

Waterview Tunnel Joint Operation
1405 Great North Road
Waterview
Auckland 1026
New Zealand

11 September 2018

Attention: Andy Schmidt

Dear Andy

Stormwater Monitoring - Annual Report 2018

Beca Ltd (Beca) was commissioned by the Waterview Tunnel Joint Operation (WTJO) to report on laboratory results from the stormwater monitoring required by the Operational Stormwater Management Plan (OSMP) approved by Auckland Council. At the end of the first year operation, WTJO are required to provide a water quality report to Auckland Council as per the OSMP (Section 2.2.2.2) and consent condition SW.16.

The OSMP requires water quality testing for two events:

1. Two samples a year after a tunnel deluge event; and
2. Four samples per year within 12 hours of a trigger rainfall event of >27mm over 24 hours.

Samples for the **cleaning and deluge** event are to be collected from the low point sump (LPS) to test the quality of the water runoff coming directly from the tunnel. Samples from the inlet and outlet of the Waterview wetland are also to be collected. It should be noted that samples from the wetland during the cleaning and deluge event will only be indicative due to the significant hydraulic retention time and dependence on existing water levels in the wetlands.

Samples for the **rainfall triggered** event should be taken from the stormwater treatment wetlands receiving tunnel water (Waterview and Alan Wood). Valonia Wetland may also be tested where deemed necessary. One surface water sample should be taken at the inlet and discharge point of the wetlands (Attachment A).

All deluge and stormwater samples collected are analysed for:

- Total Suspended Solids (TSS);
- Total and dissolved zinc and copper;
- BTEX (this suite in addition to those required in the OSMP); and
- Total Petroleum Hydrocarbons (TPH).

Analysis of the samples was undertaken by R.J. Hill Laboratories Ltd (Hill Laboratories).

Sample Location Descriptions

The stormwater treatment wetlands Waterview and Alan Wood both receive discharge from the Waterview tunnel water as well as ramp water (Waterview) and SH20 runoff (Alan Wood). The Valonia wetland receives discharge from a 10.3ha catchment which is primarily motorway carriageway.

Sample locations are presented in **Figures 1 – 3** (Attachment A). Specific details on each sampling event are located in Attachment B and C.

Method

Samples collected during a **cleaning and deluge** event were taken from the sumps and the Waterview wetland inlet and outlet. Further details on the sampling events including details on volume of water and sampling times are in Attachment B.

Grab samples were collected following a **storm event** (classed as >27mm over 24 hours). Samples were chilled and dispatched to Hill Laboratories. Rainfall data and field observations are recorded within Attachment C.

Results

Analytical results for the **deluge triggered** sampling are summarised in **Table 1**. The original Hill Laboratories report are attached (Attachment D).

Analytical results for the **rain triggered** events are summarised in **Table 2**. The original Hill Laboratories' reports are attached (Attachment E).

Treatment standards outlined in the Operational Stormwater Management Plan (OSMP)¹ for Valonia and Alan Wood wetlands require 75% TSS removal and 80% for Waterview wetland as a long term average. Once a large-scale dataset has been developed, results can be analysed to determine whether the overarching, long-term performance standard meets the above TSS removal.

Given that only four sampled rainfall events have occurred, the removal rates can only be considered to be indicative. Furthermore, the TSS concentrations for all three wetlands are relatively low, all being < 33 g/m³ and many being below the laboratory detection limits (Attachment E). Therefore, the removal percentage rates at this stage are **not** considered an appropriate measure of compliance.

There is no compliance requirement for concentrations of zinc and copper.

Total petroleum hydrocarbons were all below laboratory detection limits.

In summary, based on the results provided to date, it is considered that the wetlands are performing adequately and providing sufficient treatment when required.

¹ Operational Stormwater Management Plan (OSMP), *Waterview Connection Project*, January 2015, Document Ref: 400-RPT-04253

Table 1: Summary of results for cleaning and deluge sample event

	13 th March 2018 (NBT)			14 th March 2018 (SBT)		
	Low Point Sump	Waterview Inlet	Waterview Outlet	Low Point Sump	Waterview Inlet	Waterview Outlet
TSS	114	18	BDL	67	20	4
TPH	BDL	BDL	BDL	BDL	BDL	BDL
Total Copper	0.095	0.0105	0.0033	0.061	0.01187	0.0027
Dissolved Copper	0.023	0.0046	0.0024	0.021	0.0056	0.0023
Total Zinc	2.1	0.22	0.0169	1.44	0.26	0.0123
Dissolved Zinc	0.57	0.026	0.0061	0.71	0.055	0.0057

Units are g/m³ unless otherwise stated. BDL – Below Detection Limits.

Table 2: Mean concentrations for rainfall triggered sample events at wetlands (n=4)

	Waterview		Alan Wood		Valonia	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
TSS	6.1	12.5	2.9	3.8	5.9	5.5
TPH	BDL	BDL	BDL	BDL	BDL	BDL
Total Copper	0.0045	0.0036	0.0030	0.0024	0.0056	0.0021
Dissolved Copper	0.0034	0.0026	0.0020	0.0016	0.0043	0.0016
Total Zinc	0.029	0.024	0.039	0.017	0.024	0.0084
Dissolved Zinc	0.015	0.013	0.012	0.010	0.016	0.0052

Units are g/m³ unless otherwise stated. BDL – Below Detection Limits.

Should you have any questions please do not hesitate to contact the undersigned.

Yours sincerely,

Malea Zygadlo
Environmental Scientist



on behalf of
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Attachment A: Sample Locations



Figure 1 – Waterview Reserve Wetland Grab Sample Locations (2 x Manholes)



Figure 2 – Alan Wood Wetland Grab Sample Points (Wetland Inlet and outlet)



Figure 3 – Valonia Wetland Grab Sample Points (Wetland Inlet and Outlet)

Attachment B: Deluge event notes

Deluge / Tunnel Wash Quality Monitoring Programme

Deluge / Tunnel Wash Water Quality Testing

Event Date: 13th & 14th March 2018

Sample: Number 1 & 2 of 2 for period 1/07/17 to 30/06/18

Notes:

400-RPT-04253 Operational Stormwater Management Plan (OSMP) is guidance document.

Appendix I Stormwater Monitoring Program outlines the guidance for taking of the samples

Tunnel deluge testing for each tunnel was scheduled over two consecutive nights. Full tunnel wall washing was planned to occur at the same time and this gave the opportunity to sample the required two tunnel deluge events as required under consent condition SW. 16.

Samples were package up and sent to Hill Laboratory in Hamilton by Deadline Couriers the morning after the samples were taken.

On the night of the 13th March the North Bound Tunnel (NBT) closure was in place by 10PM, Tunnel washing was commenced from the entrance of the NBT on the outside wall (opposite the Cross Passages). The washing rig travelled at 1.2km per hour to the northern exit and then turned around and washed along the inside wall (Cross Passage side) back to the NBT entrance.

The high pressure wash uses 120 litres of water per minute. This gives approximately over the 5000 m of tunnel wall washed around 30,000 litres of water per night.

The Tunnel Deluge test commenced shortly after the Tunnel washing started and started at the NBT entrance to the exit. The deluge proceeded zone by zone and took only a couple hours.

The Low Point Sump (LPS) and North Sump were emptied prior to the closure so to just have the contaminated water from the Tunnel Washing and Deluge test available for sampling. Especially at the LPS.

With the help of the Tunnel Operator the level of the LPS was monitored so that a timely sample could be taken. This was achieved about 2 hours after washing and deluging started.

Sample was taken from the discharge pipe in the North Bound Culvert at XP14. The sample delivery line was flushed to ensure a presentative sample was taken.

After this was taken the the Northern Sump pump was started to send this sample to the Waterview Wetland area and inlet and outlet samples taken.

On the night of the 14th March the South Bound Tunnel (SBT) closure was in place by 10PM and the same process followed. Tunnel washing started at the entrance to the SBT on the outside wall and returned from from the exit back to the starting point on the Cross Passage side.

Both nights, the sample were clear to look at.

Timeline

NBT		
Date		
13/03		
Time	Level (M)	Comment
19:50	0.63	
19:54	0.08	LPS Pump turned on to empty sump before sample
23:00	0.11	LPS Started receiving water from Tunnel washing and deluge
0:25	1.78	LPS pump start at ~300 L/s for 4min57 sec = 89m3
0:30	0.5	Pump stops sumps refills
0:45	0.98	Pump restarts
0:48	0.1	LPS pump start at ~300 L/s for 2min54 sec = 52m3
4:05	0.45	LPS refills slowly till end of closure. Total volume of water used ~ 140m3

SBT

Date

14/03

Time	Level (M)	Comment
22:14	0.59	LPS not pre-drained. Residual from NBT tunnel wash and deluge. SBT tunnel wash and deluge commenced.
0:00	1.97	LPS pump start at ~300 L/s for 8min12 sec = 147m3
0:08	0.12	Pump stops, LPS refills slowly till end of closure
4:00	1.45	End of closure. Only 1 pump cycle. Total volume of water used ~ 147m3

Sump Volumes		
Sump	Area (m ²)	Volume Total (m ³)
LPS	123	237

Low Point Sump Pump - calibration flow rates			
Pump	Design L/s	Actual L/s	
PMP001	300	296.5	
PMP002	300	306.0	
2 pumps		408.0	
Set Point	Height (m)	Volume in Sump (m ³)	Comment
HHH	2.10	93.0	
HH	1.93	90.0	
H	1.78	83.0	83.0 m³ in Start Stop cycle Auto Start
L	0.60	0.0	Auto Stop
LL	0.30		
LLL	0.00		If manual start pumps to LLL

Sample Times

Sample	Date / Time	LPS	Waterview Inlet	Waterview Outlet
NBT – deluge / wash	13 th March	14/3 00:45	14/3 02:20	14/3 02:30
SBT – deluge / wash	14 th March	15/3 00:00	15/3 01:00	15/3 01:15



