Wellington Water

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Me Heke Ki Pōneke

Western Wastewater Treatment Plant

Annual Resource Consents Report 2021/2022

Your public water company

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Control Sheet

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1	Final	27/07/2022	Approved by Manager Wastewater Contracts

Executive Summary

This report has been prepared on behalf of the Wellington City Council (WCC) for compliance with the following resource consents:

WGN060283[35255]

This coastal permit allows WCC to continuously discharge disinfected secondary (fully treated) effluent to the Wellington South Coast coastal marine area (Cook Strait in the vicinity of the Karori Stream Mouth) via an existing outfall. The map reference for the discharge location is NZMS 260: R27; 504.836.

WGN060283[25227]

This coastal discharge permit allows WCC to occasionally discharge milli-screened (partially treated) effluent to the Wellington South Coast marine area (cook Strait in the vicinity of the Karori Stream Mouth) via an existing outfall during significant wet weather events. The map reference for the discharge location is NZMS 260: R27; 504.836.

WGN060283[35674]

This discharge permit allows WCC to occasionally discharge secondary treated and disinfected wastewater from the Western Wastewater Treatment Plant to Karori Stream during events when the stormwater tank is full and the flow to the plant exceeds 190L/s. The map reference for the discharge location is NZMS 260: R27; 2652332.5987157.

WGN060283[35675]

This discharge permit allows WCC to occasionally discharge milli-screened and settled wastewater from the Western WWTP to Karori stream during events when the stormwater tank is full and the flow to the plant exceeds 390L/s. The map reference for the discharge location is NZMS 260: R27; 2652332.5987157.

WGN060283[25230]

This discharge permit allows WCC to discharge contaminants to air from the operation of the Western WWTP.

The report will cover the period from 1 July 2021 to 30 June 2022.

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Resource Consent

WGN060283[35255]

Effluent discharge from the Western WWTP is governed by the resource consent under the Greater Wellington Regional Council consent file number WGN060283 [35255]. In general, the consent allows the continuous discharge disinfected secondary (fully treated) effluent to the Wellington South Coast coastal marine area (Cook Strait in the vicinity of the Karori Stream Mouth) via an existing outfall. The following outlines the conditions of this resource consent required for this report.

WGN060283[25227]

In addition to the above resource consent, the discharge from the Western WWTP is governed by another resource consent under the Greater Wellington Regional Council consent file number WGN060283 [25227]. In general, the consent allows the occasional discharge of milli-screened (partially treated) effluent to the Wellington South Coast coastal marine area via an existing outfall during significant wet weather events. The following also outlines the conditions of this resource consent required for this report.

WGN060283[35674]

In addition to the above two (2) resource consents, the discharge from the Western WWTP is governed by another resource consent under the Greater Wellington Regional Council consent file number WGN060283 [35674]. In general, the consent allows the occasional discharge of secondary treated and disinfected wastewater from the Western WWTP to Karori Stream during events when the stormwater tank is full and the flow to the plant exceeds 190L/s. The following also outlines the conditions of this resource consent required for this report.

WGN060283[35675]

The fourth resource consent that governs the discharge from the Western WWTP is under the Greater Wellington Regional Council consent file number WGN060283 [35675]. In general, the consent allows for the occasional discharge of milli-screened and settled wastewater from the Western WWTP to Karori stream during events when the stormwater tank is full and the flow to the plant exceeds 390L/s. The following also outlines the conditions of this resource consent required for this report.

WGN060283[25230]

The final resource consent that governs the discharge from the Western WWTP is under the Greater Wellington Regional Council consent file number WGN060283 [25230]. In general, the consent allows the discharge of contaminants to air from the operation of the Western WWTP. The following also outlines the conditions of this resource consent required for this report.

WGN060283 [35255]

Condition (2)

The rate of discharge shall not exceed 200 litres per second (L/s) or 17, 280 cubic metres per day (m^3/day).

The daily dicharge volume from the WWTP and the pipeline is illustrated in Figure 1. Daily rainfall was also included to show the effect of wet weather events to the volume being discharged by the plant. It is evident that high discharge volumes occur when there is heavy rainfall in the catchment.

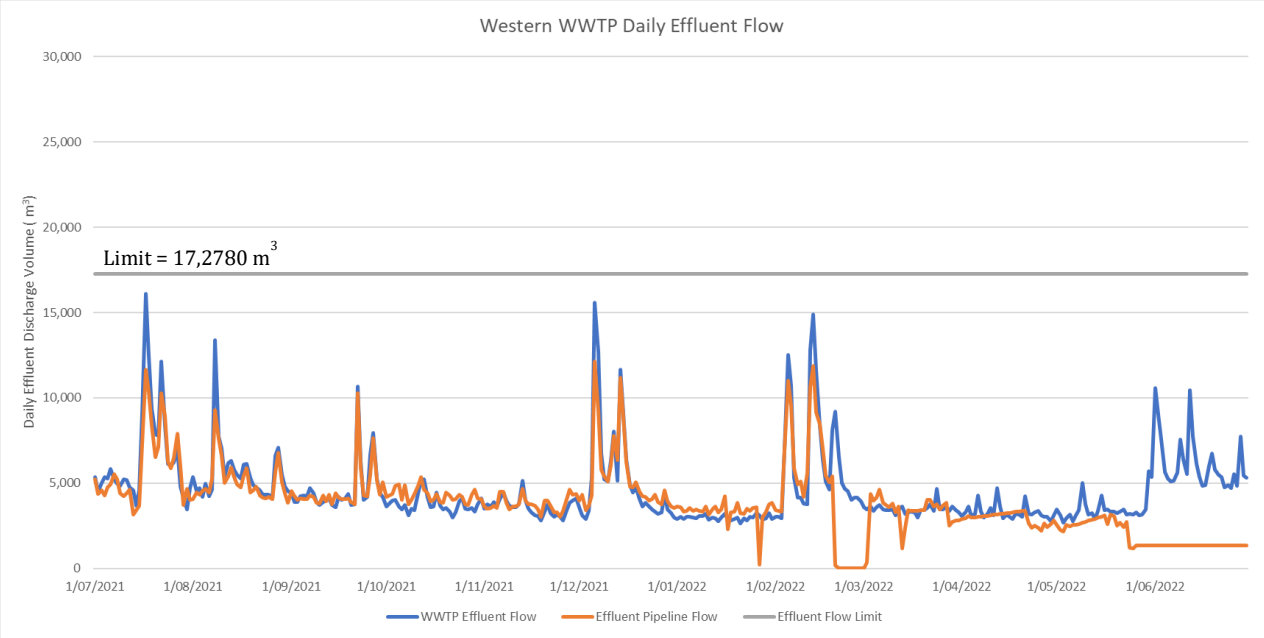


Figure 1: Western WWTP Effluent Flow

Please note that the discharge limit specified in WGN060283 [35255], Condition (2) applies to the discharge from the effluent pipeline to the coastal marine area. It is not applicable to other discharges from the WWTP.

The values between the WWTP effluent flow and the effluent pipeline flow will not have the same values due to the following factors:

1. The distance between the two flow meters
2. The type and condition of the flow meters

It can be noted that although the values do not match, they trend with each other.

The effluent pipeline was damaged during the cyclone Dovi last February 2022. Wellington Water had over-pumping setup to continuously discharge to the outfall pipe. The main repair on the outfall had been completed in July 2022. The details of the repair can be found on the Outfall Maintenance Annual Report.

Condition (5)

The permit holder shall establish a community liaison·group (CLG) which shall act as a forum for consultation and liaison with the community and be used as a vehicle to provide information regarding the Western Wastewater Treatment Plant. The permit holder shall invite persons with an interest in participating in the CLG from the following groups:

- representatives of local Tangata Whenua;
- neighbouring and downstream landowners;
- ., residents of South Karori Road;
- a representative from the Makara-Ohariu Community Board;
- a representative of the West Wellington Environmental Protection Society Inc;
- a representative of the permit holder; and
- a representative of the plant operator.

The permit holder may invite any other parties to attend.

A meeting of the CLG shall be held at least once every calendar year. Minutes of any CLG meetings held shall be forwarded to the Manager, Environmental Regulation, Wellington Regional Council and the permit holder shall report in writing to the Manager, Environmental Regulation, Wellington Regional Council, by 31 July each year on any consultation and activities undertaken with regard to the CLG. A copy of this report shall be forwarded to the CLG members.

Note: The permit holder shall not be in breach of this condition if, after taking all reasonable measures, and its best endeavours, it has not been possible to gain the requisite participation.

The Western WWTP community liaison group met on 29th September 2021. The minutes of the meeting were circulated to the group.

Condition (10)

The wastewater discharged from the Western Wastewater Treatment Plant to the South Coast shall comply with the following effluent quality criteria:

(i) BOD_5

The geometric mean of 20 consecutive sampling results taken in any calendar month shall not exceed $20g/m^3$ and no more than two of those 20 sample results shall exceed $50g/m^3$.

(ii) Suspended solids

The geometric mean of 20 consecutive sampling results shall not exceed $30g/m^3$ and no more than two in any 20 consecutive sample results shall exceed $80g/m^3$.

(iii) Faecal Coliforms

The geometric mean of 20 consecutive sampling results taken in any calendar month shall not exceed 200 colony forming units per 100mL and no more than two of those 20 sample results shall exceed 2,000 colony forming units per 100 mL.

Compliance with the effluent quality criteria shall be determined from the results of wastewater monitoring undertaken in accordance with conditions (9) (a) and (9) (b) of this permit.

Note: When the consent holder takes more than 20 samples during any calendar month, the geometric mean calculated for condition 10 must only be of the first 20 consecutive samples. All samples after the 20th sample in any calendar month shall be disregarded for the geometric mean calculation. All sample results are to be provided to Wellington Regional Council in the quarterly report required by condition 19.

Amended Condition 10 Clause effective 1st April 2022

The wastewater discharged from the Western Wastewater Treatment Plan to the South Coast shall comply with the following effluent quality criteria:

(i) BOD5

The geometric mean of any 90 consecutive daily sample results shall not exceed 20 g/m3, and no more than 18 sample results in any 90-day period (or 15 consecutive sample results in any 90-day period) shall exceed 50 g/m3.

(ii) Suspended solids

The geometric mean of any 90 consecutive daily sample results shall not exceed 30 g/m3 and no more than 18 sample results in any 90-day period (or 15 consecutive sample results in any 90-day period) shall exceed 80 g/m3.

(iii) Faecal Coliforms

The geometric mean of any 90 consecutive daily sample results shall not exceed 200 colony forming units per 100 ml and no more than 18 sample results in any 90-day period (or 15 consecutive sample results in any 90-day period) shall exceed 2,000 colony forming units per 100ml.

