber glass, Teflon lined lid, ContainerSize: 250 mL)	1
		Scion bottle	1
	ULY SW Site 4	UP1L (Unpreserved; Polyethylene, ContainerSize: 1 L)	1
		NWU100 (Unpreserved; Polyethylene, rinsed with Type 1 water; Laboratory to filter, ContainerSize: 100 mL)	1
		N250 (Nitric acid pres; Polyethylene, ContainerSize: 250 mL)	1
		BOD (Unpreserved; Polyethylene, ContainerSize: 500 mL)	1
		S250 (Sulphuric acid pres; Polyethylene, ContainerSize: 250 mL)	1
		TPH250 (Sulphuric acid pres; Amber glass, Teflon lined lid, ContainerSize: 250 mL)	1
		Scion bottle	1
		UP1L (Unpreserved; Polyethylene, ContainerSize: 1 L)	1
		NWU100 (Unpreserved; Polyethylene, rinsed with Type 1 water; Laboratory to filter, ContainerSize: 100 mL)	1

	ULY SW Site 5	N250 (Nitric acid pres; Polyethylene, ContainerSize: 250 mL)	1
		S250 (Sulphuric acid pres; Polyethylene, ContainerSize: 250 mL)	1
		TPH250 (Sulphuric acid pres; Amber glass, Teflon lined lid, ContainerSize: 250 mL)	1
		Scion bottle	1

Appendix H:

Upper Logyard Results

Appendix K - Upper Logyard Results

Summary table of results. For Site 3 (compliance point) and Site 4 (background) exceedances of the trigger limits are highlighted in purple. The trigger limits are from the Environmental Management Plan dated January 2015.

Parameter	Units	EMP trigger limits	Quarter 4 (Oct, Nov, Dec)					Quarter 1 (Jan, Feb, Mar)				
			12 November 2015					28 January 2016				
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 1	Site 2	Site 3	Site 4	Site 5
pH	-log(H^+)	6.5 – 8.5	7.6	7.2	7.6	7.6	7.9	5.5	5.5	7.1	7.2	7.4
Temperature	^oC	Not more than 3^oC above background	14.8	14.6	14.5	14.6	14.8	19	18.9	18.7	18.6	17.9
Dissolved Oxygen	g/m^3	Not less than 4	926,000	1,034,000	1,092,000	1,061,000	1,100,000	5.1	5.5	7	6.8	7.5
TPH	g/m^3	15	<0.7	<0.7	<0.7	<0.7	<0.7	1.0	1.0	<0.7	<0.7	<0.7
TSS	g/m^3	100 above background	590	430	32	24	38	91	108	84	75	41
Settleable Solids	g/m^3	n/a	1.6	<1.0	<1.2	<1.3	<1.4	<1.0	<1.0	<1.0	<1.0	<1.0
VSS	g/m^3	n/a	177	126	9	-	-	46	51	19	-	-
Total Nitrogen	g/m^3	0.4	1.88	1.73	0.81	0.8	0.34	3.4	3.9	0.80	0.96	0.46
Soluble Inorganic Nitrogen	g/m^3	0.4	0.035	0.057	0.25	0.27	0.14	0.052	0.060	0.122	0.36	0.147
$cBOD_5$	g/m^3	20 above background	-	-	5	3	-	-	-	11	3	-
Dehydroabietic Acid	g/m^3	0.025	2.5899	2.6087	0.003	<0.0001	0.0166	0.4412	0.4802	<0.0001	<0.0001	<0.0001
Total Phenols	g/m^3	0.72	0.4	0.5	<0.02	<0.02	<0.2	1.2	1.4	0.06	<0.02	<0.02
Total Tannins	g/m^3	n/a	54	62	1.11	0.62	<1.0	146	125	3.4	1.0	1.7
Dissolved Cu	g/m^3	0.0025 average of 4 quarterly samples	0.0018	0.0027	0.0028	0.0025	<0.010	0.0079	0.0028	0.0023	0.0020	<0.010
Dissolved Zn	g/m^3	0.031 average of 4 quarterly samples	0.0085	0.036	0.062	0.072	0.03	0.070	0.081	0.039	0.030	0.02
Hardness	g/m^3	n/a	-	-	66	69	-	-	-	27	25	-
Absorbance at 440nm	AU cm^{-1}	n/a	-	-	0.018	0.016	0.006	-	-	0.013	0.012	0.005