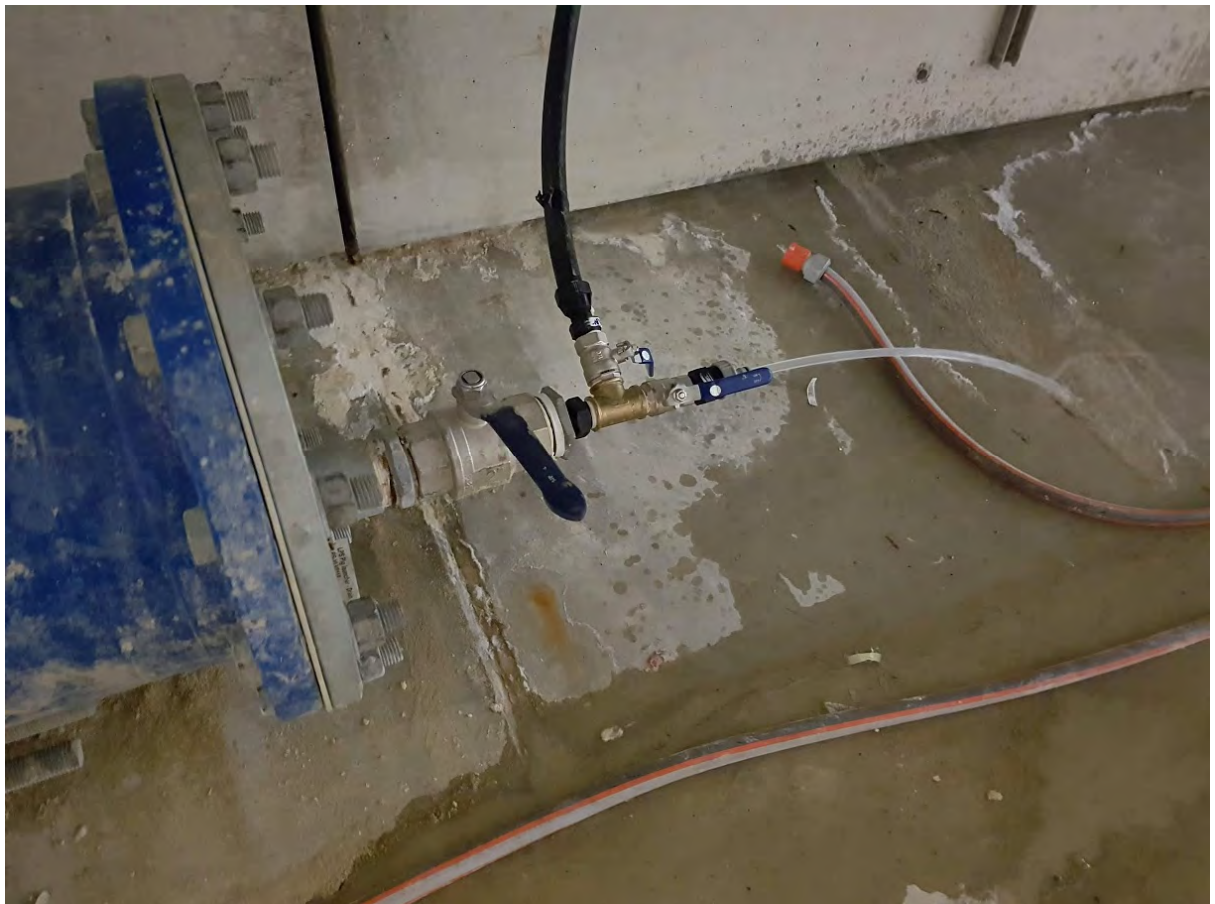
Typical Tunnel Washing Setup



Typical Deluge Setup



Typical Deluge run off into drain

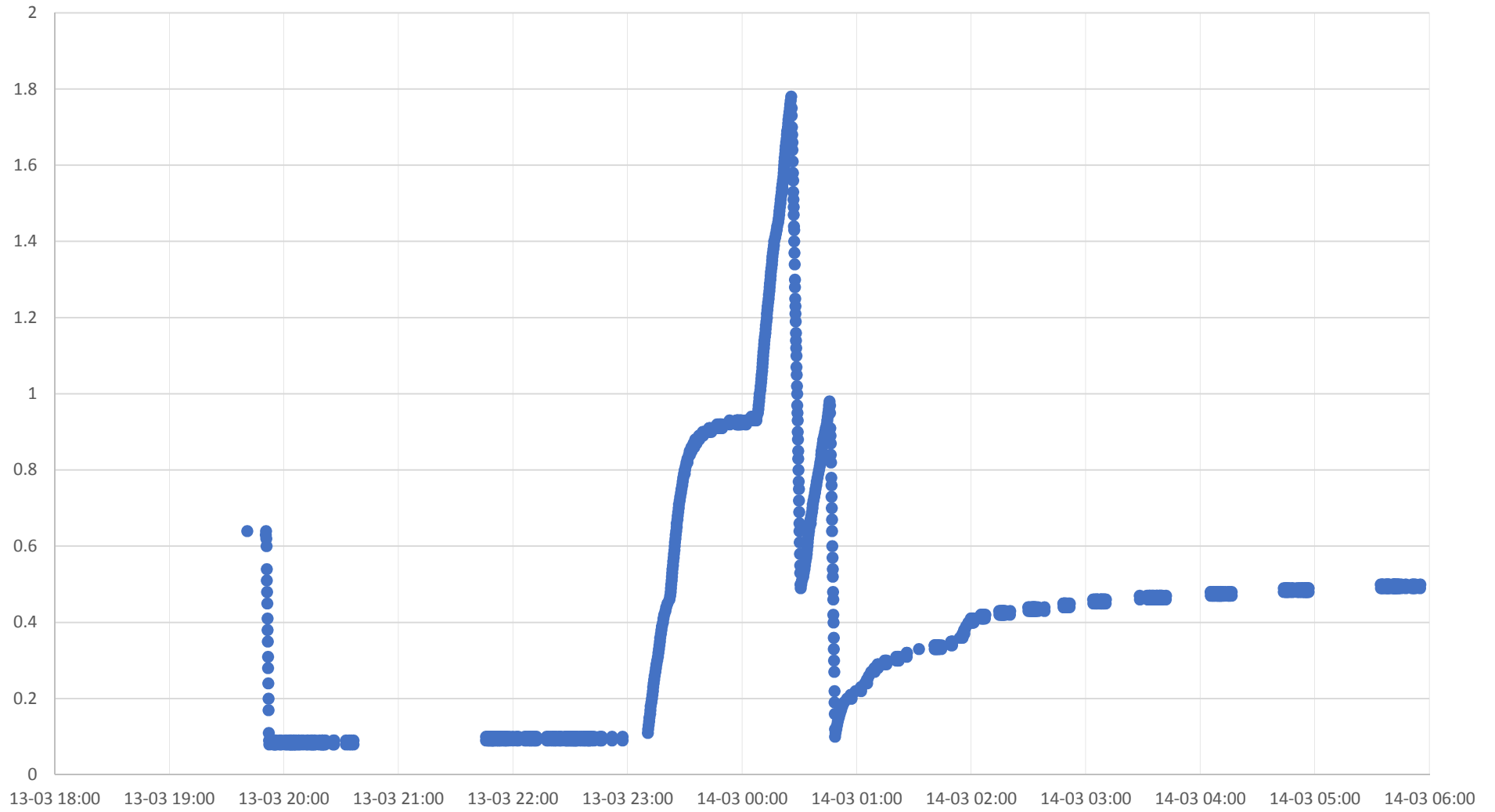


Sample point at North Bound Culvert XP14

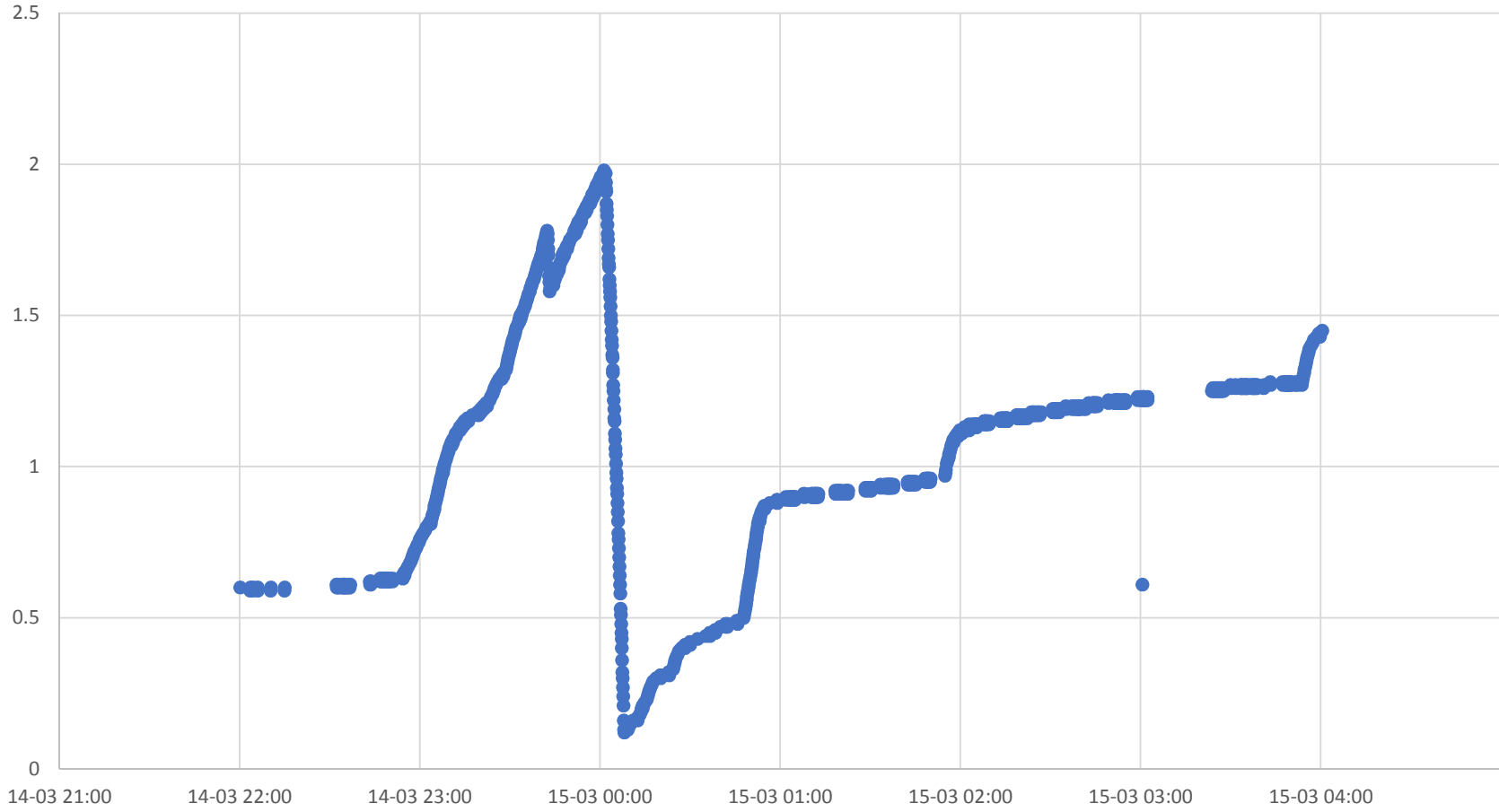


Pipe Work and Sample point at North Bound Culvert XP14

13/08/18 Low Point Sump Level NBT Sample



14/08/18 Low Point Sump Level SBT Sample



Attachment C: Rainfall event notes

Stormwater Quality Monitoring Programme

Stormwater Water Quality Testing

Event Date: 4th Jan 2018

Sample: Number 1 of 4 for period 1/07/17 to 30/06/18

Notes:

400-RPT-04253 Operational Stormwater Management Plan (OSMP) is guidance document.