Compliance with the effluent quality criteria shall be determined from the results of wastewater monitoring undertaken in accordance with conditions (9) (a) and (9) (b) of this permit.

Please note that condition 10 has been amended to revise the assessment of the Western WWTP's compliance from 20 -day calendar period to a 90-day rolling period. The change was effective by 1st April 2022.

Section (i)

Below is a summary of the geometric mean and % compliance for the Biological Oxygen Demand from July 2021 to March 2022.

Date	Biological Oxygen Demand	
	Geometric Mean	%Compliance
	g/m³	%
31 July 2021	11	95
31 August 2021	9	100
30 September 2021	10	100
31 October 2021	10	100
30 November 2021	18	80
31 December 2021	11	95
31 January 2022	7	100
28 February 2022	8	100
31 March 2022	9	100
Limits	**20**	**90**

Table 1: Carbonaceous Biological Oxygen Demand Geometric Mean and % Compliance

Below is a summary of the geometric mean and 80th percentile for the effluent Biological Oxygen Demand from April 2022 to June 2022.

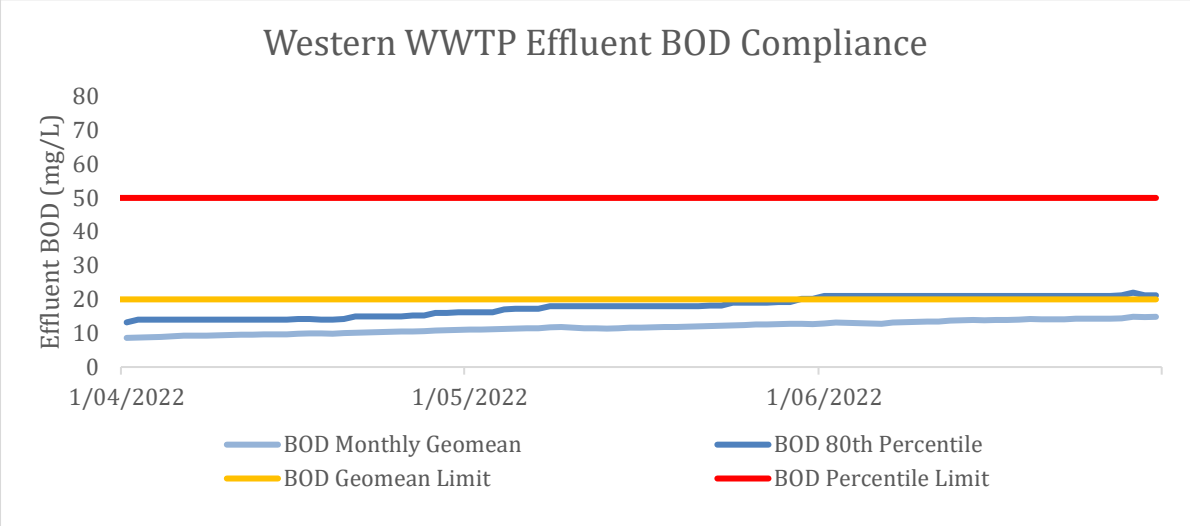


Figure 2: Western WWTP Carbonaceous Biological Oxygen Demand Compliance

A graphical representation of the daily effluent results can be found in Appendix i: Daily Effluent Results. The daily values can be found in quarterly reports and certificates of laboratory analysis can be provided upon request.

Effluent BOD was noncompliant for November 2021.

Section (ii)

Below is a summary of the geometric mean and percent compliance for the Suspended Solids.

Date	Suspended Solids	
	Geometric Mean	%Compliance
	g/m³	%
31 July 2021	17	95
31 August 2021	9	100
30 September 2021	14	100
31 October 2021	12	100
30 November 2021	25	80
31 December 2021	9	95
31 January 2022	9	100
28 February 2022	8	100
31 March 2022	8	100
Limits	**30**	**90**

Table 2: Suspended Solids Geometric Mean and % Compliance

Below is a summary of the geometric mean and 80th percentile for effluent suspended solids from April 2022 to June 2022.

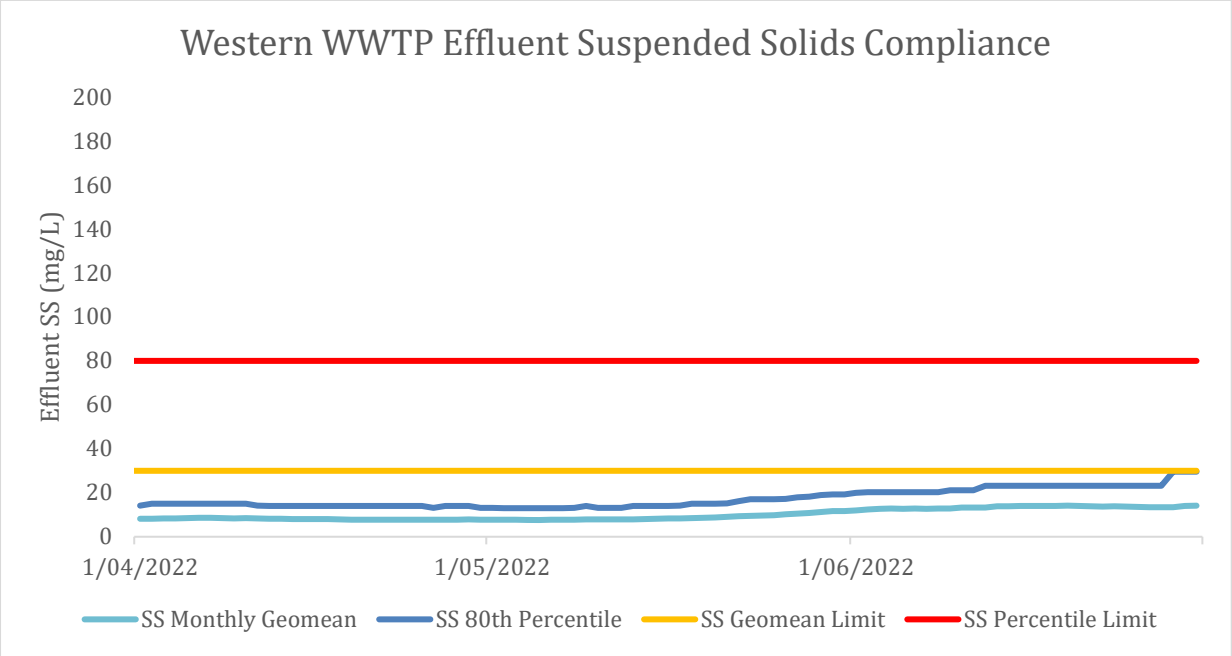


Figure 3: Western WWTP Suspended Solids Compliance

A graphical representation of the daily effluent results can be found in Appendix i: Daily Effluent Results. The daily values can be found in quarterly reports and certificates of laboratory analysis can be provided upon request.

Effluent suspended solids were noncompliant for November 2021.

Section (iii)

Below is a summary of the geometric mean and percent compliance for the Faecal Coliforms.

Date	Faecal Coliforms	
	Geometric Mean	% Compliance
	g/m³	%
31 July 2021	20	100
31 August 2021	9	100
30 September 2021	9	100
31 October 2021	12	100
30 November 2021	38	90
31 December 2021	37	85
31 January 2022	17	100
28 February 2022	42	90
31 March 2022	8	100
Limits	**200**	**90**

Table 3: Faecal Coliforms Results, Geometric Mean, and % Compliance

Below is a summary of the geometric mean and 80th percentile for effluent faecal coliform from April 2022 to June 2022.

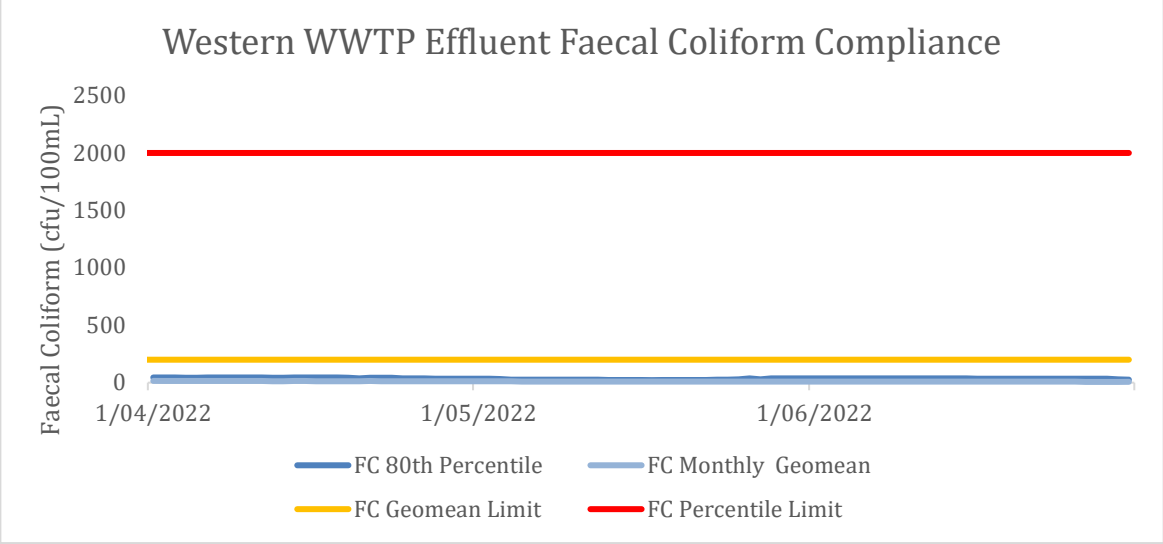


Figure 4: Western WWTP Faecal Coliform Compliance

A graphical representation of the daily effluent results can be found in Appendix i: Daily Effluent Results. The daily values can be found in quarterly reports and certificates of laboratory analysis can be provided upon request.

Effluent faecal coliform was noncompliant for December 2021.

Condition (16)

The permit holder shall collect representative coastal water samples from knee deep water at the following locations, once each month for five months through November to March inclusive (the bathing season) each year, for the duration of this permit:

a) 100m SE of the outfall (map reference NZMS 260: R27; 504.835)
b) 200m SE of the outfall (map reference NZMS 260: R27; 504.834)
c) The Karori Stream, above the tidal influence
d) 100m NW of the mouth of the Karori Stream

Sampling shall be undertaken during dry, settled weather where practicable. Each of the water samples shall be analysed for faecal coliform and enterococci bacteria (cfu/100ml). The time of the sample collection, together with the weather and tidal conditions, observations of the sea state, stream colour and location of stream mouth (if at all) shall be recorded and reported with the analytical results.