Parameter	Units	EMP trigger limits	Quarter 3 (July, August, September)					Quarter 4 (October, November, December)				
			10 October 2016					8 February 2017				
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 1	Site 2	Site 3	Site 4	Site 5
pH	-log(H^+)	6.5 – 8.5	7.1	7.0	7.6	7.6	7.9	7.1	7.1	7.4	7.4	-
Temperature	^oC	Not more than 3^oC above background	n/a	n/a	n/a	n/a	n/a	21.2	21.3	20.5	20.3	-
Dissolved Oxygen	g/m^3	Not less than 4	n/a	n/a	n/a	n/a	n/a	8	9.1	7	6.4	-
TPH	g/m^3	15	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	-
TSS	g/m^3	100 above background	480	108	29	23	10	161	161	179	122	-
Settleable Solids	g/m^3	n/a	1.0	<1.0	<1.0	<1.0	<1.0	1.2	1.6	1.2	<2	-
VSS	g/m^3	n/a	112	37	<10	-	-	84	88	n/a	30	-
Total Nitrogen	g/m^3	0.4	2.1	1.11	1.63	1.40	0.31	2.6	2.5	2.6	2.4	-
Soluble Inorganic Nitrogen	g/m^3	0.4	0.072	0.033	0.68	0.72	0.150	0.142	0.127	<0.011	0.55	-
$cBOD_5$	g/m^3	20 above background	-	-	2	<2	-	n/a	n/a	41	7	-
Dehydroabietic Acid	g/m^3	0.025	2.3668	1.7513	<0.0001	<0.0001	<0.0001	1.7422	1.5696	0.2874	0.0015	-
Total Phenols	g/m^3	0.72	0.07	0.15	<0.02	<0.02	<0.02	0.03	0.03	<0.02	<0.02	-
Total Tannins	g/m^3	n/a	72	39	0.65	<0.10	<5	173	169	16.6	1.3	-
Dissolved Cu	g/m^3	0.0025 average of 4 quarterly samples	0.0016	0.00014	0.0027	0.0024	<0.01	0.0070	0.0061	0.0036	0.0047	-
Dissolved Zn	g/m^3	0.031 average of 4 quarterly samples	0.0134	0.024	0.075	0.076	<0.02	0.074	0.079	0.0195	0.024	-
Hardness	g/m^3	n/a	-	-	120	118	-	n/a	n/a	84	82	-
Absorbance at 440nm	AU cm^{-1}	n/a	-	-	0.027	0.025	0.007	n/a	n/a	0.057	0.033	-

Parameter	Units	EMP trigger limits	Quarter 1 (January, February, March)					Quarter 2 (April, May, June)				
			10 March 2017					1 May 2017				
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 1	Site 2	Site 3	Site 4	Site 5
pH	-log(H^+)	6.5 – 8.5	7.78	7.65	7.05	7.17	7.73	6.9	6.9	7.4	7.6	7.5
Temperature	^oC	Not more than 3^oC above background	16.4	15.9	16.2	16.3	16.6	13.2	13.1	13.7	13.7	14.1
Dissolved Oxygen	g/m^3	Not less than 4	8	4.8	10	10	8.9	3.3	2	9.5	9.5	13.5
TPH	g/m^3	15	4.8	1.0	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
TSS	g/m^3	100 above background	21,000	2,000	117	30	75	870	1,130	155	146	141
Settleable Solids	g/m^3	n/a	102	7.0	<1.3	<1.7	<1.3	<1.0	1.0	<1.0	<1.0	<1.0
VSS	g/m^3	n/a	7,300	550	n/a	5	n/a	175	240	20	n/a	n/a
Total Nitrogen	g/m^3	0.4	19.2	4.0	0.61	0.58	0.22	4.5	4.5	2.9	2.7	2.7
Soluble Inorganic Nitrogen	g/m^3	0.4	0.190	0.031	0.012	0.24	0.023	0.012	0.040	0.95	1.10	0.89
$cBOD_5$	g/m^3	20 above background	n/a	n/a	9	<2	n/a	n/a	n/a	7	3	n/a
Dehydroabietic Acid	g/m^3	0.025	4.1249	3.6165	0.0144	<0.0001	<0.0001	2.25	2.8426	0.0625	<0.0001	<0.0001
Total Phenols	g/m^3	0.72	<0.2	<0.2	<0.02	<0.02	<0.02	0.23	0.28	<0.02	<0.02	<0.02
Total Tannins	g/m^3	n/a	390	93	3.4	0.47	1.8	99	84	2.9[4]	1.2[2]	2.6[2]
Dissolved Cu	g/m^3	0.0025 average of 4 quarterly samples	0.0036	0.0040	0.0017	0.0019	<0.005	0.0018	0.0016	0.0035	0.0036	<0.003
Dissolved Zn	g/m^3	0.031 average of 4 quarterly samples	0.007	0.0086	0.0132	0.033	0.030	0.0128	0.0084	0.031	0.032	0.045
Hardness	g/m^3	n/a	n/a	n/a	75	61	n/a	n/a	n/a	96	93	n/a
Absorbance at 440nm	AU cm^{-1}	n/a	n/a	n/a	0.028	0.009	0.007	n/a	n/a	0.071	0.072	0.037