Appendix D outlines the guidance for taking of the grab samples

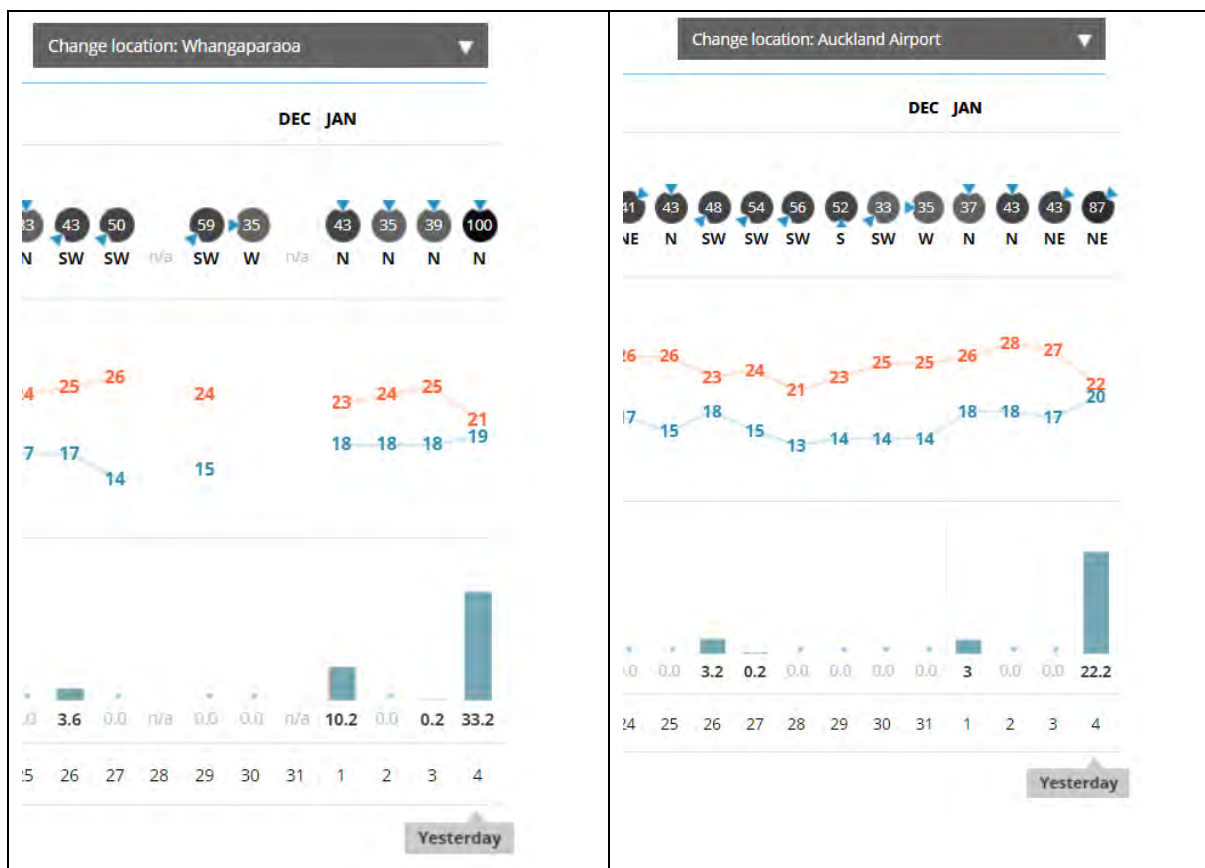
Rain fall on the 4th January can be seen to be >27mm in a 24-hour period in the Waterview Tunnel area. The Met Service information was reviewed along with the Auckland Council Geo Maps Rainfall Hydrology. Summary is;

Met Service Airport 22.2mm / Whangaparaoa 33.2mm.

Auckland Council Avondale Racecourse ~45mm / Mt Albert Grammar 46mm

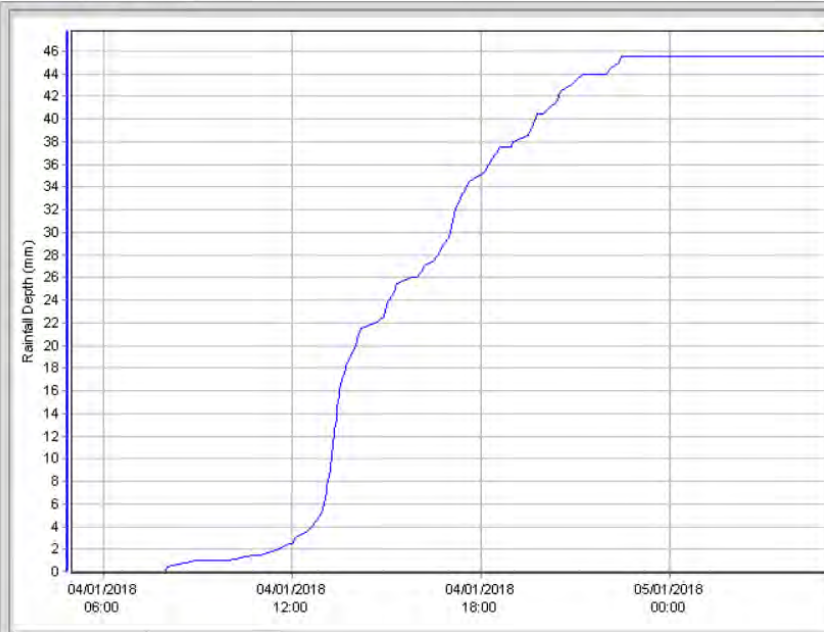
Sampling is detailed below. Samples taken ~ 10 hours after rainfall event.

Sampled set to Hill Laboratory in Hamilton by Deadline Couriers at 11:AM



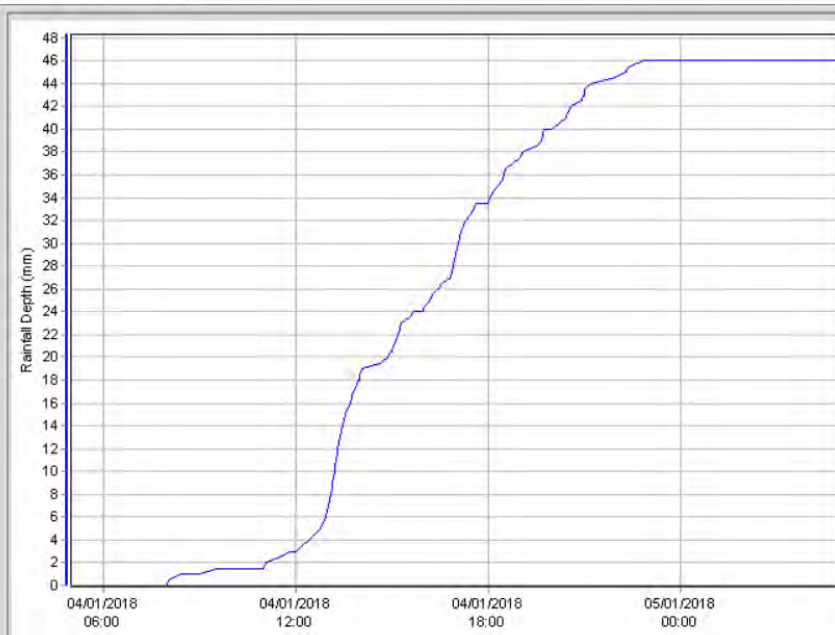
Avondale Racecourse Rain

Overview Rainfall Depth



Mt Albert Grammar Rain

Overview Rainfall Depth



Sampling Date 5/01/2018

Waterview Reserve Wetland Inlet

Time: 08:15AM

Weather: Northerly, windy with showers

Pond level slightly raised, low flow from inlet. No erosion or damage was seen.



Waterview Reserve Wetland Outlet

Time: 08:20AM

Weather: Northerly, windy with showers

Pond level slightly raised, low flow from outlet, not high enough to discharge over the culvert weir. No erosion or damage was seen.



Valonia Wetland Inlet

Time: 09:10AM

Weather: Northerly, windy with heavy showers

Pond level raised, medium flow from inlet. Solids like leaves seen in the flow. No erosion or damage was seen.



Valonia Wetland Outlet

Time: 09:15AM

Weather: Northerly, windy with showers

Pond level raised, medium flow from outlet, not high enough to discharge over the culvert weir. No erosion or damage was seen.



Alan Wood Wetland Inlet

Time: 09:20AM

Weather: Northerly, windy with showers

Pond level raised, medium flow from inlet. No erosion or damage was seen.



Alan Wood Wetland Outlet

Time: 08:15AM

Weather: Northerly, windy with showers

Pond level raised, medium flow from outlet, both valves, not high enough to discharge over the culvert weir. No erosion or damage was seen.



Stormwater Quality Monitoring Programme

Stormwater Water Quality Testing

Event Date: 14th April 2018

Sample: Number 2 of 4 for period 1/07/17 to 30/06/18

Notes:

400-RPT-04253 Operational Stormwater Management Plan (OSMP) is guidance document.

Appendix D outlines the guidance for taking of the grab samples

Rain fall on the 14th April can be seen to be >27mm in a 24-hour period in the Waterview Tunnel area (55mm at the Airport and 45mm at Avondale within the last 12 hours). The Met Service information was reviewed along with the Auckland Council Geo Maps Rainfall Hydrology. Summary is;

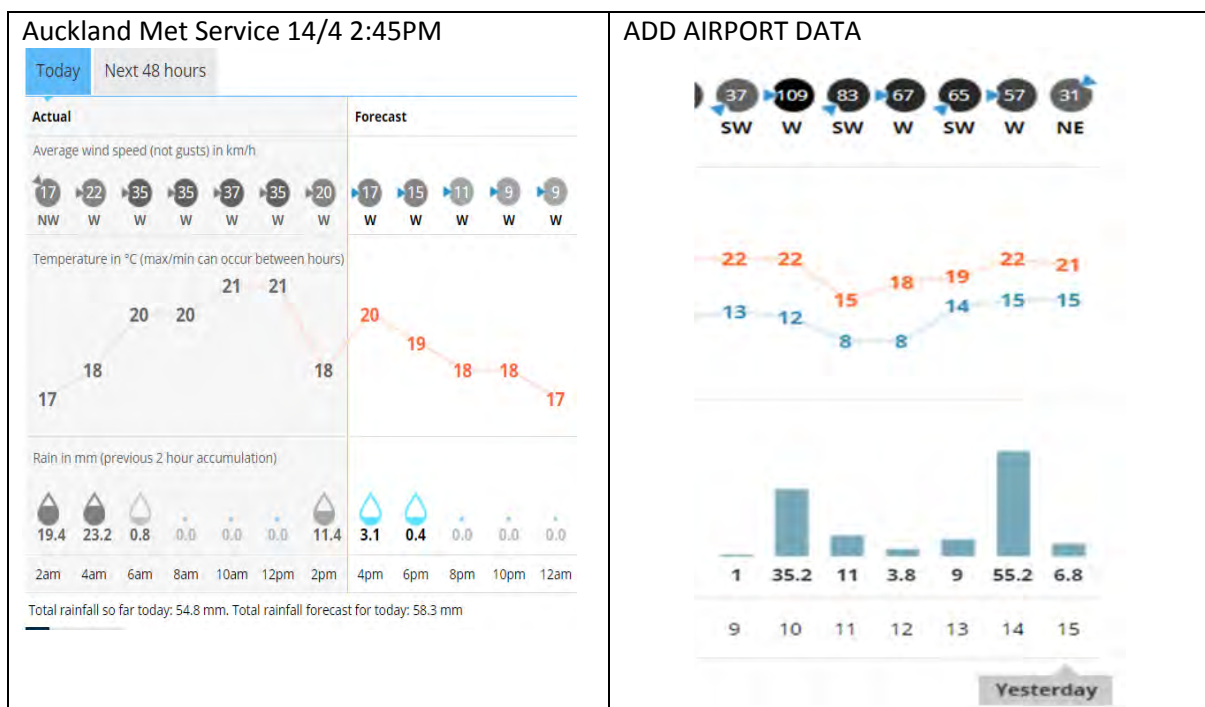
Met Service Airport 54.8mm for 14th April at 2:45PM.