Water samples taken during the months of January to March inclusive, shall also be analysed for the following parameters:

Ammoniacal nitrogen	g/m^3
Nitrite nitrogen	g/m^3
Nitrate nitrogen	g/m^3
Dissolved reactive phosphorus	g/m^3

The permit holder shall provide the results to the Manager, Environmental Regulation, Regional Council, by 30 April each year (as part of the quarterly report required by condition (19) of this permit), or on request.

Following is a summary of the analytical results for the November to March monthly coastal water samples.

Date	100m SE of the Outfall								
	Enterococci	Faecal Coliforms	Ammoniacal Nitrogen	Nitrite Nitrogen	Nitrate Nitrogen	Dissolved Reactive Phosphorus	Sea Conditions	Tide	Weather
dd/mm/yyyy	cfu/100mL	cfu/100mL	g/m³	g/m³	g/m³	g/m³	--	--	--
26/11/2021	9.1	9.1	N/A	N/A	N/A	N/A	Low	Flood	Cloudy
30/12/2021	1.8	1.8	N/A	N/A	N/A	N/A	Low	Ebb	Overcast
28/01/2022	3.6	1.8	0.4	0.002	0.0069	0.028	High	Flood	Cloudy
23/02/2022	160	76	0.04	0.002	0.12	0.078	Low	Flood	Overcast
31/03/2022	5.5	1.8	<0.4	0.0029	0.16	0.035	High	flood	calm

Table 4: 100m SE of the Outfall

Date	200m SE of the Outfall								
	Enterococci	Faecal Coliforms	Ammoniacal Nitrogen	Nitrite Nitrogen	Nitrate Nitrogen	Dissolved Reactive Phosphorus	Sea Conditions	Tide	Weather
dd/mm/yyyy	cfu/100mL	cfu/100mL	g/m³	g/m³	g/m³	g/m³	--	--	--
26/11/2021	5.5	3.6	N/A	N/A	N/A	N/A	Low	Flood	Cloudy
30/12/2021	2	1.8	N/A	N/A	N/A	N/A	Low	Ebb	Overcast
28/01/2022	4	1.8	0.4	0.002	0.014	0.029	High	Flood	Cloudy
23/02/2022	270	72	0.4	0.002	0.096	0.078	Low	Flood	Overcast
31/03/2022	7.3	11	<0.4	0.0046	0.18	0.031	High	flood	calm

Table 5: 100m SE of the Outfall

Date	The Karori Stream, Above the Tidal Influence								
	Enterococci	Faecal Coliforms	Ammoniacal Nitrogen	Nitrite Nitrogen	Nitrate Nitrogen	Dissolved Reactive Phosphorus	Colour of Stream	Location of Stream Mouth	Weather
dd/mm/yyyy	cfu/100mL	cfu/100mL	g/m^3	g/m^3	g/m^3	g/m^3	--	--	--
26/11/2021	1000	860	N/A	N/A	N/A	N/A	Clear	Beside Outfall	Cloudy
30/12/2021	74	240	N/A	N/A	N/A	N/A	Clear	Beside Outfall	Overcast
28/01/2022	160	86	0.4	0.0027	0.35	0.045	Clear	Beside Outfall	Cloudy
23/02/2022	110	210	0.04	0.0225	1.1	0.049	Clear	Beside Outfall	Overcast
31/03/2022	160	480	<0.4	0.0021	0.99	0.047	High	Ebb	calm

Table 6: The Karori Stream, Above the Tidal Influence

Date	100m NW of the Mouth of the Karori Stream								
	Enterococci	Faecal Coliforms	Ammoniacal Nitrogen	Nitrite Nitrogen	Nitrate Nitrogen	Dissolved Reactive Phosphorus	Sea Conditions	Tide	Weather
dd/mm/yyyy	cfu/100mL	cfu/100mL	g/m^3	g/m^3	g/m^3	g/m^3	--	--	--
26/11/2021	7.3	9.1	N/A	N/A	N/A	N/A	Low	Flood	Cloudy
30/12/2021	3.6	1.8	N/A	N/A	N/A	N/A	Low	Ebb	Overcast
28/01/2022	3.6	3.6	0.4	0.0027	0.35	0.033	High	Flood	Cloudy
23/02/2022	130	58	0.4	0.002	0.11	0.082	Low	Flood	Overcast
31/03/2022	160	170	<0.4	<0.002	0.31	0.024	High	flood	calm

Table 7: 100m NW of the Mouth of the Karori Stream

Condition (20)

The permit holder shall provide to the Manager, Environmental Regulation, Wellington Regional Council an Annual Assessment and Analysis Report for the period 1 July to 30 June by 31 July each year summarising compliance with the conditions of this permit. This report shall include, but not be limited to the following:

a) A summary of all monitoring undertaken in accordance with the conditions of this permit and a critical analysis of the information in terms of compliance and adverse environmental effects;
b) A comparison of data with previously collected data in order to identify any emerging trends;
c) Comments on compliance with the conditions of this permit;
d) Any reasons for non-compliance or difficulties in achieving compliance with the conditions of this permit;
e) Any measures that have been undertaken to improve the environmental performance of the wastewater treatment and disposal system;
f) Any other issues considered to be important;

Section (a)

Table 5 summarises all the treatment plant data monitored from July 2020 to June2021. The median, minimum and maximum values are tabulated for each parameter.

Parameter	Units	Geomean Limit	Minimum	Median	80th Percentile	Maximum
WWTP Effluent Discharge	m^3	-	2,646	3,841	5,349	16,090
Effluent BOD	g/m^3	20	1	11	16	180
Effluent Suspended Solids	g/m^3	30	1	11	19	460
Effluent Faecal Coliform	cfu/100mL	200	2	10	37	66,332

Table 8: Summary of WWTP Monitoring Data

The median values of all the daily effluent quality parameters such as BOD, suspended solids and faecal coliform are within the geomean limits.

The median values for the receiving water monitoring for this reporting period are tabulated in Table 6.

Parameter	100m SE of the Outfall	200m SE of the Outfall	The Karori Stream, Above the Tidal Influence	100m NW of the Mouth of the Karori Stream
Enterocci	5.5	5.5	160	7.3
Faecal Coliform	1.8	3.6	240	9.1
Ammoniacal Nitrogen	0.22	0.4	0.22	0.4
Nitrite Nitrogen	0.002	0.002	0.0027	0.00235
Nitrate Nitrogen	0.12	0.096	0.99	0.31
Dissolve Reactive Phosporus	0.035	0.031	0.047	0.033

Table 9: Summary of Receiving Environment Monitoring Data

The average enterococci and faecal coliform values for both 100m and 200m SE of outfall is well below the bathing season limit which is 35 cfu/100 mL and 150 cfu/100mL respectively.

Section (b)

A comparison of data was made between the last five financial years. The following section summarises that comparison.

Due to some missing data in the outfall effluent pipeline daily discharge volumes, WWTP effluent discharge volume is used to establish a trend. The WWTP discharge volume tends to increase during winter season and decreases during summer.

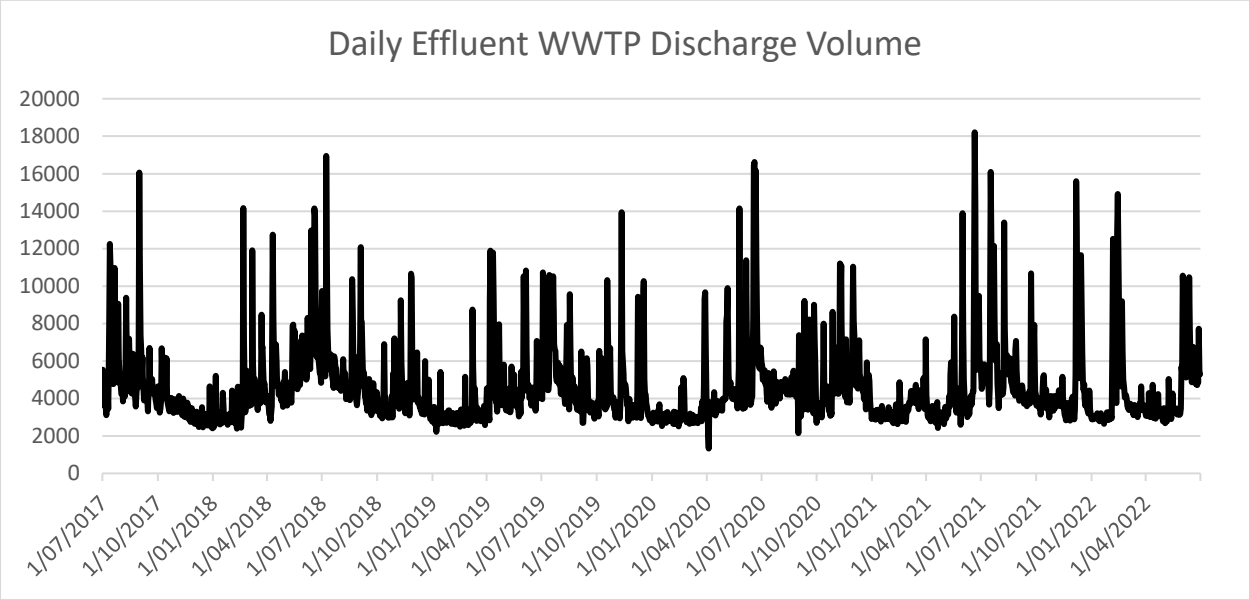


Figure 5: WWTP Effluent Discharge Volume versus Rainfall

WWTP Effluent BOD_5:

To establish a trend, all daily effluent BOD in the last five (5) years have been used. Please note that only the first 20 samples of each calendar month are used to assess compliance as stated in the resource consent until end of March 2022. The consent does not require daily effluent sampling thus there are some days with missing effluent BOD_5 results in the past years.