Parameter	Units	EMP trigger limits	Quarter 3 (July, August, September)					Quarter 4 (October, November, December)				
			28 September 2017					20 November 2017				
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 1	Site 2	Site 3	Site 4	Site 5
pH	-log(H^+)	6.5 – 8.5	7.4	6.1	7.6	7.8	7.7	6.7	5.7	7.3	7.5	7.4
Temperature	^oC	Not more than 3^oC above background	14.1	13.7	13.8	13.9	13.7	14.8	14.6	14.9	14.9	16
Dissolved Oxygen	g/m^3	Not less than 4	2.7	1.4	9.6	6.9	9.4	2	0.8	9.2	9.1	9.1
TPH	g/m^3	15	0.9	1.3	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
TSS	g/m^3	100 above background	300	100	28	21	50	59	81	24	7	23
Settleable Solids	g/m^3	n/a	<1	<1.2	<1.5	<1.5	<3	<1.0	10	<1.0	<1.3	<1.3
VSS	g/m^3	n/a	96	63	15	n/a	n/a	24	50	11	n/a	n/a
Total Nitrogen	g/m^3	0.4	3.1	1.11	0.78	1.39	0.71	1.85	0.88	0.60	0.80	0.53
Soluble Inorganic Nitrogen	g/m^3	0.4	0.014	0.028	<0.011	0.71	0.092	<0.03	<0.03	0.019	0.29	<0.011
$cBOD_5$	g/m^3	20 above background	n/a	n/a	18	<2	n/a	n/a	n/a	14	<2	n/a
Dehydroabietic Acid	g/m^3	0.025	6.8514	3.2074	0.0047	<0.0001	0.0008	3.4951	2.6575	0.196	<0.0001	0.0804
Total Phenols	g/m^3	0.72	<0.2	0.09	<0.02	<0.02	<0.02	0.05	0.06	<0.02	<0.02	<0.02
Total Tannins	g/m^3	n/a	125	66	2.8	0.7	2.4	58	37	3.7	0.4	1.8
Dissolved Cu	g/m^3	0.0025 average of 4 quarterly samples	0.0016	0.0029	0.0025	0.0026	<0.003	0.0013	0.0008	0.0019	0.0026	<0.005
Dissolved Zn	g/m^3	0.031 average of 4 quarterly samples	0.058	0.031	0.033	0.049	0.040	0.037	0.038	0.037	0.064	0.04
Hardness	g/m^3	n/a	n/a	n/a	118	118	n/a	n/a	n/a	80	80	n/a
Absorbance at 440nm	AU cm^{-1}	n/a	n/a	n/a	0.016	0.021	0.019	n/a	n/a	0.006	0.008	0.006

[4] Severe matrix interferences required that a dilution be performed prior to analysis of samples 1767544/3,4&5, resulting in a detection limit higher than that normally achieved for the Tannin analysis.