Auckland Council Avondale Racecourse ~30mm between midnight and 2:25AM. Mt Albert Grammar revived about the same. Mt Roskill received a bit more during the same early morning period of ~50mm

Sampling is detailed below. Samples taken ~ 10 hours after rainfall event.

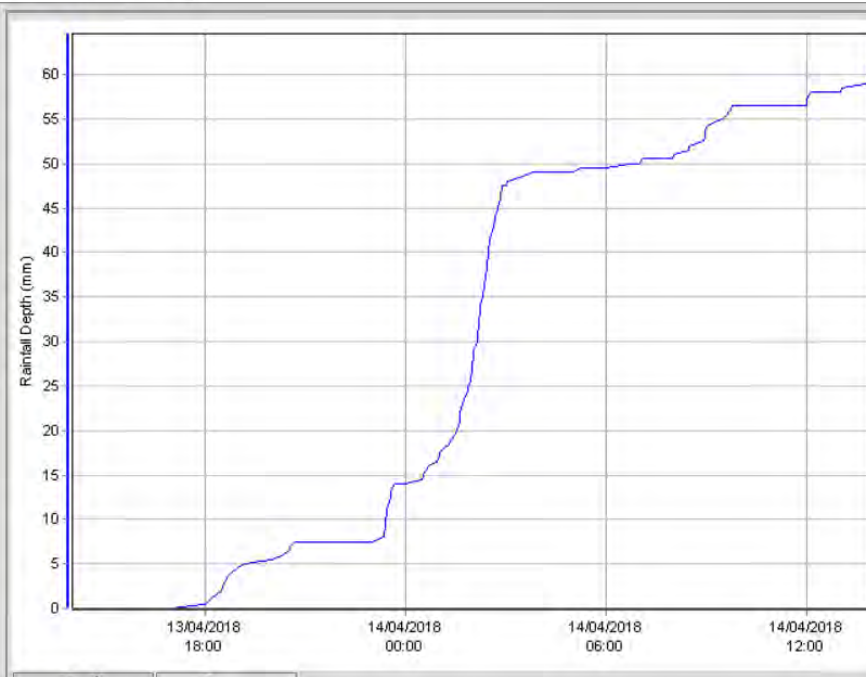
At Barrymore carpark Dianne Smith who is known as the Camera Lady from the construction project was taken photos of the flash flood form the rainfall event. Photos below show the debris. Dianne is a useful source of information as she is always taking photos of the Tunnel and the environment around it. Dianne is emailing photos from previous rain event as a record for WTJO.

Sampled set to Hill Laboratory in Hamilton by Deadline Couriers at 2:45 PM. Will be delivered Monday morning.



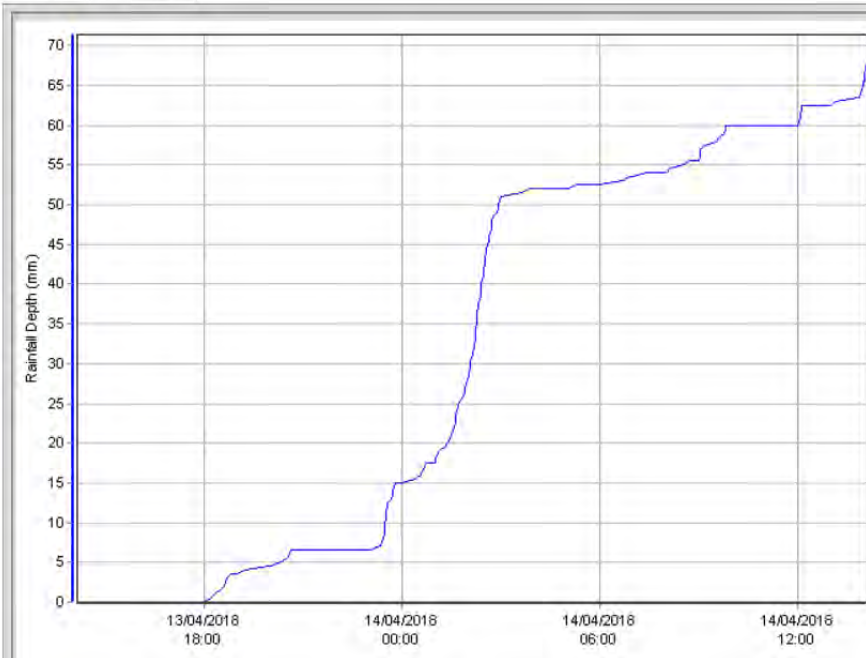
Avondale Racecourse Rain

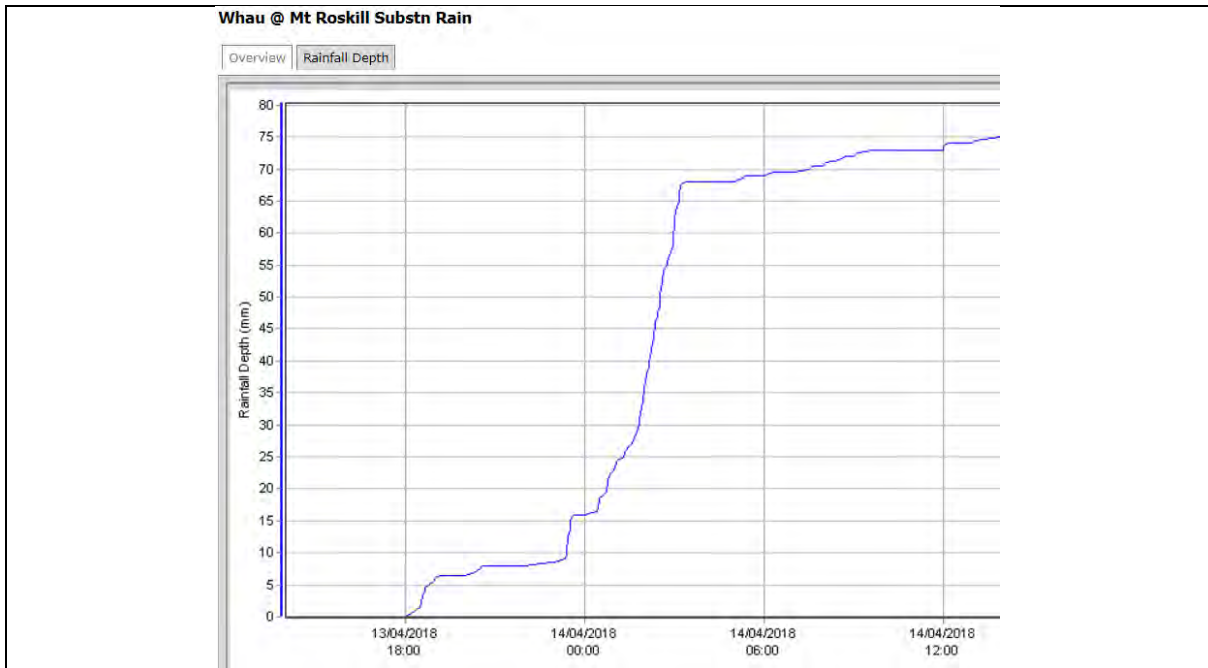
Overview Rainfall Depth



Mt Albert Grammar Rain

Overview Rainfall Depth





Date 14/04/2018

Barrymore – Kukuwai Park / Te
Whitanga Footbridge Footing

Time: 11:58AM

Debris around footing



Barrymore – Kukuwai Park / Te
Whitanga Footbridge Footing

Time: 11:58AM

Debris from Oakley Creek Te Auaunga
/ Richardson Road Pedestrian
underpass construction site.



Sampling Date 14/04/2018

Waterview Reserve Wetland Inlet

Time: 11:45AM

Weather: West, windy with rain squalls

Pond level slightly raised, low flow from inlet as rain event had passed with only rain squalls occasionally. Had Tunnel Operator at ATOC turn the North Sump Pump to Waterview Wetland on to achieve a sample.

No erosion or damage was seen.



Waterview Reserve Wetland Outlet

Time: 11:50AM

Weather: West, windy with rain squalls

Pond level slightly raised, medium flow from outlet, not high enough to discharge over the culvert weir. No erosion or damage was seen.



Valonia Wetland Inlet

Time: 12:30PM

Weather: West, windy with rain squalls

Pond level raised, low flow from inlet as rain event had passed with only rain squalls occasionally. No erosion or damage was seen.



Valonia Wetland Outlet

Time: 12:35PM

Weather: West, windy with rain squalls

Pond level slightly raised, medium flow from outlet, high enough to discharge over the culvert weir. No erosion or damage was seen. Note the plant debris on the weir protection grate. Could do with a gap to allow passage of this material. Cleared the debris after sample taken.



Alan Wood Wetland Inlet

Time: 12:50AM

Weather: West, windy with rain squalls

Pond level raised, low flow from inlet as rainfall event had passed. Had Tunnel Operator at ATOC turn the South Sump Pump to Alan Wood Wetland on to achieve a sample.

No erosion or damage was seen.

One can see that the outlet pipe is completely overgrown and need to be cleared (AMA have been sent a MEX order to tidy up parts of the pond).

Today



4th January 2018



Alan Wood Wetland Outlet

Time: 12:55AM

Weather: West, windy with rain squalls

Pond level raised, medium flow from outlet, both valves, almost high enough to discharge over the culvert weir. No erosion or damage was seen. Water was discoloured.



Stormwater Quality Monitoring Programme

Stormwater Water Quality Testing

Event Date: 23rd May 2018

Sample: Number 3 of 4 for period 1/07/17 to 30/06/18

Notes:

400-RPT-04253 Operational Stormwater Management Plan (OSMP) is guidance document.

Appendix D outlines the guidance for taking of the grab samples

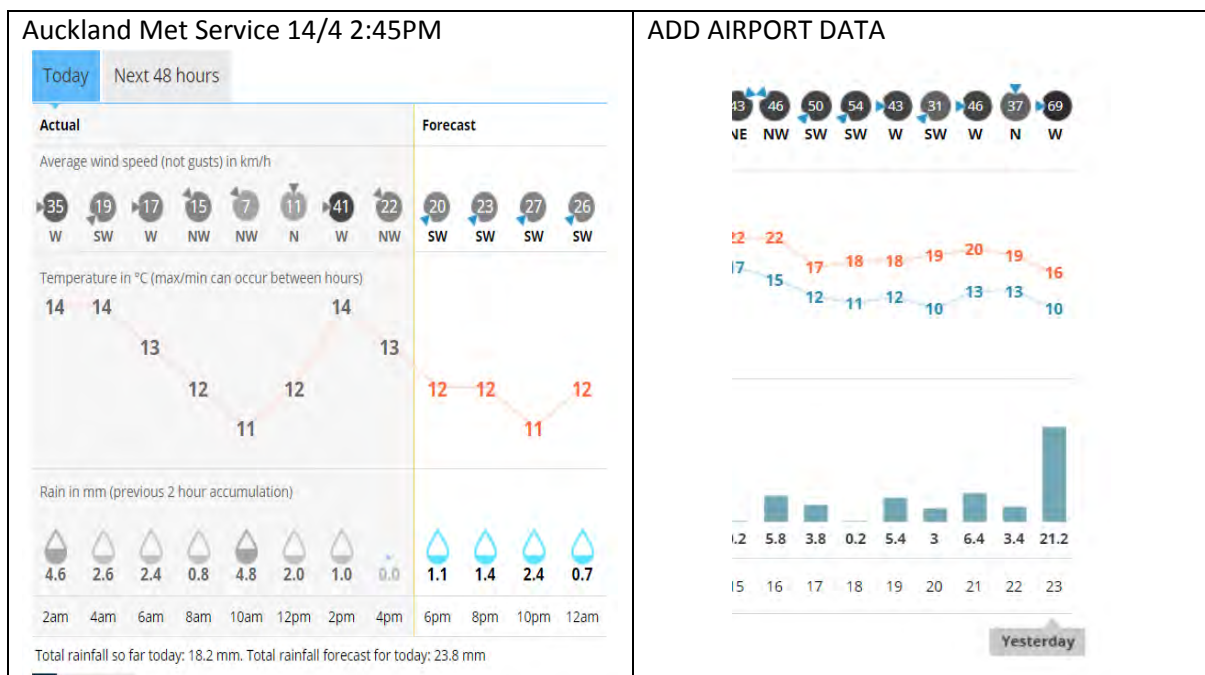
Rain fall on the 22nd and 23rd May can be seen to be >27mm in a 24-hour period in the Waterview Tunnel area. The Airport data is less than 27mm but the local hydrology information average to be >27mm.