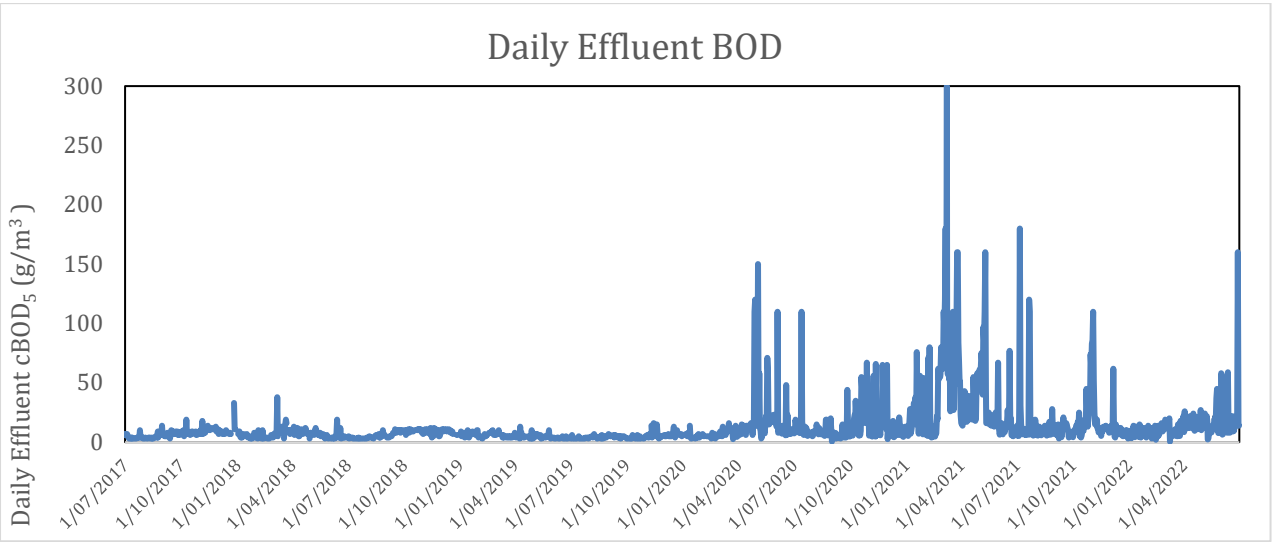


Figure 6: Daily Effluent BOD_5 results

To establish a trend, all daily effluent suspended solids in the last 5 years have been used. Please note that only the first 20 samples of each calendar month are used to assess compliance as stated in the resource consent until end of March 2022. The consent does not require daily effluent sampling thus there are some days with missing effluent suspended solids results in the past years.

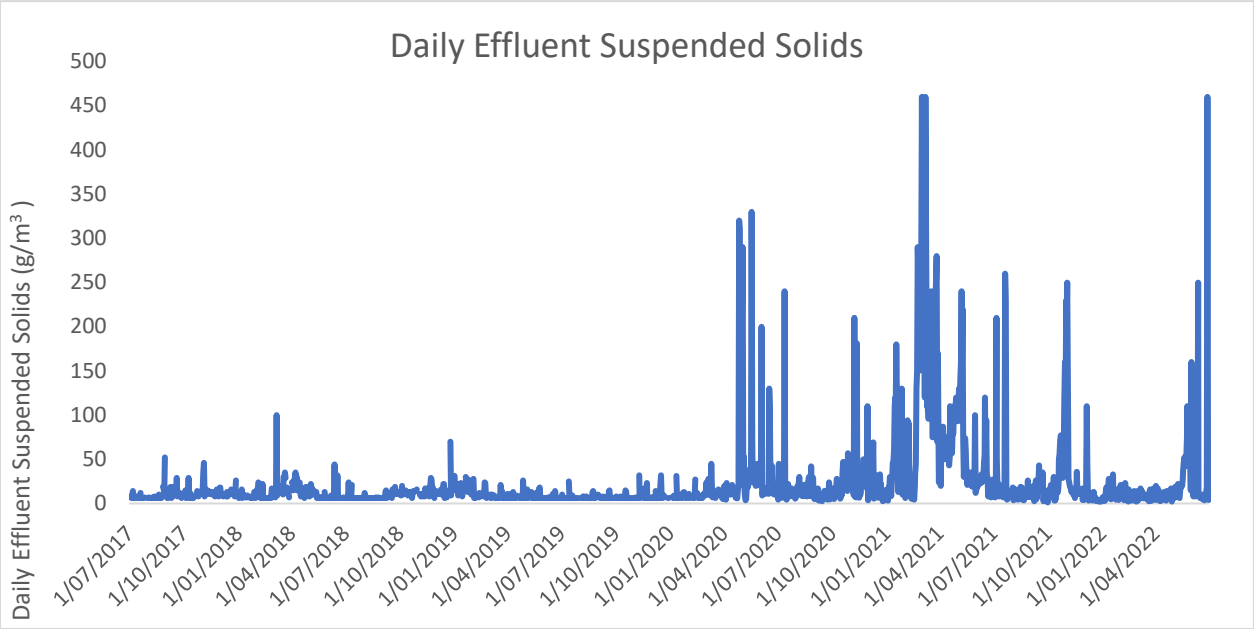


Figure 7: Daily Effluent Suspended Solids Results

WWTP Effluent Faecal Coliform:

To establish a trend, all daily effluent suspended solids in the last 5 years have been used. Please note that only the first 20 samples of each calendar month are used to assess compliance as stated in the resource consent. The consent does not require daily effluent sampling thus there are some days with missing effluent suspended solids results in the past years.

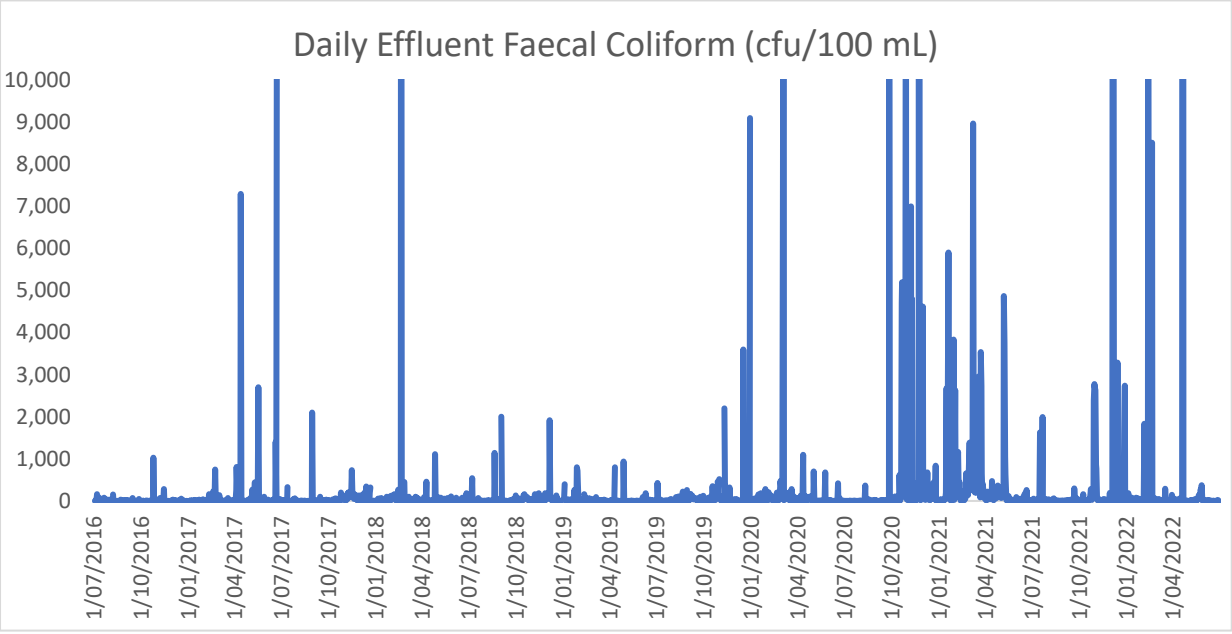


Figure 8: Daily Effluent Faecal Coliform Results

In figures 6,7 and 8, the effluent quality of the treatment plant seems to have deteriorated in financial year 2020/2021. A report regarding this exceedance was submitted to GWRC previously. The plant's performance had improved in FY2021/22 after some modifications have been made in the plant's operation.

The following is a comparison of the monthly coastal waters samples between the previous and current reporting period:

Parameter	Units	Karori Stream above Tidal Influence					100m North West of Karori Stream Mouth					100m South East of Western Outfall					200m South East of Western Outfall				
		2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022
Enterococci	**cfu/100mL**	501	48	19.2	37	160	23	8	5.6	42	7.3	12	4	4.8	33	5.5	23	40	5.6	32	5.5
Faecal Coliforms	**cfu/100mL**	294	134	74.8	151	240	10	10	5.6	32	9.1	7	4	4	20	1.8	30	13	8.8	22	3.6
Ammoniacal Nitrogen	**g/ m^3**	0.010	0.015	0.17	1.6	0.22	0.010	0.010	0.06	0.4	0.4	0.020	0.017	0.04	0.4	0.22	0.020	0.020	0.04	0.4	0.4
Nitrite Nitrogen	**g/ m^3**	0.010	0.010	0.4333	0.002	0.0027	0.100	0.100	0.4	0.003	0.00235	0.100	0.100	0.4	0.002	0.002	0.100	0.100	0.4	0.003	0.002
Nitrate Nitrogen	**g/ m^3**	0.7200	0.4500	0.2	0.643	0.99	0.1300	0.1300	0.09	0.15	0.31	0.0700	0.1000	0.1	0.067	0.12	0.0900	0.1000	0.1	0.174	0.096
Dissolved Reactive Phosphorus	**g/ m^3**	0.0300	0.0310	0.022	0.062	0.047	0.0200	0.0200	0.0187	0.062	0.033	0.0200	0.0240	0.0163	0.051	0.035	0.0200	0.0320	0.0173	0.023	0.031

Table 10: Coastal Monitoring

The results were consistent throughout the 5 year period.

Section (c)

Western WWTP was not able to consistently meet its compliance requirement for this financial year. Wellington Water had received an abatement notice in November 2021 due to discharge of non-compliant effluent quality from 29 October 2021 to 4 November 2021.

Section (d)

Veolia's investigation reports regarding the non-compliances indicated that the cause of these exceedances can be attributed to several factors such as:

- Plant's process control of the return activated sludge (RAS) flow
- Seasonal fluctuation of hydraulic and organic loading

Section (e)

Wellington Water and Veolia have implemented some changes in the operation of the treatment plant such as modifying the control philosophy of how the plant of the RAS flow. The plant's operation is still being continuously monitored.

Section (f)

Wellington Water submitted an s127 to modify the compliance calculation of the treatment plant a 20-day calendar period to a 90-day rolling period. The 80th percentile and geomean limits are used to assess compliance. The change had been approved by GWRC and was implemented on April 2022.

Condition (23)

The permit holder shall submit an annual report for the main outfall pipeline, which addresses activities undertaken during the previous year, to the Manager, Environmental Regulation, Wellington Regional Council and members of the CLG, by 31 July each year.

This report shall include, but not be limited to, the following elements:

a) details of the location, extent and duration of any leakage or faults, and the timing, nature and success of remedial action taken to remedy the leaks or faults;
b) details of any other works (including any repairs and replacements) undertaken during the past year; and
c) any work planned in the next 12 months to repair or replace the pipeline.