Parameter	Units	EMP trigger limits	Quarter 1 (January, February, March)					Quarter 2 (April, May, June)				
			9 February 2018					12 June 2018				
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 1	Site 2	Site 3	Site 4	Site 5
pH	-log(H^+)	6.5 – 8.5	6.9	6.0	6.9	7.3	7.0	6.4	4.9	7.4	7.4	7.9
Temperature	^oC	Not more than 3^oC above background	18.1	18.4	18.3	18.4	18.7	13.9	13.6	13.7	13.7	13.9
Dissolved Oxygen	g/m^3	Not less than 4	6.2	4.5	8.5	8.2	8.4	6.10	5.49	9.65	9.66	9.66
TPH	g/m^3	15	<0.7	1.3	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
TSS	g/m^3	100 above background	300	43	44	12	51	240	850	49	43	45
Settleable Solids	g/m^3	n/a	<1.0	<1.0	<1.0	<1.0	<1.0	< 1.0	36	< 1.0	< 1.0	< 1.0
VSS	g/m^3	n/a	107	24	<30	n/a	n/a	53	330	10	-	-
Total Nitrogen	g/m^3	0.4	2.1	0.47	0.46	0.43	0.37	2.1	0.5	3.1	3.1	3.1
Soluble Inorganic Nitrogen	g/m^3	0.4	<0.011	0.018	<0.011	0.190	<0.011	0.017	< 0.011	1.6	1.6	1.55
$cBOD_5$	g/m^3	20 above background	n/a	n/a	17	<2	n/a	-	-	< 2	< 2	-
Dehydroabietic Acid	g/m^3	0.025	2.2349	1.7156	0.3504	<0.0001	0.0504	2,216.1	3,179.2	n.d.	n.d.	n.d.
Total Phenols	g/m^3	0.72	0.05	0.14	<0.02	<0.02	<0.02	0.05	0.07	< 0.02	0.5	< 0.02
Total Tannins	g/m^3	n/a	104	43	4.1	0.4	3.9	2.6 [#5]	2.7 [#1]	1.5 [#1]	1.4 [#1]	1.2 [#1]
Dissolved Cu	g/m^3	0.0025 average of 4 quarterly samples	0.0015	0.0007	0.0011	0.0012	<0.003	0.0015	0.0009	0.0037	0.0036	< 0.003
Dissolved Zn	g/m^3	0.031 average of 4 quarterly samples	0.045	0.028	0.020	0.020	0.035	0.037	0.027	0.042	0.042	0.042
Hardness	g/m^3	n/a	n/a	n/a	41	33	n/a	-	-	98	98	-
Absorbance at 440nm	AU cm^{-1}	n/a	n/a	n/a	0.016	0.010	0.009	-	-	0.063	0.05	0.031

[#5] Severe matrix interferences required that a dilution be performed prior to analysis resulting in a detection limit higher than that normally achieved for the Tannin analysis.