The Met Service information was reviewed along with the Auckland Council Geo Maps Rainfall Hydrology. Summary is;

Location	mm
Met Service Airport	21.2
Auckland Council Avondale Racecourse	30.5
Mt Albert Grammar	25.0
Mt Roskill	27.5

Sampling is detailed below. Samples taken ~ 4 hours after rainfall event.

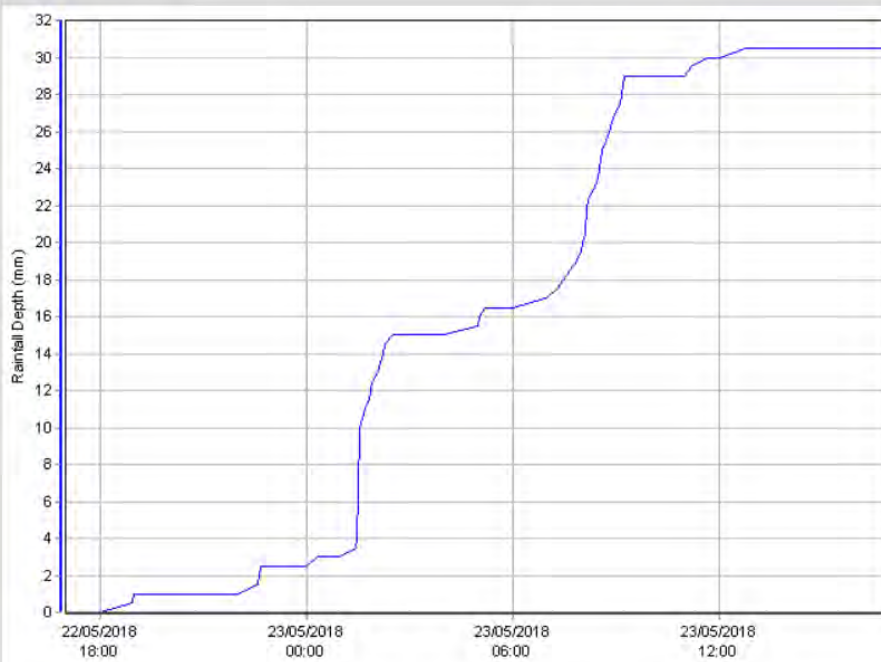
Sampled set to Hill Laboratory in Hamilton by Deadline Couriers at 6:00 PM. Will be delivered Thursday to Hill.



Avondale Racecourse Rain

Overview

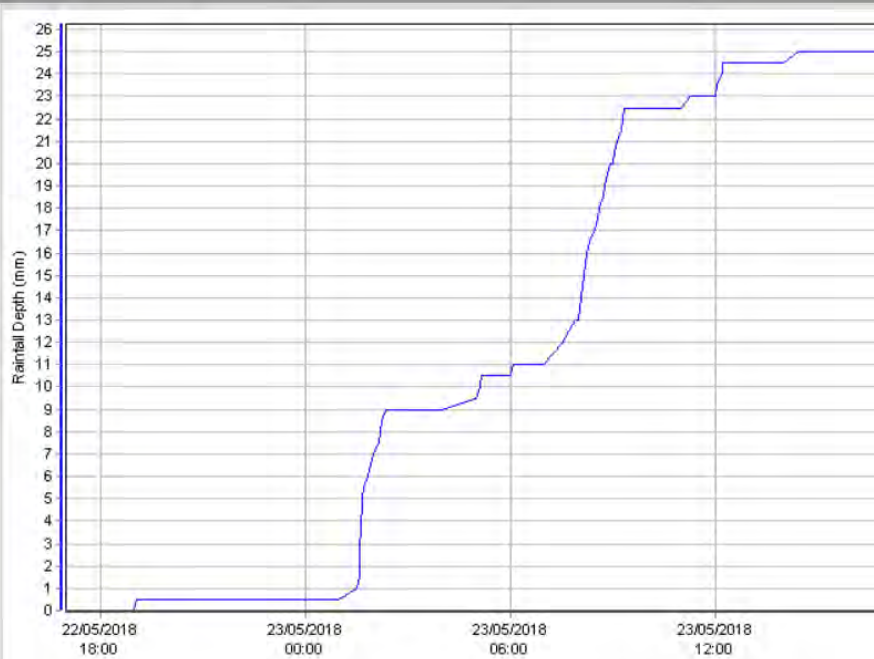
Rainfall Depth



Mt Albert Grammar Rain

Overview

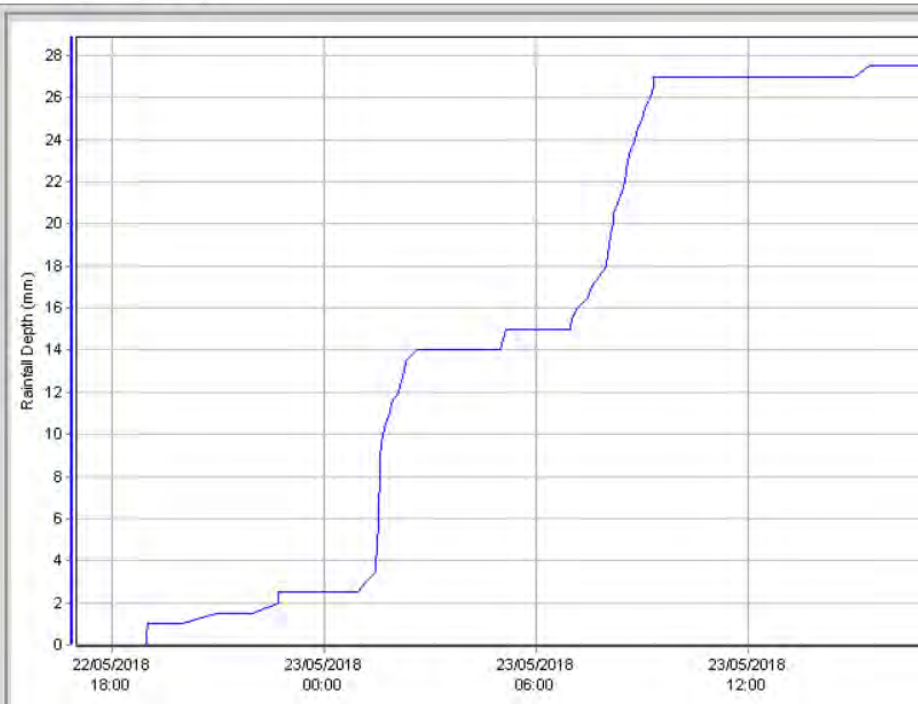
Rainfall Depth



Whau @ Mt Roskill Substn Rain

Overview

Rainfall Depth



Sampling Date 23/05/2018

Waterview Reserve Wetland Inlet

Time: 2:30PM

Weather: West, windy with rain squalls

Pond level slightly raised, good flow from inlet, rain event had passed with only rain squalls occasionally. North Sump Pump to Waterview Wetland was operating.

No erosion or damage was seen.



Waterview Reserve Wetland Outlet

Time: 2:40PM

Weather: West, windy with rain squalls

Pond level slightly raised, medium flow from outlet, just high enough to discharge over the culvert weir. No erosion or damage was seen.



Valonia Wetland Inlet

Time: 3:30PM

Weather: West, windy with rain squalls

Pond level raised, low flow from inlet as rain event had passed with only rain squalls occasionally. Scum on surface but no oil visible. A lot of rubbish had been flushed into the Wetland. No erosion or damage was seen.



Valonia Wetland Outlet

Time: 3:40PM

Weather: West, windy with rain squalls

Pond level slightly raised, medium flow from outlet, high enough to discharge over the culvert weir. No erosion or damage was seen. Note the plant debris on the weir protection grate. Could do with a gap to allow passage of this material. Cleared the debris after sample taken.



Alan Wood Wetland Inlet

Time: 3:50PM

Weather: West, windy with rain squalls

Pond level raised, low flow from inlet as rainfall event had passed.

No erosion or damage was seen.

Last sample on 14th April it was thought that the outlet pipe was completely overgrown. This is revised as the wetland water level at the time was high and covering the inlet.

23rd May 2018



14th April 2018



Alan Wood Wetland Outlet

Time: 4:00PM

Weather: West, windy with rain squalls

Pond level raised, medium flow from outlet, both valves, almost high enough to discharge over the culvert weir. No erosion or damage was seen. Water was clear.



Stormwater Quality Monitoring Programme

Stormwater Water Quality Testing

Event Date: 6th June 2018

Sample: Number 4 of 4 for period 1/07/17 to 30/06/18

Notes:

400-RPT-04253 Operational Stormwater Management Plan (OSMP) is guidance document.

Appendix D outlines the guidance for taking of the grab samples

Rainfall on the 3rd and 4th June can be seen to be >27mm in each 24-hour period in the Waterview Tunnel area. The Airport data is less than 27mm for the 2nd event but the local hydrology information average to be >27mm.