A report regarding the main outfall pipeline can be found in Appendix iii: Western Treatment Plant: Annual Outfall Pipeline Report_2021 -2022.

Condition (25)

The permit holder shall collect representative water samples from the Karori Stream at the following locations, once every fortnight for the duration of this permit:

a) Karori Stream at Friend Street (map reference NZMS 260: R27; 554.901)
b) Karori Stream at Campbell Street (map reference NZMS 260: R27; 554.900)
c) Karori Stream at South Karori Road (map reference NZMS 260: R27; 540.880)
d) Karori Stream approximately 100 metres upstream of the Western Treatment Plant (map reference NZMS 260: R27; 523.872)
e) Karori Stream 100 metres approximately downstream of the Western Treatment Plant (map reference NZMS 260: R27; 523.871)

The water samples shall be analysed for faecal coliforms (cfu/100mL). The time of the sample collection, together with the weather conditions shall be recorded and reported with the analytical results.
The permit holder shall provide the results of this monitoring to the Manager, Environmental Regulation, Wellington Regional Council, quarterly, in accordance with the requirements of condition (19) of this permit, or on request.

The Karori Stream monitoring records can be found in Appendix v of this report.

WGN060283 [25227]

Condition (2)

This permit shall only be exercised when the sewage inflow to the treatment plant exceeds 190 litres per second (L/s), and the 1000 m^3 storage tank is full.

There were eight bypass events that discharge partially treated effluent to Cook Strait via an existing outfall that occurred in the 2021/2022 reporting year. These events had an influent flow rate to the Western WWTP greater than 190L/s and the 1000m^3 storage tank was full. This resource consent can be applied.

Condition (5)

The permit holder shall monitor and record the time, flow rate, duration and total volume of the bypass discharges into the coastal marine area, and shall report the results to the Manager, Environmental Regulation, Wellington Regional Council, within 10 working days of the overflow event occurring.

The permit holder shall maintain an incident log containing the details of each bypass discharge and make it available to the public or the Manager, Environmental Regulation, Wellington Regional Council upon request.

The following is a summary of the bypass events from the Western WWTP for the 2021/2022 reporting period.

Date	Duration	Average Discharge Flow Rate	Max Discharge Flow Rate	Total Volume of Bypass	Consented	Cause
dd mmm yyyy	hrs/mins	L/s	L/s	m^3	Y/N	--
17 Jul 2021	15hr 26m	165	239	9,199	Y	Storm Event
22 Jul 2021	03hr 23m	56	97	689	Y	Storm Event
08 Aug 2021	09hr 58m	46	108	1,331	Y	Storm Event
22 Sep 2021	00hr 43m	5	12	13	Y	Storm Event
06 Dec 2021	32hr 14m	80	191	8,449	Y	Storm Event
05 Feb 2022	27hr 07m	74	181	1,613	Y	Storm Event
12 Feb 2022	40hr 17m	175	303	25,357	Y	Storm Event
20 Feb 2022	05hr 24m	70	171	1,360	Y	Storm Event

Table 11: Coastal Marine Area Bypass Events from 2021/2022 Reporting Period

Condition (6)

The permit holder shall submit to the Manager, Environmental Regulation, Wellington Regional Council the amount of rainfall recorded in each hour at Karori Reservoir rain-gauge for each of the 7 days preceding each overflow event in the annual report required by condition (10) of this permit.

The bypass events occurred on several days during the reporting period. The following figures are of the hourly rainfall rate for the seven days prior to the overflow events. All rainfall data is obtained from the GWRC Environmental Monitoring and Research website. The current rain gauge used is Karori Sream at Samuel Marsden School. A graphical representation of the plant's hourly inflow versus the hourly rainfall data are shown for all the bypass discharge events. It can be noted that the plant's inflow is greatly affected by inflow and infiltration in the catchment especially during wet weather events.