Parameter	Units	EMP trigger limits	Quarter 3 (July, August, September)					Quarter 4 (October, November, December)				
			30 August 2018					19 November 2018				
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 1	Site 2	Site 3	Site 4	Site 5
pH	-log(H+)	6.5 – 8.5	7.1	6.6	7.4	7.5	7.5	7.6	5.7	7.3	7.5	7.7
Temperature	°C	Not more than 3°C above background	12.5	12.4	12.8	12.9	12.9	18.1	18.6	18.2	18.1	16.1
Dissolved Oxygen	g/m³	Not less than 4	9.25	7.41	10.36	10.29	10.28	3.12	1.30	7.22	7.20	8.77
Hardness	g/m³	n/a	-	-	37	35	-	-	-	133	121	-
VSS	g/m³	n/a	142	13	48	-	-	300	< 40 #6	< 30 #2	-	-
TSS	g/m³	100 above background	620	24	240	230	260	960	46	37	16	47
Settleable Solids	g/m³	n/a	3.2	< 3 #7	< 3 #2	< 3 #2	< 1.3 #2	1.7	< 1.0	1.2	< 1.0	< 1.0
Dissolved Aluminum	g/m³	n/a	0.464	0.572	0.0574	0.0469	0.0351	0.39	0.55	0.037	0.019	< 0.03
Total Aluminum	g/m³	n/a	12.9	3.3	3.5	3.6	4.1	25	3.7	0.48	0.29	0.98
Dissolved Copper	g/m³	0.0025 average of 4 quarterly samples	0.0021	0.0037	0.0015	0.0018	0.0015	0.0031	< 0.0005	0.0036	0.0051	0.005
Dissolved Zinc	g/m³	0.031 average of 4 quarterly samples	0.0079	0.0129	0.0185	0.0165	0.0178	0.038	0.0023	0.03	0.04	0.042
Soluble Inorganic Nitrogen	g/m³	0.4	0.039	0.012	0.175	0.26	0.161	0.069	0.011	0.044	0.51	0.36
Total Nitrogen	g/m³	0.4	1.75	0.58	2.1	1.72	1.9	4	1.04	1.34	1.65	1.33
cBOD5	g/m³	20 above background	-	-	4	4	-	-	-	16	6	-
Total Phenols	g/m³	0.72	0.11	0.16	< 0.02	< 0.02	< 0.02	0.08	1.4	0.08	< 0.02	< 0.02
Total Tannins	g/m³	n/a	56 #8	29 #1	1.4 #1	< 1.0 #1	1.8 #1	92	22	2.7	1.2 #1	1.0 #1
Absorbance at 440 nm	AU cm^{-1}	n/a	-	-	0.019	0.015	0.014	-	-	0.018	0.023	0.01
TPH	g/m³	15	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	1.5	1.6	<0.7	<0.7	<0.7
Dehydroabietic Acid	g/m³	0.025	1623.7	1222.3	n.d.	n.d.	-	9.0110	1.6875	0.0571	n.d.	n.d.

#6 Due to the nature of samples 2083641/2&3, it was not possible to filter the usual volume for the Volatile Suspended Solids analysis. As the volume filtered was less than usual, the detection limit achieved is greater than normal.
#7 There was insufficient sample left for the Settleable Solids test on samples 2041348/2-5, so the detection limit is higher than normal.
#8 Severe matrix interferences required that a dilution be performed prior to analysis resulting in a detection limit higher than that normally achieved for the Tannin analysis.

Parameter	Units	EMP trigger limits	Quarter 1 (January, February, March)					Quarter 2 (April, May, June)				
			16 January 2019					29 March 2019				
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 1	Site 2	Site 3	Site 4	Site 5
pH	-log(H+)	6.5 – 8.5	6.2	5	7.2	7.6	7.7	6.7	5.3	7.3	7.4	7.2
Temperature	°C	Not more than 3°C above background	20.3	20.9	20.1	20.2	20.6	18.4	18.0	18.3	18.2	18.6
Dissolved Oxygen	g/m³	Not less than 4	6.86	4.70	9.30	9.42	9.51	1.46	0.97	3.26	6.90	7.32
Hardness	g/m³	n/a	-	-	45	39	-	-	-	120	114	-
VSS	g/m³	n/a	66	15	21	-	-	280	144	< 3	-	-
TSS	g/m³	100 above background	161	21	109	108	122	780	320	5	4	69
Settleable Solids	g/m³	n/a	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.6	1.6	< 1.0	< 1.0	< 1.0
Dissolved Aluminum	g/m³	n/a	0.57	6.7	0.123	0.041	0.037	0.69	2.5	0.047	0.012	0.31
Total Aluminum	g/m³	n/a	2.8	7.7	1.74	1.98	1.96	18.1	17.1	0.26	0.115	3.7
Dissolved Copper	g/m³	0.0025 average of 4 quarterly samples	0.0014	0.0017	0.0021	0.0017	< 0.003	0.0028	0.0018	0.0016	0.0016	< 0.003
Dissolved Zinc	g/m³	0.031 average of 4 quarterly samples	0.041	0.042	0.0138	0.0116	0.022	0.029	0.042	0.0195	0.023	0.013
Soluble Inorganic Nitrogen	g/m³	0.4	0.025	< 0.011	0.27	0.49	0.21	< 0.11	0.057	0.53	0.63	< 0.11
Total Nitrogen	g/m³	0.4	3.6	0.76	1.28	1.62	0.98	3.6	2	0.76	0.92	0.64
cBOD5	g/m³	20 above background	-	-	7	< 2	-	-	-	2	< 2	-
Total Phenols	g/m³	0.72	0.02	0.07	< 0.02	< 0.02	< 0.02	0.29	0.25	< 0.02	< 0.02	0.04
Total Tannins	g/m³	n/a	40[#1]	291[#1]	1.11[#1]	0.91[#1]	1.5	230	106	0.8	0.5 [#1]	14.6
Absorbance at 440 nm	AU cm^{-1}	n/a	-	-	0.021	0.027	0.011	-	-	0.011	0.01	0.012
TPH	g/m³	15	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	1.3	1.4	< 0.7	< 0.7	< 0.7
Dehydroabietic Acid	g/m³	0.025	1,031.6	480.8	n.d.	n.d.	n.d.	16.6461	9.7292	0.0069	nd	0.6566