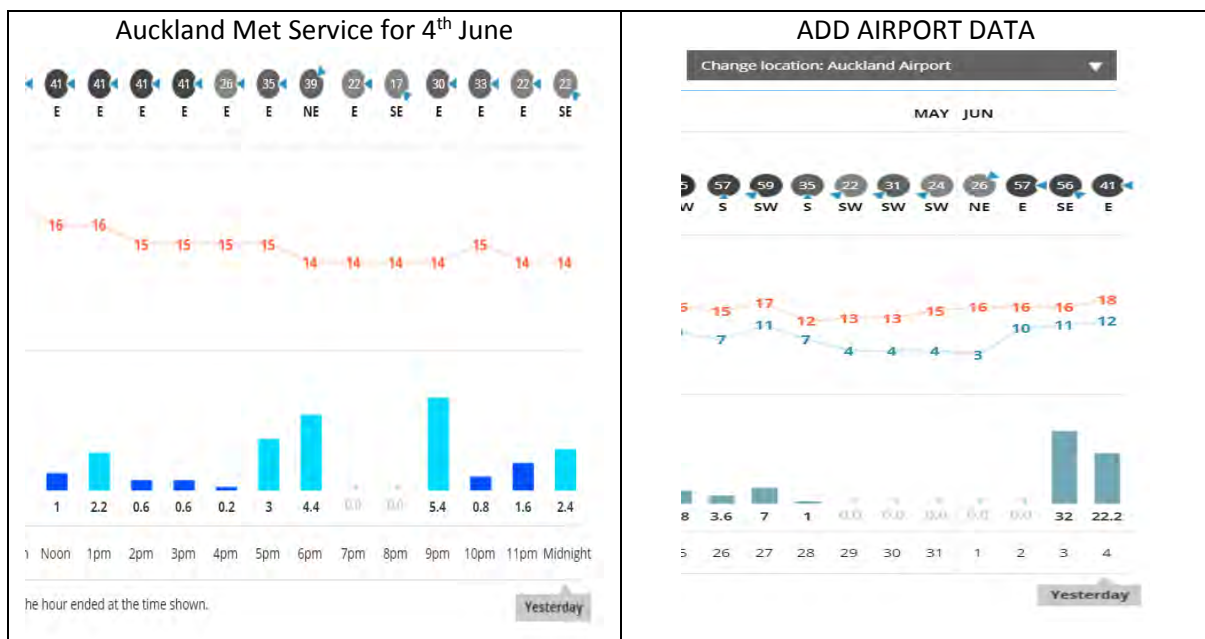
There were two rainfall events, the first being greater but unable to be sampled due to personal unavailability. First event was of 7 hours duration and the 2nd event followed 24 hours later with a duration of ~18 hours.

The Met Service information was reviewed along with the Auckland Council Geo Maps Rainfall Hydrology. Summary is;

Location	3rd June	4th June
Met Service Airport	32.0 mm	22.2 mm
Auckland Council Avondale Racecourse	34.5 mm	24.5 mm
Mt Albert Grammar	38.5 mm	34.5 mm
Mt Roskill	36.0 mm	33.0 mm

Sampling is detailed below. Samples taken ~ 4 hours after rainfall event.

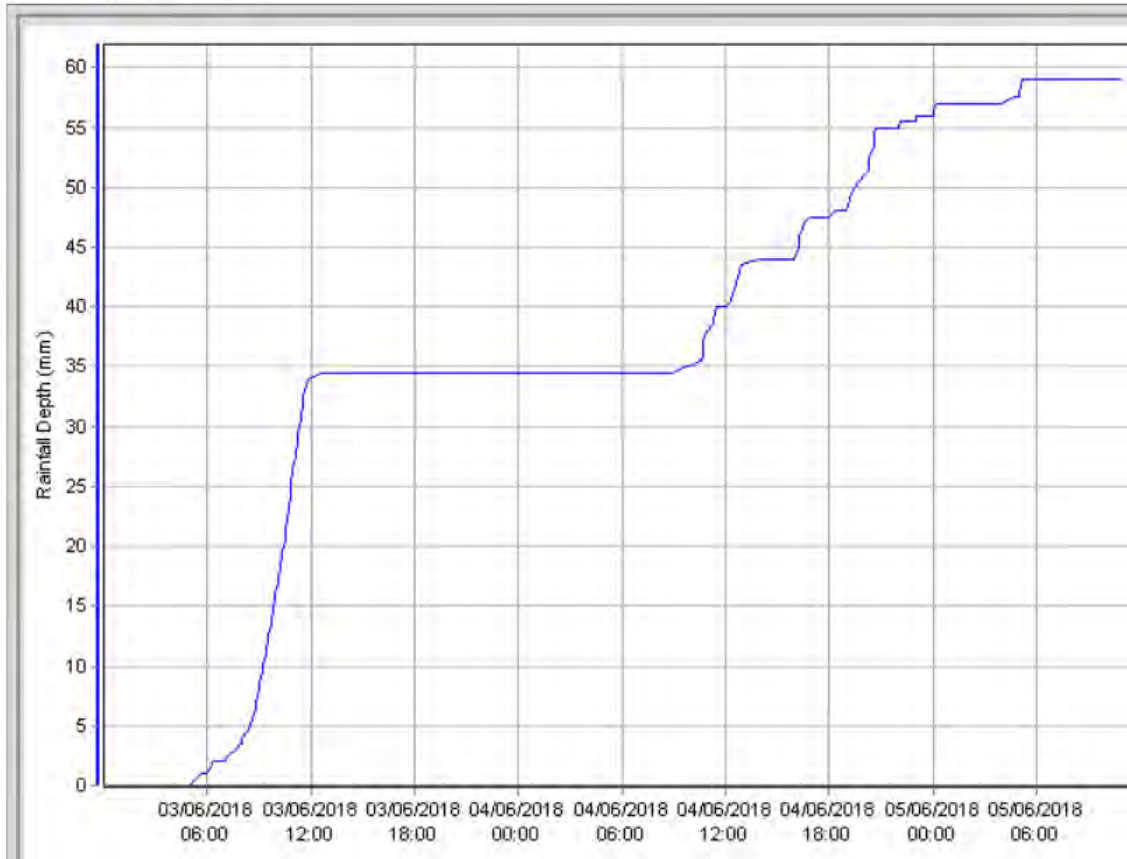
Sampled set to Hill Laboratory in Hamilton by Deadline Couriers at 12:00 PM. Will be delivered Tuesday to Hills.



Avondale Racecourse Rain

Overview

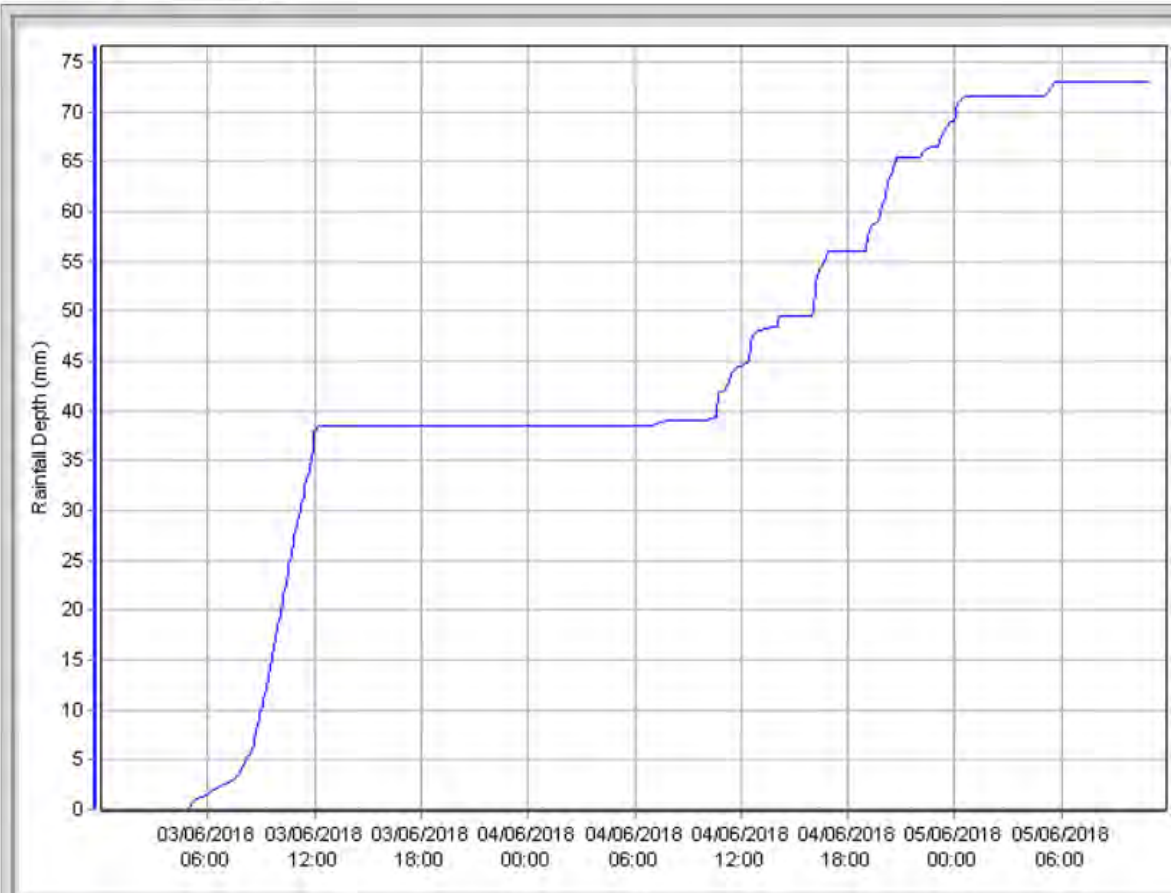
Rainfall Depth



Mt Albert Grammar Rain

Overview

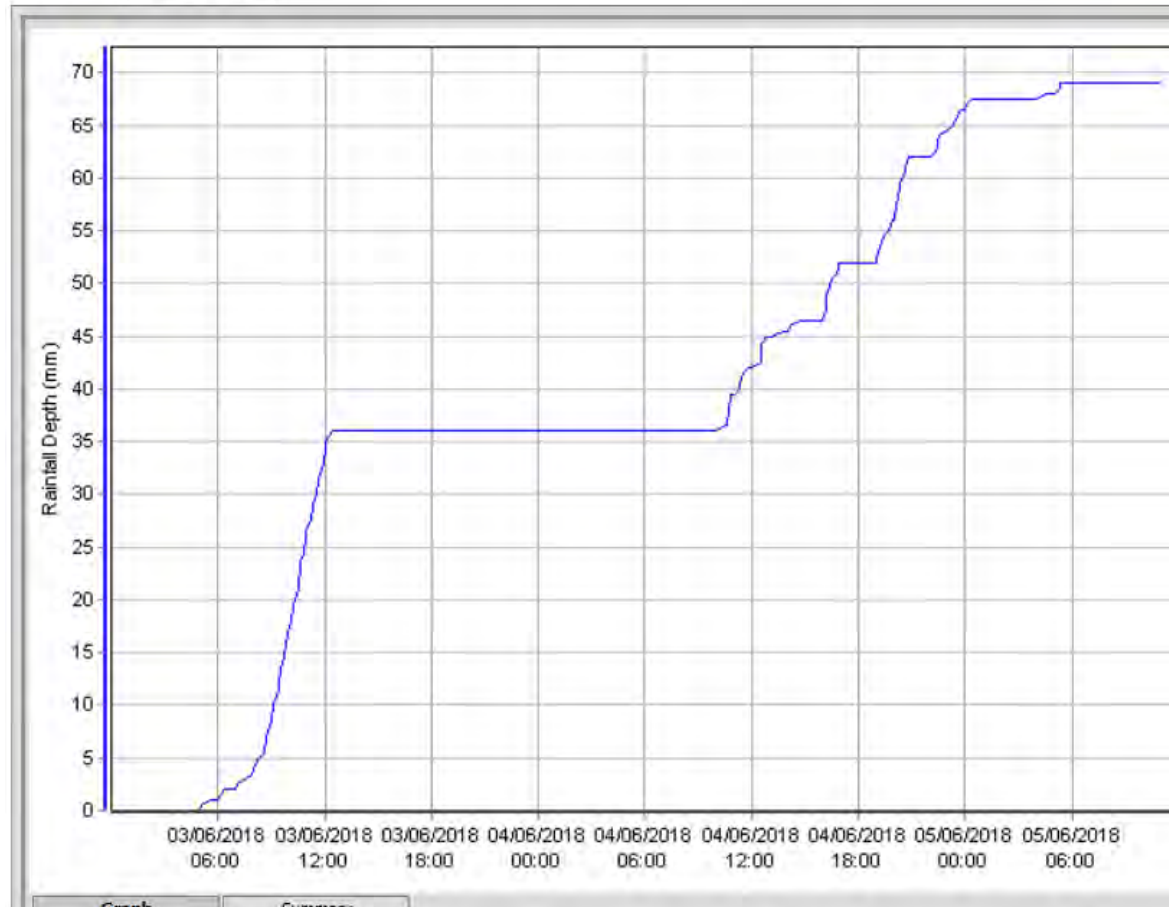
Rainfall Depth



Whau @ Mt Roskill Substn Rain

Overview

Rainfall Depth



Graph

Summary

Sampling Date 05/06/2018

Waterview Reserve Wetland Inlet

Time: 8:45AM

Weather: SW, windy cloudy no rain.