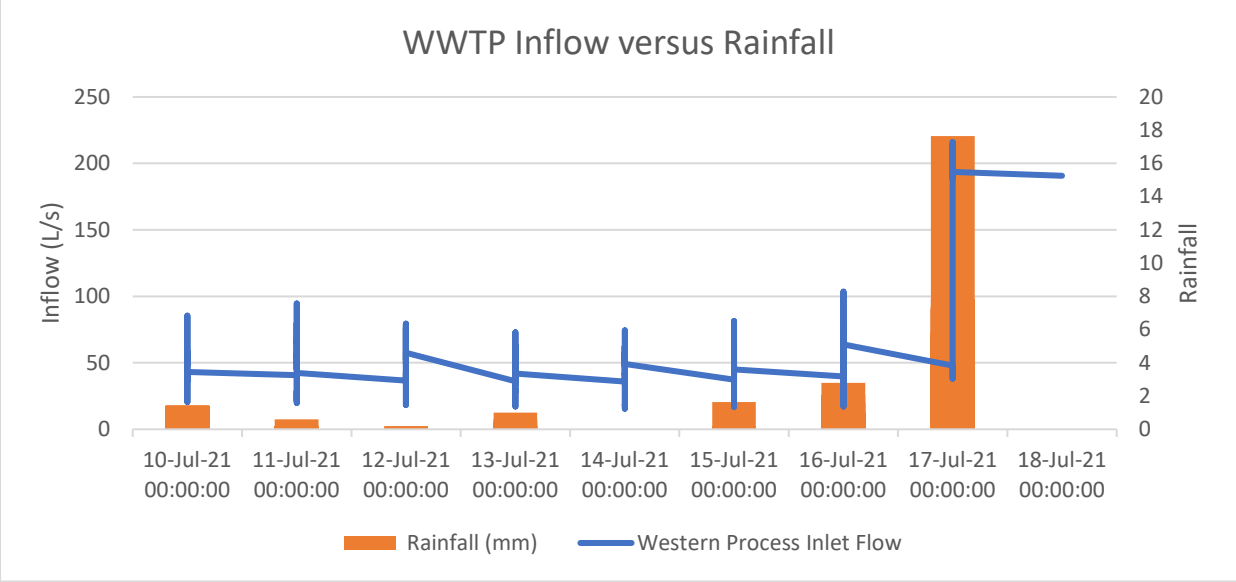


Figure 9: Rainfall and Inflow Data for 7 days prior 17/07/2021 Bypass Event

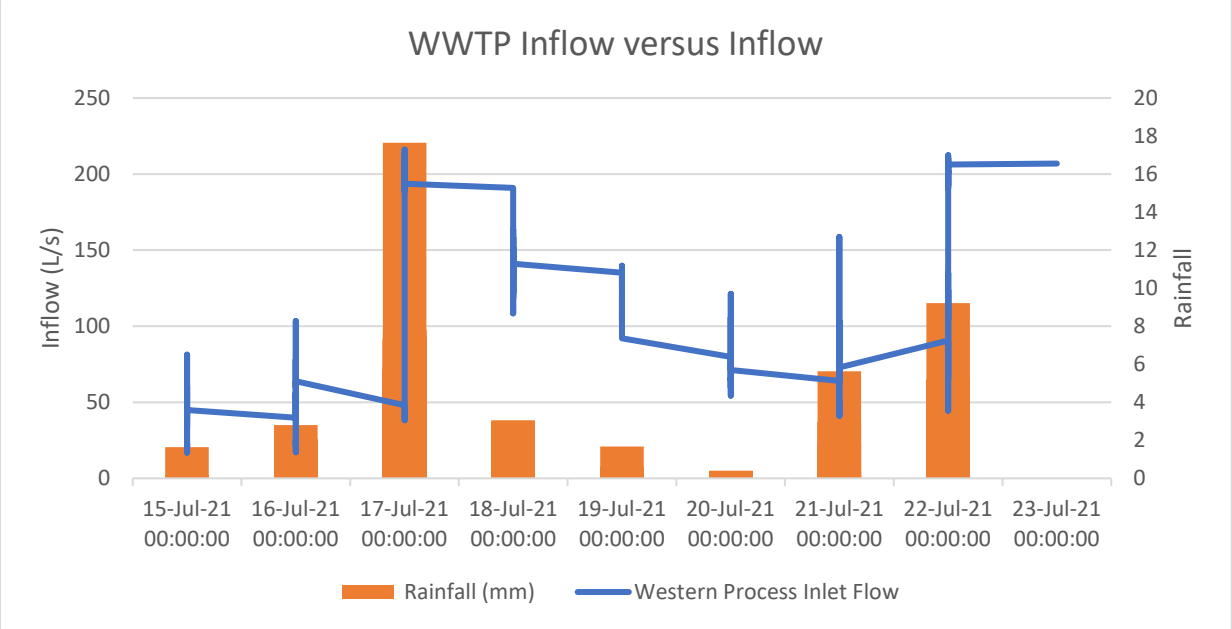


Figure 10: Rainfall and Inflow Data for 7 days prior 22/07/2021 Bypass Event

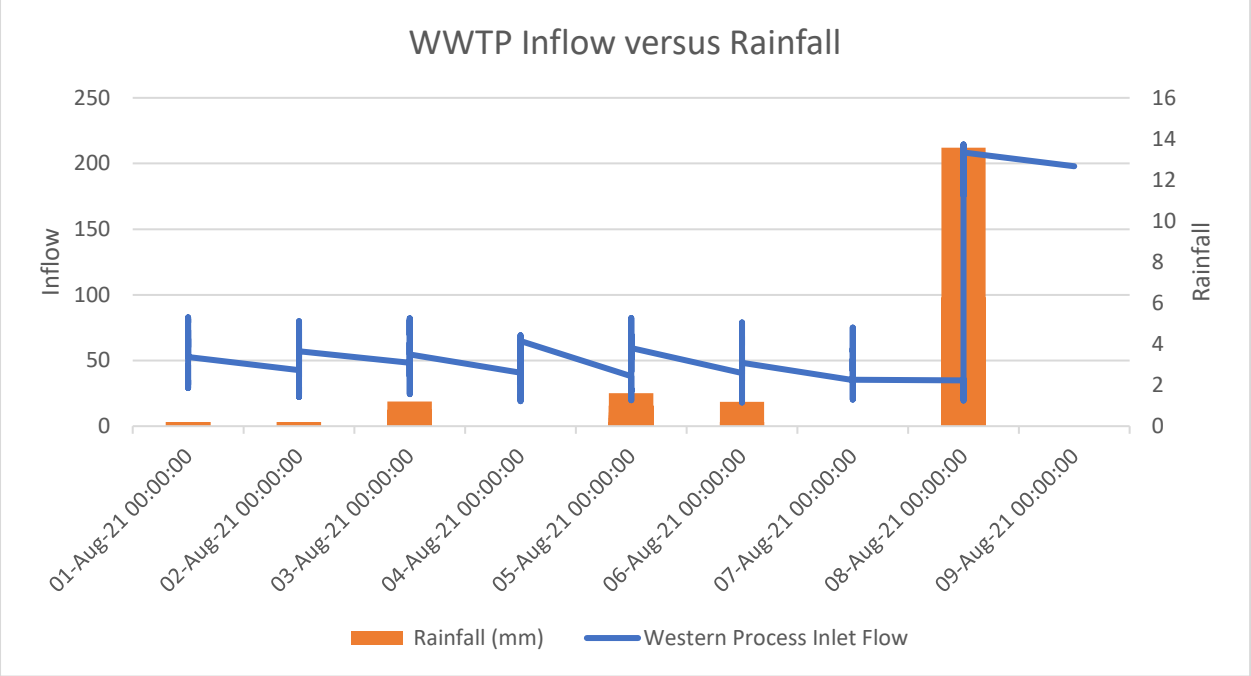


Figure 11: Rainfall and Inflow Data for 7 days prior 8/08/2021Bypass Event

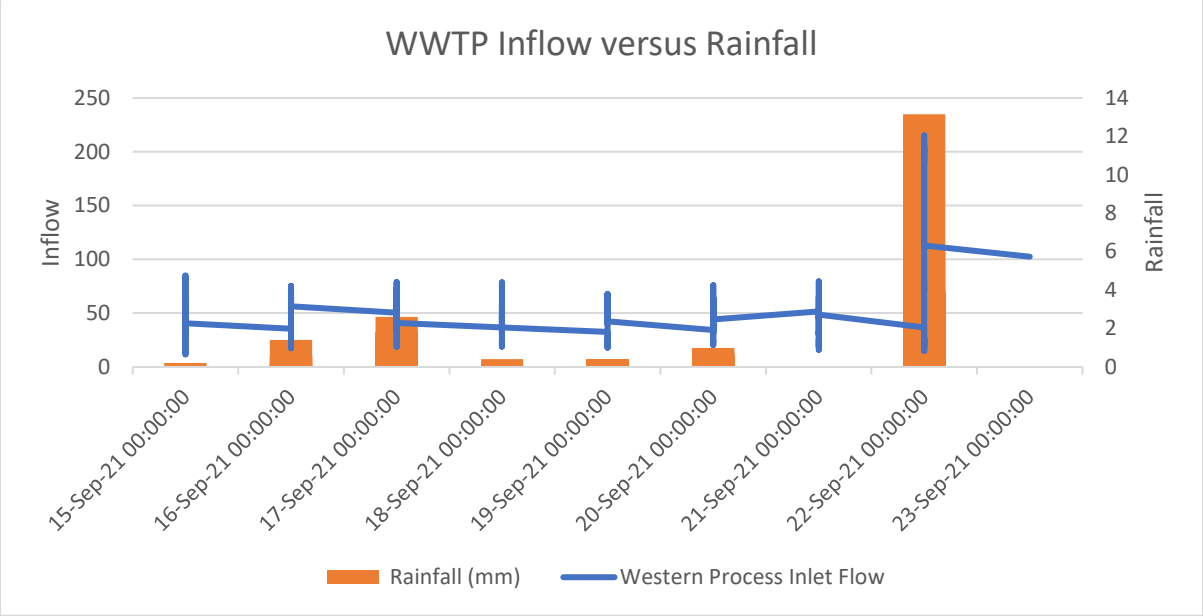


Figure 12: Rainfall and Inflow Data for 7 days prior 22/09/2021 Bypass Event

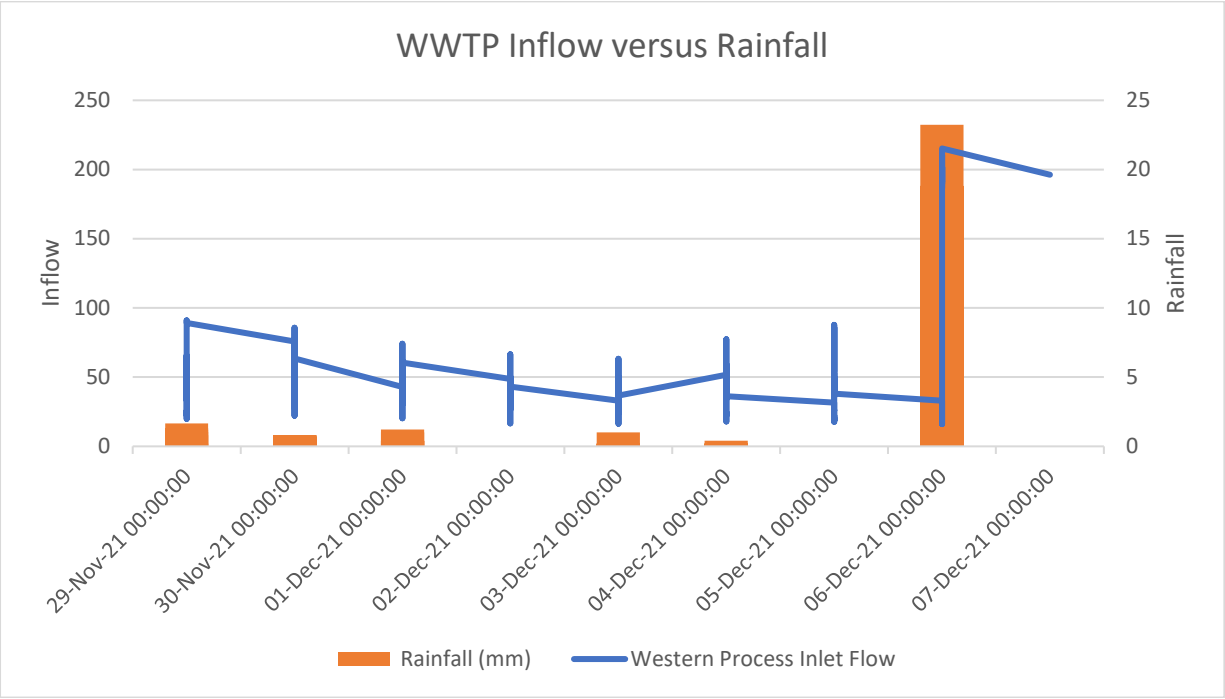


Figure 13: Rainfall and Inflow Data for 7 days prior 6/12/2021 Bypass Event

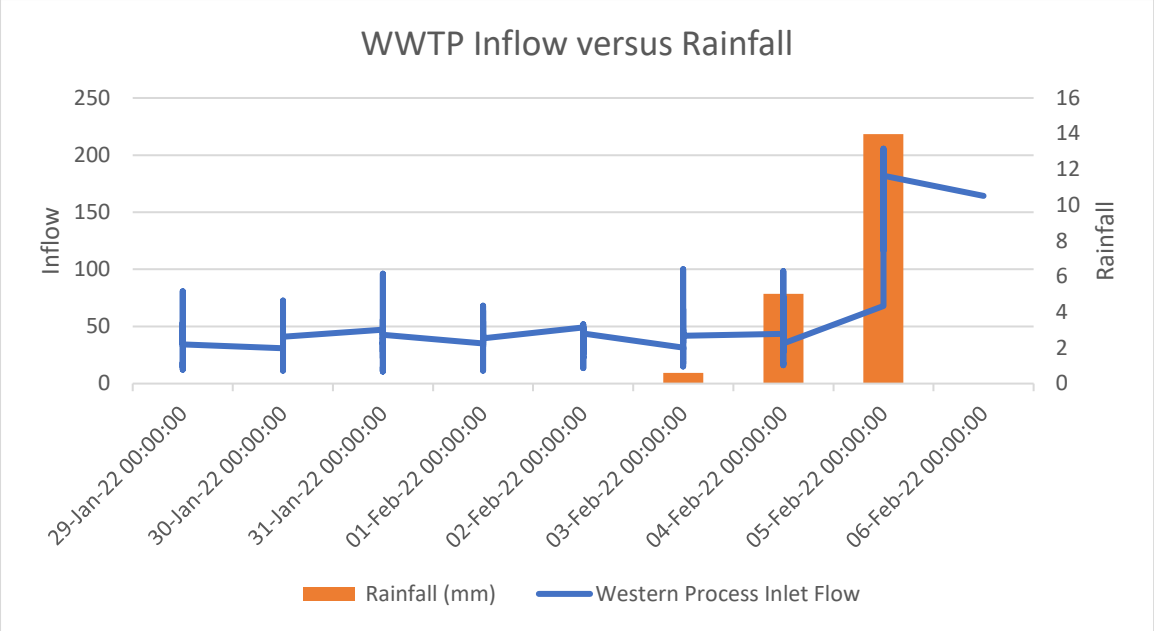


Figure 14: Rainfall and Inflow Data for 7 days prior 5/02/2022 Bypass Event

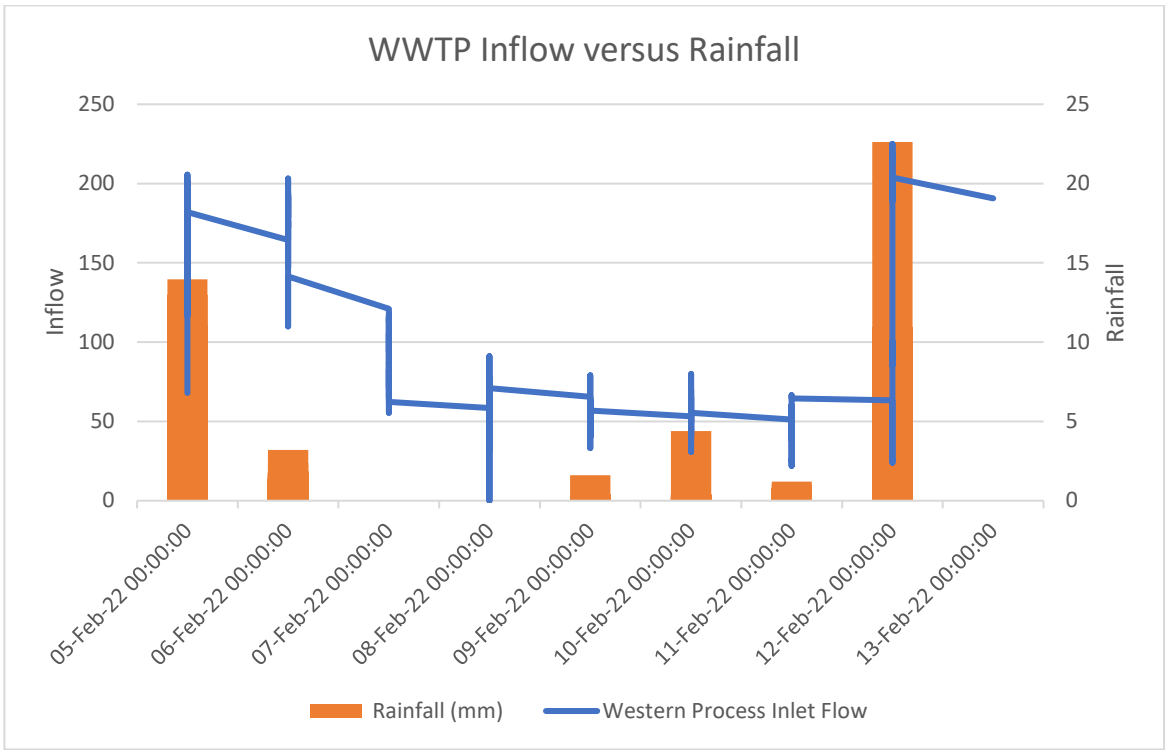


Figure 15: Rainfall and Inflow Data for 7 days prior 12/02/2022 Bypass Event

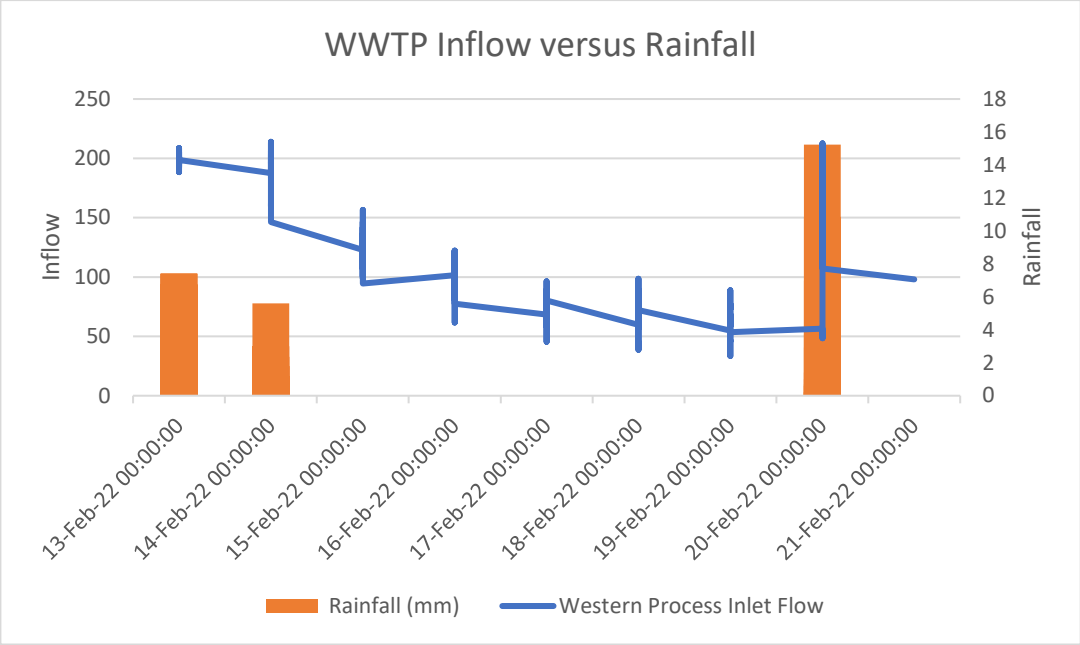


Figure 16: Rainfall and Inflow Data for 7 days prior 20/02/2022 Bypass Event

Condition (7)

The permit holder shall take one representative grab sample of the settled, milli-screened effluent prior to its entry into the coastal outfall pipe every time the discharge authorised by this permit has occurred for more than two hours. Each sample shall be analysed for the following parameters:

pH	
Suspended solids	g/m^3
Total BOD_5	g/m^3
Faecal coliform	cfu/100mL
bacteria oils/grease	g/m^3

The results of the monitoring shall be forwarded to the Manager, Environmental Regulation, Wellington Regional Council within 10 working days of the bypass discharge occurring.

Below is a summary of the results obtained from the sample analysis during bypass events:

Date	pH	Suspended Solids	Total BOD5	Faecal Coliform Bacteria	Oils/Grease
	--	g/m^3	g/m^3	cfu/100mL	g/m^3
17/07/2021	7.3	38	18	250,000	11.0
23/07/2021	7.1	29	26	410,000	13.0
9/08/2021	7.1	26	29	380,000	5.6
23/09/2021	7.1	30	26	610,000	11.4
6/12/2021	7.2	53	37	610,000	7.4
5/02/2022	7.2	42	16	250000	10
13/02/2022	7	17	3.9	34000	9.6
20/02/2022	7.1	25	10	460000	8.4

Table 12: Bypass Sample Analysis

The analytical data sheets for these samples can be found in the quarterly reports.

Condition (8)

When a bypass discharge occurs that lasts for longer than 10 hours the permit holder shall collect two sets of representative water samples from knee deep water at the following locations:

a) 100m SE of the outfall (map reference NZMS 260: R27; 504.835)
b) 200m SE of the outfall (map reference NZMS 260: R27; 504.834)
c) The Karori Stream, above the tidal influence
d) 100m NW of the mouth of the Karori Stream

The first set of samples shall be taken within 24 hours of the discharge commencing and the second set of samples shall be taken 12- 48 hours after the discharge has ceased.

These samples shall only be taken provided that safe vehicular access is available and weather conditions allow for safe access to the sample locations.

The water samples shall be analysed for enterococci bacteria (cfu/100ml). The time of the sample collection, together with the weather and tidal conditions shall be recorded and reported with the analytical results.

The results of the monitoring shall be forwarded to the Manager, Environmental Regulation, Wellington Regional Council within 10 working days of the bypass discharge occurring.

One bypass event in the first quarter met this requirement, the results of the analysis can be found below. The 100m NW of the Mouth of the Karori stream sample was not collected due to health and safety risk.

Site Name	Sample Date	Sample Time	Enterococci	Sea Conditions/ Colour of Stream	Tide/ Location of Stream Mouth	Weather
	dd/mm/yyyy	hh:mm	cfu/100mL	--	--	--
100m SE of the Outfall	18/07/2021	16:38	40	Mid	Ebb	Overcast
	20/07/2021	16:40	1.8	High	Ebb	Overcast
200m SE of the Outfall	18/07/2021	16:38	22	Mid	Ebb	Overcast
	20/07/2021	16:40	1.8	High	Ebb	Overcast
The Karori Stream, Above the Tidal Influence	18/07/2021	16:21	78	Clear	Beside Outfall	Overcast
	20/07/2021	16:35	24	Clear	Beside Outfall	Overcast
100m NW of the Mouth of the Karori Stream	18/07/2021	N/A	N/A	N/A	N/A	N/A
	20/07/2021	N/A	N/A	N/A	N/A	N/A

Table 13: July to September 2021 Quarter