Parameter	Units	EMP trigger limits	Quarter 3 (July, August, September)					Quarter 4 (October, November, December)				
			05 July 2019					12 November 2019				
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 1	Site 2	Site 3	Site 4	Site 5
pH	-log(H+)	6.5 – 8.5	6.8	4.7	7.5	7.6	7.9	7.1	4.9	6.8	7.1	7
Temperature	°C	Not more than 3°C above background	11.1	10.8	12.1	12.1	12.3	16.4	15.9	15.5	15.6	15.6
Dissolved Oxygen	g/m³	Not less than 4	2.26	0.78	10.40	10.30	10.28	0.82	0.89	8.79	8.72	8.84
Hardness	g/m³	n/a	-	-	183	189	-	-	-	107	112	-
VSS	g/m³	n/a	62	9	7	-	-	250	20	19	-	-
TSS	g/m³	100 above background	135	13	27	25	57	740	51	40	21	28
Settleable Solids	g/m³	n/a	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1	8	1	< 1.0	< 1.0
Dissolved Aluminum	g/m³	n/a	0.68	5	0.189	0.098	0.08	1.06	8.6	0.26	0.015	0.077
Total Aluminum	g/m³	n/a	3.6	5.6	1.04	0.81	1.05	14.9	13.2	2.1	0.42	1.43
Dissolved Copper	g/m³	0.0025 average of 4 quarterly samples	0.0016	< 0.0005	0.0036	0.0034	< 0.010	0.002	0.0013	0.0024	0.0028	0.0019
Dissolved Zinc	g/m³	0.031 average of 4 quarterly samples	0.025	0.032[#9]	0.039	0.045	0.03	0.055	0.052	0.028	0.064	0.033
Soluble Inorganic Nitrogen	g/m³	0.4	0.051	< 0.011	1.93	2.1	1.12	< 0.011	< 0.011	0.26	0.76	0.175
Total Nitrogen	g/m³	0.4	3.6	0.21	3.2	3.4	1.61	1.19	0.3	0.72	1.2	0.52
cBOD5	g/m³	20 above background	-	-	6	< 2	-	-	-	19	< 2	-
Total Phenols	g/m³	0.72	0.03	0.04	< 0.02	< 0.02	< 0.02	< 0.2 #1	< 0.2 #1	< 0.2 #1	< 0.02	< 0.02
Total Tannins	g/m³	n/a	49	20	1.6	1.3	1.7	141	32	3.5	0.44	3.4
Absorbance at 440 nm	AU cm^{-1}	n/a	-	-	0.033	0.034	0.016	-	-	0.011	0.016	0.008
TPH	g/m³	15	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Dehydroabietic Acid	g/m³	0.025	2.1581	0.6238	n.d.	n.d.	n.d.	2.2232	0.4279	n.d.	n.d.	n.d.

[#9] It has been noted that the result for the dissolved fraction was greater than that for the total fraction, but within analytical variation of the methods.