Pond level slightly raised, good flow from inlet, rain event had passed. Water was very clear. No erosion or damage was seen.



Waterview Reserve Wetland Outlet

Time: 8:50AM

Weather: SW, windy cloudy no rain.

Pond level slightly raised, low to medium flow from outlet, Water was clear. No erosion or damage was seen.



Valonia Wetland Inlet

Time: 9:15AM

Weather: SW, windy cloudy no rain.

Pond level raised, low flow from inlet as rain event had passed. A lot of rubbish was present. No erosion or damage was seen.



Valonia Wetland Outlet

Time: 9:20AM

Weather: SW, windy cloudy no rain.

Pond level slightly raised, medium flow from outlet, high enough to discharge over the culvert weir. No erosion or damage was seen. The weir protection grate is to be modified.



Alan Wood Wetland Inlet

Time: 9:30AM

Weather: SW, windy cloudy no rain.

Pond level raised, low flow from inlet as rainfall event had passed.

No erosion or damage was seen.



Alan Wood Wetland Outlet

Time: 9:40AM

Weather: SW, windy cloudy no rain.

Pond level raised, low flow from outlet, both valves. No erosion or damage was seen. Water was clear.



Attachment D: Deluge event - Hill Laboratories Reports



Certificate of Analysis

Client:	Waterview Tunnel Joint Operation	Lab No:	1944015	SPV1
Contact:	Andy Schmidt C/- Waterview Tunnel Joint Operation Private Bag 76914 Manukau City Auckland 2241	Date Received:	15-Mar-2018	
		Date Reported:	22-Mar-2018	
		Quote No:	87985	
		Order No:		
		Client Reference:	Storm Water Testing	
		Submitted By:	Andy Schmidt	

Sample Type: Aqueous

Sample Name:	Waterview Tunnel Storm Water - Low point Sump 14-Mar-2018 12:45 pm	Waterview Tunnel Storm Water - Inlet 14-Mar-2018 2:20 pm	Waterview Tunnel Storm Water - Outlet 14-Mar-2018 2:30 pm		
Lab Number:	1944015.1	1944015.2	1944015.3		

Individual Tests

Total Suspended Solids	g/m ³	114	18	< 3	-	-
Dissolved Copper	g/m ³	0.023	0.0046	0.0024	-	-
Total Copper	g/m ³	0.095	0.0105	0.0033	-	-
Dissolved Zinc	g/m ³	0.57	0.026	0.0061	-	-
Total Zinc	g/m ³	2.1	0.22	0.0169	-	-

BTEX in Water by Headspace GC-MS

Benzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Toluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Ethylbenzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
m&p-Xylene	g/m ³	< 0.002	< 0.002	< 0.002	-	-
o-Xylene	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-

Total Petroleum Hydrocarbons in Water

C7 - C9	g/m ³	< 0.06	< 0.06	< 0.06	-	-
C10 - C14	g/m ³	< 0.2	< 0.2	< 0.2	-	-
C15 - C36	g/m ³	< 0.4	< 0.4	< 0.4	-	-
Total hydrocarbons (C7 - C36)	g/m ³	< 0.7	< 0.7	< 0.7	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis, US EPA 8260B [KBIs:26687,3629]	0.0010 - 0.002 g/m ³	1-3
Total Petroleum Hydrocarbons in Water	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m ³	1-3
Total Digestion	Nitric acid digestion. APHA 3030 E 22 nd ed. 2012 (modified).	-	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 22 nd ed. 2012.	3 g/m ³	1-3
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22 nd ed. 2012.	-	1-3
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-3
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.00053 g/m ³	1-3



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 *, which are not accredited.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-3
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.0011 g/m ³	1-3
C7 - C9	Head Space, GCMS analysis.	0.06 g/m ³	1-3

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Carole Rodgers-Carroll BA, NZCS
Client Services Manager - Environmental



Certificate of Analysis

Client:	Waterview Tunnel Joint Operation	Lab No:	1945058	SPV1
Contact:	Andy Schmidt C/- Waterview Tunnel Joint Operation Private Bag 76914 Manukau City Auckland 2241	Date Received:	16-Mar-2018	
		Date Reported:	23-Mar-2018	
		Quote No:	87985	
		Order No:		
		Client Reference:	Storm Water Testing	
		Submitted By:	Andy Schmidt	

Sample Type: Aqueous

Sample Name:	Waterview Tunnel Storm Water - LP Sump 15-Mar-2018 12:00 pm	WW Inlet 15-Mar-2018 1:00 am	WW Outlet 15-Mar-2018 1:15 am		
Lab Number:	1945058.1	1945058.2	1945058.3		

Individual Tests

Total Suspended Solids	g/m ³	67	20	4	-	-
Dissolved Copper	g/m ³	0.021	0.0056	0.0023	-	-
Total Copper	g/m ³	0.061	0.0118	0.0027	-	-
Dissolved Zinc	g/m ³	0.71	0.055	0.0057	-	-
Total Zinc	g/m ³	1.44	0.26	0.0123	-	-

BTEX in Water by Headspace GC-MS

Benzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Toluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Ethylbenzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
m&p-Xylene	g/m ³	< 0.002	< 0.002	< 0.002	-	-
o-Xylene	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-

Total Petroleum Hydrocarbons in Water

C7 - C9	g/m ³	< 0.06	< 0.06	< 0.06	-	-
C10 - C14	g/m ³	< 0.2	< 0.2	< 0.2	-	-
C15 - C36	g/m ³	< 0.4	< 0.4	< 0.4	-	-
Total hydrocarbons (C7 - C36)	g/m ³	< 0.7	< 0.7	< 0.7	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis, US EPA 8260B [KBIs:26687,3629]	0.0010 - 0.002 g/m ³	1-3
Total Petroleum Hydrocarbons in Water	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m ³	1-3
Total Digestion	Nitric acid digestion. APHA 3030 E 22 nd ed. 2012 (modified).	-	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 22 nd ed. 2012.	3 g/m ³	1-3
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22 nd ed. 2012.	-	1-3
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-3
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.00053 g/m ³	1-3



Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-3
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.0011 g/m ³	1-3
C7 - C9	Head Space, GCMS analysis.	0.06 g/m ³	1-3

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

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Ara Heron BSc (Tech)
Client Services Manager - Environmental

Attachment E: Rainfall event Hill Laboratories Reports



ANALYSIS REPORT

Client:	Waterview Tunnel Joint Operation	Lab No:	1903615	SPv1
Contact:	Andy Schmidt C/- Waterview Tunnel Joint Operation Private Bag 76914 Manukau City Auckland 2241	Date Received:	06-Jan-2018	
		Date Reported:	16-Jan-2018	
		Quote No:	87985	
		Order No:	461	
		Client Reference:	Storm Water Testing	
		Submitted By:	Andy Schmidt	

Sample Type: Aqueous

Sample Name:	Waterview Tunnel Storm Water - Waterview Inlet 05-Jan-2018 8:25 am	Waterview Tunnel Storm Water - Waterview Outlet 05-Jan-2018 8:30 am	Waterview Tunnel Storm Water - Valonia Inlet 05-Jan-2018 9:10 am	Waterview Tunnel Storm Water - Valonia Outlet 05-Jan-2018 9:15 am	Waterview Tunnel Storm Water - Alanwood Inlet 05-Jan-2018 9:20 am
Lab Number:	1903615.1	1903615.2	1903615.3	1903615.4	1903615.5

Individual Tests

Total Suspended Solids	g/m ³	6	8	16	8	< 3
Dissolved Copper	g/m ³	0.0044	0.0037	0.0029	0.0016	0.0018
Total Copper	g/m ³	0.0063	0.0048	0.0046	0.0023	0.0022
Dissolved Zinc	g/m ³	0.0129	0.0133	0.021	0.0040	0.0186
Total Zinc	g/m ³	0.030	0.024	0.038	0.0105	0.027

BTEX in Water by Headspace GC-MS

Benzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m ³	< 0.0010	0.0012	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m ³	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Total Petroleum Hydrocarbons in Water

C7 - C9	g/m ³	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
C10 - C14	g/m ³	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C15 - C36	g/m ³	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C7 - C36)	g/m ³	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

Sample Name:	Waterview Tunnel Storm Water - Alanwood Outlet 05-Jan-2018 9:25 am				
Lab Number:	1903615.6				

Individual Tests

Total Suspended Solids	g/m ³	6	-	-	-	-
Dissolved Copper	g/m ³	0.0016	-	-	-	-
Total Copper	g/m ³	0.0022	-	-	-	-
Dissolved Zinc	g/m ³	0.0078	-	-	-	-
Total Zinc	g/m ³	0.0125	-	-	-	-

BTEX in Water by Headspace GC-MS

Benzene	g/m ³	< 0.0010	-	-	-	-
Toluene	g/m ³	< 0.0010	-	-	-	-
Ethylbenzene	g/m ³	< 0.0010	-	-	-	-
m&p-Xylene	g/m ³	< 0.002	-	-	-	-
o-Xylene	g/m ³	< 0.0010	-	-	-	-



Sample Type: Aqueous						
Sample Name:	Waterview Tunnel Storm Water - Alanwood Outlet 05-Jan-2018 9:25 am					
Lab Number:	1903615.6					
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m ³	< 0.06	-	-	-	-
C10 - C14	g/m ³	< 0.2	-	-	-	-
C15 - C36	g/m ³	< 0.4	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m ³	< 0.7	-	-	-	-

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis, US EPA 8260B [KBIs:26687,3629]	0.0010 - 0.002 g/m ³	1-6
Total Petroleum Hydrocarbons in Water	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m ³	1-6
Total Digestion	Nitric acid digestion. APHA 3030 E 22 nd ed. 2012 (modified).	-	1-6
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 22 nd ed. 2012.	3 g/m ³	1-6
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22 nd ed. 2012.	-	1-6
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-6
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.00053 g/m ³	1-6
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-6
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.0011 g/m ³	1-6
C7 - C9	Head Space, GCMS analysis.	0.06 g/m ³	1-6

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Ara Heron BSc (Tech)
Client Services Manager - Environmental