One bypass event in the second quarter met this requirement, the results of the analysis can be found below. The 100m NW of the Mouth of the Karori stream sample was not collected due to health and safety risk.

Site Name	Sample Date	Sample Time	Enterococci	Weather	Tide/Location of Stream Mouth
	dd/mm/yyyy	hh:mm	cfu/100mL	--	
100m SE of the Outfall	8/12/2021	8:35	13	Cloudy	Flood
	10/12/2021	8:14	13	Overcast	Flood
200m SE of the Outfall	8/12/2021	8:35	25	Cloudy	Flood
	10/12/2021	8:14	7	Overcast	Flood
The Karori Stream, Above the Tidal Influence	8/12/2021	8:21	700	Cloudy	Next to outfall
	10/12/2021	8:23	220	Overcast	Next to outfall
100m NW of the Mouth of the Karori Stream	8/12/2021	N/A	N/A	N/A	N/A
	10/12/2021	6:19	9.1	Overcast	Flood

Table 14: October to December 2021 Quarter

Two discharges have exceeded the 10 hour threshold in the third quarter, however samples were not collected due to health and safety reasons. The Karori Stream was flooded, and the alternative route was unavailable.

Condition (12)

The permit holder shall provide the Manager, Environmental Regulation, Wellington Regional Council with an annual report detailing what steps have and will be taken to reduce infiltration and stormwater ingress into the Karori sewerage network.

The report shall be submitted to the Manager, Environmental Regulation, Wellington Regional Council by 31 July each year and shall include, but not be limited to, the following information:

a) Details of works that have been undertaken and what these works are expected to achieve;
b) An indication of when any ongoing works will be completed;
c) Details of any investigations undertaken with regard to inflow and infiltration in the Karori catchment; and
d) Details of any works or investigations planned for the next financial year.

Note: One annual inflow and infiltration report may be submitted to the Manager, Environmental Regulation, Wellington Regional Council to meet the requirements in this regard of permits WGN060283 [25226], [25227], [35674] and [25229].

An annual inflow and infiltration report can be found in Appendix iv.

Condition (13)

The permit holder shall keep a record of any complaints that are received. The record shall contain the following details, where practicable:

a) Name and address of the complainant;
b) Identification of the nature of the complaint;
c) Date and time of the complaint and of the alleged event;
d) Weather conditions at the time of the complaint; and
e) Any measures taken to address the cause of the complaint.

The permit holder shall notify the Manager, Environmental Regulation, Wellington Regional Council of any complaints relating to the exercise of this permit, within twenty-four hours of being received by the permit holder or the next working day.

The permit holder shall forward to the Manager, Environmental Regulation, Wellington Regional Council a copy of any complaints recorded in the annual report required by condition (10) of this permit.

There were no complaints during the 2021/2022 reporting period.

WGN060283 [35674]

Condition (2)

This permit shall only be exercised when the sewage inflow to the treatment plant exceeds 190 litres per second (L/s), and the 1000 m^3 storage tank is full.

There were seven bypass events that discharged fully treated effluent to the Karori stream that occurred in the 2020/2021 reporting year. These events had an influent flow rate to the Western WWTP greater than 190L/s and the 1000m^3 storage tank was full.

Condition (6)

The permit holder shall monitor and record the time, flow rate, duration and total volume of the overflow discharges into the Karori Stream, and shall report the results to the Manager, Environmental Regulation, Wellington Regional Council, within 10 working days of the overflow event occurring.

The permit holder shall maintain an incident log containing the details of each overflow discharge and make it available to the public or the Manager, Environmental Regulation, Wellington Regional Council upon request.

The following is a summary of the bypass events from the Western WWTP for the 2021/2022 reporting period.