Parameter	Units	EMP trigger limits	Quarter 1 (January, February, March)					Quarter 2 (April, May, June)				
			14 January 2020					6 July 2020				
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 1	Site 2	Site 3	Site 4	Site 5
pH	-log(H+)	6.5 – 8.5	6.2	4.7	6.7	6.9	7.7	6.5	6.6	7.3	7.5	7.2
Temperature	°C	Not more than 3°C above background	19	18.5	18.2	18	18.3	11.2	11.1	12.3	12.4	12.4
Dissolved Oxygen	g/m³	Not less than 4	7.7	7.64	8.3	8.37	8.26	8.89	8.04	9.88	9.95	9.66
Hardness	g/m³	n/a	-	-	44	41	-	-	-	86	87	-
VSS	g/m³	n/a	12	71	103	-	-	690	5	10	-	-
TSS	g/m³	100 above background	27	142	188	11	22	2,400	8	37	37	39
Settleable Solids	g/m³	n/a	3	< 1.0	< 1.0	< 1.0	< 1.0	50	<1.0	<1.0	<1.0	<1.0
Dissolved Aluminum	g/m³	n/a	1.36	10.4	0.112	0.025	0.14	0.70	0.37	0.038	0.043	0.026
Total Aluminum	g/m³	n/a	8.7	26	1.7	0.22	0.92	175	0.75	0.87	0.96	0.85
Dissolved Copper	g/m³	0.0025 average of 4 quarterly samples	0.0023	0.0022	0.0017	0.0022	< 0.010	0.001	0.0009	0.0023	0.0024	<0.003
Dissolved Zinc	g/m³	0.031 average of 4 quarterly samples	0.067	0.078	0.02	0.037	0.02	0.0033	0.023	0.045	0.047	0.048
Soluble Inorganic Nitrogen	g/m³	0.4	< 0.011	< 0.011	< 0.011	0.187	0.06	0.017	<0.011	0.63	0.63	0.49
Total Nitrogen	g/m³	0.4	1	0.76	0.29	0.46	0.24	13.7	0.17	1.12	1.14	0.94
cBOD5	g/m³	20 above background	-	-	13	3	-	-	-	2	<2	-
Total Phenols	g/m³	0.72	0.03	0.03	< 0.02	< 0.02	< 0.02	<0.2	0.07	<0.02	<0.02	<0.02
Total Tannins	g/m³	n/a	36	30	2.9	0.7	1.1[10]	210	17.1	0.27	0.37	0.9
Absorbance at 440 nm	AU cm^{-1}	n/a	-	-	0.011	0.015	0.004	-	-	0.021	0.020	0.017
TPH	g/m³	15	< 0.9	< 0.7	< 0.7	< 0.7	< 0.7	0.7	<0.7	<0.7	<0.7	<0.7
Dehydroabietic Acid	g/m³	0.025	1.7042	0.7714	n.d	n.d	n.d	20.9086	2.4814	n.d	n.d	n.d

[10] Severe matrix interferences required that a dilution be performed prior to analysis, resulting in a detection limit higher than that normally achieved for the Tannin analysis.

Parameter	Units	EMP trigger limits	Quarter 3 (July, August, September)					Quarter 4 (October, November, December)				
			15 October 2020					25 November 2020				
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 1	Site 2	Site 3	Site 4	Site 5
pH	-log(H+)	6.5 – 8.5	7	5.5	6.9	7	7.9	6.9	5.7	7.4	6.6	8.0
Temperature	°C	Not more than 3°C above background	12.8	12.1	13	13.1	14.5	15.2	15.5	15.9	15.9	15.9
Dissolved Oxygen	g/m³	Not less than 4	9.72	8.19	10.04	10.09	10.18	8.14	7.06	9.04	9.06	8.83
Hardness	g/m³	n/a	-	-	53	49	-	-	-	58	56	-
VSS	g/m³	n/a	155	8	9	-	-	145	13	15	-	-
TSS	g/m³	100 above background	530	23	27	25	8	460	24	32	13	9
Settleable Solids	g/m³	n/a	1.6	<1.5	<1.3	<1.3	<1.7	<1	<1.2	<1.4	<1.3	<1.2
Dissolved Aluminum	g/m³	n/a	0.74	2.7	0.086	0.018	<0.3	1.26	2.6	0.059	0.025	<0.3
Total Aluminum	g/m³	n/a	11.1	4.2	0.75	0.45	<0.32	10.4	4.4	1.16	0.31	<0.32
Dissolved Copper	g/m³	0.0025 average of 4 quarterly samples	0.0024	0.0025	0.0023	0.0025	<0.05	0.0035	0.0012	0.0024	0.0032	<0.05
Dissolved Zinc	g/m³	0.031 average of 4 quarterly samples	0.031	0.048	0.042	0.045	<0.1	0.069	0.032	0.026	0.046	<0.1
Soluble Inorganic Nitrogen	g/m³	0.4	0.016	<0.03	<0.011	0.28	0.03	<0.11	<0.01	<0.01	0.26	<0.11
Total Nitrogen	g/m³	0.4	1.78	0.44	0.39	0.65	0.23	2.6	0.58	0.34	0.66	<0.11
cBOD5	g/m³	20 above background	-	-	32	2	-	-	-	17	3	-
Total Phenols	g/m³	0.72	<0.2	0.09	<0.02	<0.02	<0.02	0.07	0.14	<0.02	<0.02	<0.02
Total Tannins	g/m³	n/a	88	30	2.5	0.7	<5	127	34	2.5	0.6	<5
Absorbance at 440 nm	AU cm^{-1}	n/a	-	-	0.012	0.014	<0.002	-	-	0.007	0.012	<0.002
TPH	g/m³	15	0.8	1	<0.7	<0.7	<0.7	1.6	1.1	<0.7	<0.7	<0.7
Dehydroabietic Acid	g/m³	0.025	7.1323	1.4845	0.0747	n.d	n.d	3.977	1.2586	0.0034	<0.0001	Not sampled[11]