Certificate of Analysis

Client:	Waterview Tunnel Joint Operation	Lab No:	1963634	SPV1
Contact:	Andy Schmidt C/- Waterview Tunnel Joint Operation Private Bag 76914 Manukau City Auckland 2241	Date Received:	16-Apr-2018	
		Date Reported:	01-May-2018	
		Quote No:	87985	
		Order No:	PO 735	
		Client Reference:	Storm Water Testing	
		Submitted By:	Andy Schmidt	

Sample Type: Aqueous

Sample Name:	Waterview Inlet 14-Apr-2018 11:45 am	Waterview Outlet 14-Apr-2018 11:50 am	Valonia Inlet 14-Apr-2018 12:30 pm	Valonia Outlet 14-Apr-2018 12:35 pm	Alanwood Inlet 14-Apr-2018 12:50 pm
Lab Number:	1963634.1	1963634.2	1963634.3	1963634.4	1963634.5

Individual Tests

	g/m ³	11	33	3	5	7
Total Suspended Solids	g/m ³	11	33	3	5	7
Dissolved Copper	g/m ³	0.0036	0.0020	0.0050	0.0012	0.0016
Total Copper	g/m ³	0.0043	0.0029	0.0071	0.00164	0.0022
Dissolved Zinc	g/m ³	0.0181	0.0186	0.023	0.0057	0.0071
Total Zinc	g/m ³	0.030	0.026	0.030	0.0080	0.0134

BTEX in Water by Headspace GC-MS

	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Benzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m ³	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Total Petroleum Hydrocarbons in Water

	g/m ³	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
C7 - C9	g/m ³	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
C10 - C14	g/m ³	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C15 - C36	g/m ³	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C7 - C36)	g/m ³	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

Sample Name:	Alanwood Outlet 14-Apr-2018 12:55 pm				
Lab Number:	1963634.6				

Individual Tests

	g/m ³	6	-	-	-	-
Total Suspended Solids	g/m ³	6	-	-	-	-
Dissolved Copper	g/m ³	0.0015	-	-	-	-
Total Copper	g/m ³	0.0026	-	-	-	-
Dissolved Zinc	g/m ³	0.0066	-	-	-	-
Total Zinc	g/m ³	0.021	-	-	-	-

BTEX in Water by Headspace GC-MS

	g/m ³	< 0.0010	-	-	-	-
Benzene	g/m ³	< 0.0010	-	-	-	-
Toluene	g/m ³	< 0.0010	-	-	-	-
Ethylbenzene	g/m ³	< 0.0010	-	-	-	-
m&p-Xylene	g/m ³	< 0.002	-	-	-	-
o-Xylene	g/m ³	< 0.0010	-	-	-	-

Total Petroleum Hydrocarbons in Water

	g/m ³	< 0.06	-	-	-	-
C7 - C9	g/m ³	< 0.06	-	-	-	-
C10 - C14	g/m ³	< 0.2	-	-	-	-
C15 - C36	g/m ³	< 0.4	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m ³	< 0.7	-	-	-	-



Summary of Methods

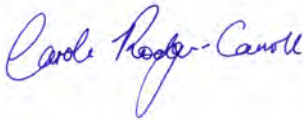
The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis, US EPA 8260B [KBIs:26687,3629]	0.0010 - 0.002 g/m ³	1-6
Total Petroleum Hydrocarbons in Water	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m ³	1-6
Total Digestion	Nitric acid digestion. APHA 3030 E 22 nd ed. 2012 (modified).	-	1-6
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) 22 nd ed. 2012.	3 g/m ³	1-6
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22 nd ed. 2012.	-	1-6
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-6
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.00053 g/m ³	1-6
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-6
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.0011 g/m ³	1-6
C7 - C9	Head Space, GCMS analysis.	0.06 g/m ³	1-6

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Carole Rodgers-Carroll BA, NZCS
Client Services Manager - Environmental



Certificate of Analysis

Client:	Waterview Tunnel Joint Operation	Lab No:	1987823	SPv1
Contact:	Andy Schmidt C/- Waterview Tunnel Joint Operation Private Bag 76914 Manukau City Auckland 2241	Date Received:	24-May-2018	
		Date Reported:	31-May-2018	
		Quote No:	87985	
		Order No:	PO 874	
		Client Reference:	Storm Water Testing	
		Submitted By:	Andy Schmidt	

Sample Type: Aqueous

Sample Name:	WV Inlet 23-May-2018 2:30 pm	WV Outlet 23-May-2018 2:40 pm	Valonia Inlet 23-May-2018 3:30 pm	Valonia Outlet 23-May-2018 3:40 pm	Alanwood Inlet 23-May-2018 3:50 pm
Lab Number:	1987823.1	1987823.2	1987823.3	1987823.4	1987823.5

Individual Tests

Parameter	Unit	1987823.1	1987823.2	1987823.3	1987823.4	1987823.5
Total Suspended Solids	g/m ³	6	5	< 3	4	< 3
Dissolved Copper	g/m ³	0.0029	0.0022	0.0051	0.0014	0.0023
Total Copper	g/m ³	0.0040	0.0034	0.0061	0.00154	0.0033
Dissolved Zinc	g/m ³	0.0100	0.0083	0.0115	0.0044	0.0134
Total Zinc	g/m ³	0.032	0.025	0.0158	0.0048	0.0186

BTEX in Water by Headspace GC-MS

Parameter	Unit	1987823.1	1987823.2	1987823.3	1987823.4	1987823.5
Benzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m ³	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Total Petroleum Hydrocarbons in Water

Parameter	Unit	1987823.1	1987823.2	1987823.3	1987823.4	1987823.5
C7 - C9	g/m ³	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
C10 - C14	g/m ³	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C15 - C36	g/m ³	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C7 - C36)	g/m ³	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

Sample Name:	Alanwood Outlet 23-May-2018 4:00 pm				
Lab Number:	1987823.6				

Individual Tests

Parameter	Unit	1987823.6				
Total Suspended Solids	g/m ³	< 3	-	-	-	-
Dissolved Copper	g/m ³	0.0017	-	-	-	-
Total Copper	g/m ³	0.0025	-	-	-	-
Dissolved Zinc	g/m ³	0.0153	-	-	-	-
Total Zinc	g/m ³	0.021	-	-	-	-

BTEX in Water by Headspace GC-MS

Parameter	Unit	1987823.6				
Benzene	g/m ³	< 0.0010	-	-	-	-
Toluene	g/m ³	< 0.0010	-	-	-	-
Ethylbenzene	g/m ³	< 0.0010	-	-	-	-
m&p-Xylene	g/m ³	< 0.002	-	-	-	-
o-Xylene	g/m ³	< 0.0010	-	-	-	-

Total Petroleum Hydrocarbons in Water

Parameter	Unit	1987823.6				
C7 - C9	g/m ³	< 0.06	-	-	-	-
C10 - C14	g/m ³	< 0.2	-	-	-	-
C15 - C36	g/m ³	< 0.4	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m ³	< 0.7	-	-	-	-



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis, US EPA 8260B [KBIs:26687,3629]	0.0010 - 0.002 g/m ³	1-6
Total Petroleum Hydrocarbons in Water	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m ³	1-6
Total Digestion	Nitric acid digestion. APHA 3030 E 22 nd ed. 2012 (modified).	-	1-6
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) 22 nd ed. 2012.	3 g/m ³	1-6
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22 nd ed. 2012.	-	1-6
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-6
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.00053 g/m ³	1-6
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-6
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.0011 g/m ³	1-6
C7 - C9	Head Space, GCMS analysis.	0.06 g/m ³	1-6

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Ara Heron BSc (Tech)
Client Services Manager - Environmental



Certificate of Analysis

Client:	Waterview Tunnel Joint Operation	Lab No:	1994859	SPV1
Contact:	Andy Schmidt C/- Waterview Tunnel Joint Operation Private Bag 76914 Manukau City Auckland 2241	Date Received:	06-Jun-2018	
		Date Reported:	12-Jun-2018	
		Quote No:	87985	
		Order No:	PO 937	
		Client Reference:	Storm Water Testing	
		Submitted By:	Andy Schmidt	

Sample Type: Aqueous

Sample Name:	WV In 05-Jun-2018 8:45 am	WV Out 05-Jun-2018 8:50 am	Valona In 05-Jun-2018 9:15 am	Valona Out 05-Jun-2018 9:20 am	Alanwood In 05-Jun-2018 9:30 am
Lab Number:	1994859.1	1994859.2	1994859.3	1994859.4	1994859.5

Individual Tests

Parameter	Unit	WV In	WV Out	Valona In	Valona Out	Alanwood In
Total Suspended Solids	g/m ³	< 3	4	3	5	< 3
Dissolved Copper	g/m ³	0.0028	0.0025	0.0042	0.0021	0.0021
Total Copper	g/m ³	0.0034	0.0032	0.0047	0.0027	0.0042
Dissolved Zinc	g/m ³	0.0173	0.0115	0.0094	0.0068	0.0070
Total Zinc	g/m ³	0.025	0.021	0.0133	0.0101	0.095

BTEX in Water by Headspace GC-MS

Parameter	Unit	WV In	WV Out	Valona In	Valona Out	Alanwood In
Benzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m ³	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Total Petroleum Hydrocarbons in Water

Parameter	Unit	WV In	WV Out	Valona In	Valona Out	Alanwood In
C7 - C9	g/m ³	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
C10 - C14	g/m ³	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C15 - C36	g/m ³	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C7 - C36)	g/m ³	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

Sample Name:	Alanwood Out 05-Jun-2018 9:40 am
Lab Number:	1994859.6

Individual Tests

Parameter	Unit	WV In	WV Out	Valona In	Valona Out	Alanwood In
Total Suspended Solids	g/m ³	< 3	-	-	-	-
Dissolved Copper	g/m ³	0.0016	-	-	-	-
Total Copper	g/m ³	0.0022	-	-	-	-
Dissolved Zinc	g/m ³	0.0100	-	-	-	-
Total Zinc	g/m ³	0.0130	-	-	-	-

BTEX in Water by Headspace GC-MS

Parameter	Unit	WV In	WV Out	Valona In	Valona Out	Alanwood In
Benzene	g/m ³	< 0.0010	-	-	-	-
Toluene	g/m ³	< 0.0010	-	-	-	-
Ethylbenzene	g/m ³	< 0.0010	-	-	-	-
m&p-Xylene	g/m ³	< 0.002	-	-	-	-
o-Xylene	g/m ³	< 0.0010	-	-	-	-

Total Petroleum Hydrocarbons in Water

Parameter	Unit	WV In	WV Out	Valona In	Valona Out	Alanwood In
C7 - C9	g/m ³	< 0.06	-	-	-	-
C10 - C14	g/m ³	< 0.2	-	-	-	-
C15 - C36	g/m ³	< 0.4	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m ³	< 0.7	-	-	-	-



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis, US EPA 8260B [KBIs:26687,3629]	0.0010 - 0.002 g/m ³	1-6
Total Petroleum Hydrocarbons in Water	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m ³	1-6
Total Digestion	Nitric acid digestion. APHA 3030 E 22 nd ed. 2012 (modified).	-	1-6
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) 22 nd ed. 2012.	3 g/m ³	1-6
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22 nd ed. 2012.	-	1-6
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-6
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.00053 g/m ³	1-6
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-6
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.0011 g/m ³	1-6
C7 - C9	Head Space, GCMS analysis.	0.06 g/m ³	1-6

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