[11] The Site 5 sample bottle broke in transit and so DHAA was unable to be analysed for Site 5.

Parameter	Units	EMP trigger limits	Quarter 2 (April, May, June)					Quarter 3 (July, August, September)				
			13 May 2021					17 September				
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 1	Site 2	Site 3	Site 4	Site 5
pH	-log(H+)	6.5 – 8.5	6.9	5.6	7.2	6.8	7.9	6.7	6.6	7.4	7.8	7.4
Temperature	°C	Not more than 3°C above background	12.8	12.1	12.9	12.8	16.3	11.9	11.3	11.7	11.8	12.5
Dissolved Oxygen	g/m³	Not less than 4	0.36	0.47	10.14	10.15	8.33	8.91	8.81	10.1	10.09	9.85
Hardness	g/m³	n/a	-	-	49	49	-	-	-	104	4200	-
VSS	g/m³	n/a	171	72	7	-	-	210	84	<15	-	-
TSS	g/m³	100 above background	400	115	29	33	71	630	156	65	57	61
Settleable Solids	g/m³	n/a	1	8	<1	<1.7	<1.5	10	<1.0	<1.0	<1.0	<1.0
Dissolved Aluminum	g/m³	n/a	1.06	9.9	0.023	0.021	0.09	0.39	0.4	0.087	<0.3	0.075
Total Aluminum	g/m³	n/a	12.9	15.1	0.72	0.62	2.7	8.3	3.8	1.5	0.71	1.73
Dissolved Copper	g/m³	0.0025 average of 4 quarterly samples	0.0015	0.0029	0.002	0.0019	<0.005	0.0013	0.0013	0.0037	0.0014	0.0038
Dissolved Zinc	g/m³	0.031 average of 4 quarterly samples	0.058	0.070	0.054	0.055	0.041	0.0107	0.0132	0.057	0.011	0.059
Soluble Inorganic Nitrogen	g/m³	0.4	0.11	<0.11	0.4	0.38	0.115	<0.011	<0.011	1.37	0.22	1.34
Total Nitrogen	g/m³	0.4	3.3	0.45	0.66	0.62	0.39	1.3	0.72	2.7	0.32	2.6
cBOD5	g/m³	20 above background	-	-	<2	3	-	-	-	2	<2	-
Total Phenols	g/m³	0.72	<0.2	0.09	<0.02	<0.02	<0.02	0.02	0.03	<0.02	<0.02	<0.02
Total Tannins	g/m³	n/a	109	89	0.54	0.5	<5	49	31	1.5	1.4	2
Absorbance at 440 nm	AU cm^{-1}	n/a	-	-	0.015	0.016	0.009	-	-	0.059	0.004	0.057
TPH	g/m³	15	3.7	1	<0.7	<0.7	<0.7	2.1	1	<0.7	<0.7	<0.7
Dehydroabietic Acid	g/m³	0.025	5.02	1.24	<0.0001	<0.0001	0.0035	2191.2	1807.2	n.d.	n.d.	n.d.