Date	Duration	Average Flow to Stream Rate	Maximum Flow Rate to Stream	Total Volume of Bypass to Stream	Consented	Cause
dd mmm yyyy	hrs/mins	L/s	L/s	m^3	Y/N	--
17 Jul 2021	15hr 26m	44	67	2,388	Y	Storm event.
22 Jul 2021	03hr 23m	15	26	161	Y	Storm event.
08 Aug 2021	09hr 58m	13	28	277	Y	Storm event.
06 Dec 2021	32hr 14m	20	48	2,166	Y	storm event
05 Feb 2022	27hr 07m	24	41	334	Y	storm event
12 Feb 2022	40hr 17m	45	76	6,408	Y	Storm event.
20 Feb 2022	05hr 24m	16	36	275	Y	Storm event.

Table 15: Karori Stream Bypass Events from 2020/2021 Reporting Period

Condition (7)

The permit holder shall submit to the Manager, Environmental Regulation, Wellington Regional Council the amount of rainfall recorded in each hour at Karori Reservoir rain-gauge for each of the 7 days preceding each overflow event in the annual report required by condition (11) of this permit.

For all the consented discharges' rainfall data please refer to WGN080003 [25227] Condition (6).

Condition (8)

After an overflow discharge has occurred for more than 2 hours, the permit holder shall collect a representative grab sample of the treated effluent, prior to its entry into Karori Stream. All samples shall be analysed for the following parameters:

Suspended solids	g/m^3
Ammoniacal nitrogen	g/m^3
Total BOD_5	g/m^3
Faecal coliform	cfu/100mL

The results of the monitoring shall be forwarded to the Manager, Environmental Regulation, Wellington Regional Council within 10 working days of the bypass discharge occurring.

Eight events during the 2021/2022 reporting year exceeded the two (2) hour limit stated in this condition. Therefore, these samples were required. Below is a summary of the analytical results from the samples:

Date	Suspended Solids	Ammoniacal Nitrogen	BOD_5	Faecal Coliforms
	g/m^3	g/m^3	g/m^3	cfu/100mL
17/07/2021	18	2.7	13	340
23/07/2021	8.8	2.6	3.4	11
9/08/2021	12.0	3.1	5.8	36
23/09/2021	16.0	0.9	9.2	66
6/12/2021	54.0	9.5	44	19000
5/02/2022	7.5	5.2	10	2100
13/02/2022	14	0.7	8.7	13000
20/02/2022	12	3.9	11	7500

Table 16: Western WWTP Treated Effluent Sample Results

The analytical data sheets can be found in the quarterly reports.

Condition (9)

After an overflow discharge has occurred for more than 24 hours, the permit holder shall collect two representative grab samples from the Karori Stream, one from upstream of the discharge point and one no more than 100 metres downstream of the discharge point. This sampling shall be repeated at daily intervals thereafter for the duration of the discharge. A final set of samples shall be taken two hours after the discharge has ceased, or as soon as is practicable thereafter.

All samples shall be analysed for the following parameters:

Suspended solids	g/m^3
Ammoniacal nitrogen	g/m^3
Total BOD_5	g/m^3
Faecal coliform	cfu/100mL

The results of the monitoring shall be forwarded to the Manager, Environmental Regulation, Wellington Regional Council within 10 working days of the bypass discharge occurring.

Note: No monitoring shall be required during the hours of darkness, or when conditions are too dangerous for the safe procurement of samples.

Three events during the 2021/2022 reporting year exceeded the 24-hour limit stated in this condition. Therefore, these samples were required. Below is a summary of the analytical results from the samples:

Date	Suspended Solids	Ammoniacal Nitrogen	BOD_5	Faecal Coliforms
	g/m^3	g/m^3	g/m^3	cfu/100mL
6/12/2021	180.0	0.018	3.3	81000
5/02/2022	33	0.063	3.2	19000
13/02/2022	900	0.028	3.0	8100

Table 16: Karori Stream 100m Upstream of WWTP

Condition (15)

The permit holder shall provide the Manager, Environmental Regulation, Wellington Regional Council and the members of the Community Liaison Group with an annual report detailing what steps have and will be taken to reduce infiltration and stormwater ingress into the Karori sewerage network.

The report shall be submitted to the Manager, Environmental Regulation, Wellington Regional Council by 31 July each year and shall include, but not be limited to, the following information:

a) Details of works that have been undertaken and what these works are expected to achieve;
b) An indication of when any ongoing works will be complete;
c) Details of any investigations undertaken with regard to inflow and infiltration in the Karori catchment; and
d) Details of any works or investigations planned for the next financial year.

Note: One annual inflow and infiltration report may be submitted to the Manager, Environmental Regulation, Wellington Regional Council to meet the requirements in this regard of permits WGN060283 [25227]-[25229).

An annual inflow and infiltration report can be found in Appendix iv.

Condition (16)

The permit holder shall keep a record of any complaints that are received. The record shall contain the following details, where practicable:

f) Name and address of the complainant;
g) Identification of the nature of the complaint;
h) Date and time of the complaint and of the alleged event;
i) Weather conditions at the time of the complaint; and
j) Any measures taken to address the cause of the complaint.

The permit holder shall notify the Manager, Environmental Regulation, Wellington Regional Council of any complaints relating to the exercise of this permit, within twenty-four hours of being received by the permit holder or the next working day.

The permit holder shall forward to the Manager, Environmental Regulation, Wellington Regional Council a copy of any complaints recorded in the annual report required by condition (10) of this permit.

There were no complaints during the 2021/2022 reporting period.

WGN 060283 [35675]

Condition (2)

This consent shall only be exercised when the sewage inflow to the treatment plant exceeds 390 litres per second (L/s), and the 1000 m^3 storage tank is full.

There were four bypass events where milli-screened and settled wastewater was discharged to the Karori Stream during this reporting period. These events had an influent flow rate to the Western WWTP greater than 390L/s and the 1000m3 storage tank was full. This resource consent can be applied.

Condition (5)

The permit holder shall monitor and record the time, flow rate, duration and total volume of the bypass overflow discharges into the Karori Stream, and shall report the results to the Manager, Environmental Regulation, Wellington Regional Council, within 10 working days of the overflow event occurring. The permit holder shall maintain an incident log containing the details of each bypass overflow discharge and make it available to the public or the Manager, Environmental Regulation, Wellington Regional Council, upon request.

The details of the discharges can be found below.

Date	Duration	Average Influent Flow Rate	Maximum Influent Flow Rate	Average Bypass Flowrate	Total Volume of Bypass	Consented	Cause
dd/mm/yyyy	hrs/mins	L/s	L/s	L/s	m^3	Y/N	--
17/07/2021	N/A	365	454	N/A	N/A	Y	Wet weather in the catchment area.
6/12/2021	N/A	272	398	N/A	N/A	Y	Wet weather in the catchment area.
5/02/2022	N/A	184	395	N/A	N/A	Y	Wet weather in the catchment area.
12/02/2022	N/A	375	513	N/A	N/A	Y	Wet weather in the catchment area.

Table 17: Bypass Event Details

Condition (6)

The permit holder shall submit to the Manager, Environmental Regulation, Wellington Regional Council the amount of rainfall recorded at the Karori Reservoir rain-gauge in each hour for each of the 7 days preceding each bypass overflow event in the annual report required by condition (9) of this permit.

Rainfall data can be found in WGN060283 [25227] Condition 6 of this report.

Condition (7)

The permit holder shall take one representative grab sample of the settled, milli-screened effluent prior to its entry into the Karori Stream every time the discharge authorised by this permit has occurred for more than one hour. Each sample shall be analysed for the following parameters:
pH
Suspended solids g/m3
Total BOD5 g/m3
Faecal coliform bacteria cfu/100ml
Oils/grease g/m3
The results of the monitoring shall be forwarded to the Manager, Environmental Regulation, Wellington Regional Council within 10 working days of the bypass discharge occurring.

Date	pH	Suspended Solids	Total BOD5	Faecal Coliform Bacteria	Oils/Grease
	--	g/m^3	g/m^3	cfu/100mL	g/m^3
17/07/2021	7.3	38	18	250,000	11
6/12/2021	7.2	53	37	610,000	7.4
5/02/2022	7.2	42	16	250,000	10
13/02/2022	7	17	3.9	34,000	9.6

Table 18: Partially Treated Effluent Sample Results

WGN060283 [25230]

Condition (3)

The permit holder shall monitor air quality in the vicinity of the plant to confirm the absence of faecal coliforms and salmonella originating from the plant. Sampling is to be carried out at least once every six months.

The sampling method and locations are to be agreed with the Wellington Regional Council within three months of the granting of this permit.

Should the presence of faecal coliforms or salmonella be measured at any time, the Wellington Regional Council may direct that the permit holder sample at least once every month for six months before returning to the six monthly sampling regime.

The results shall be provided annually to Wellington Regional Council as part of the annual report required by condition 8 of this permit.

Ambient Microbe Monitoring was performed at the Western WWTP. The following table is a summary of the air quality monitoring in the vicinity of the WWTP:

Location	Faecal Coliforms		Salmonella	
	4/11/2021	28/04/2022	4/11/2021	28/04/2022
Site 1	Absent	Absent	Absent	Absent
Site 2	Absent	Absent	Absent	Absent
Site 3	Absent	Absent	Absent	Absent

Table 19: Semi-Annual Air Quality Monitoring

The full reports can be found in the quarterly reports for October – December 2021 and April – June 2022 quarterly reports.

Condition (4)

The permit holder shall undertake a comprehensive assessment of the quality of the biofilter media on an annual basis (or more frequently if appropriate).

The results of this assessment, including a summary of the findings, details of any action(s) to be taken to improve the efficiency of the biofilter, and a timetable for those actions to be undertaken, shall be submitted to the Manager, Environmental Regulation, Wellington Regional Council within one month of the assessment being undertaken.

Actions to be undertaken may include, but are not limited to:

a) Turning, restructuring and dampening of the bed material,
b) the addition of supplementary bed material, or
c) total bed material replacement.

The first assessment shall be undertaken within three months of the granting of this permit. Subsequent assessments shall be undertaken annually thereafter.

The biofilter assessment can be found in Appendix ii.

Condition (5)

The permit holder shall monitor the following parameters at the frequency noted:

a) Weekly visual observations of the state of the biofilter bed, particularly for short circuiting and clogging of the bed;
b) weekly monitoring of pressure drop across the biofilter bed;
c) weekly monitoring of biofilter bed moisture content; and
d) monthly monitoring of biofilter bed pH.

The frequency of (b), (c), and (d) can be altered by agreement in writing by the Manager, Environmental Regulation, Wellington Regional Council.
Monitoring results shall be recorded and be made available to Wellington Regional Council upon request. Information shall be forwarded annually to Wellington Regional Council as part of the annual report required by condition 8 of this permit.

The following graphs summarise the observations for July 2021 – June 2022 Reporting Period:

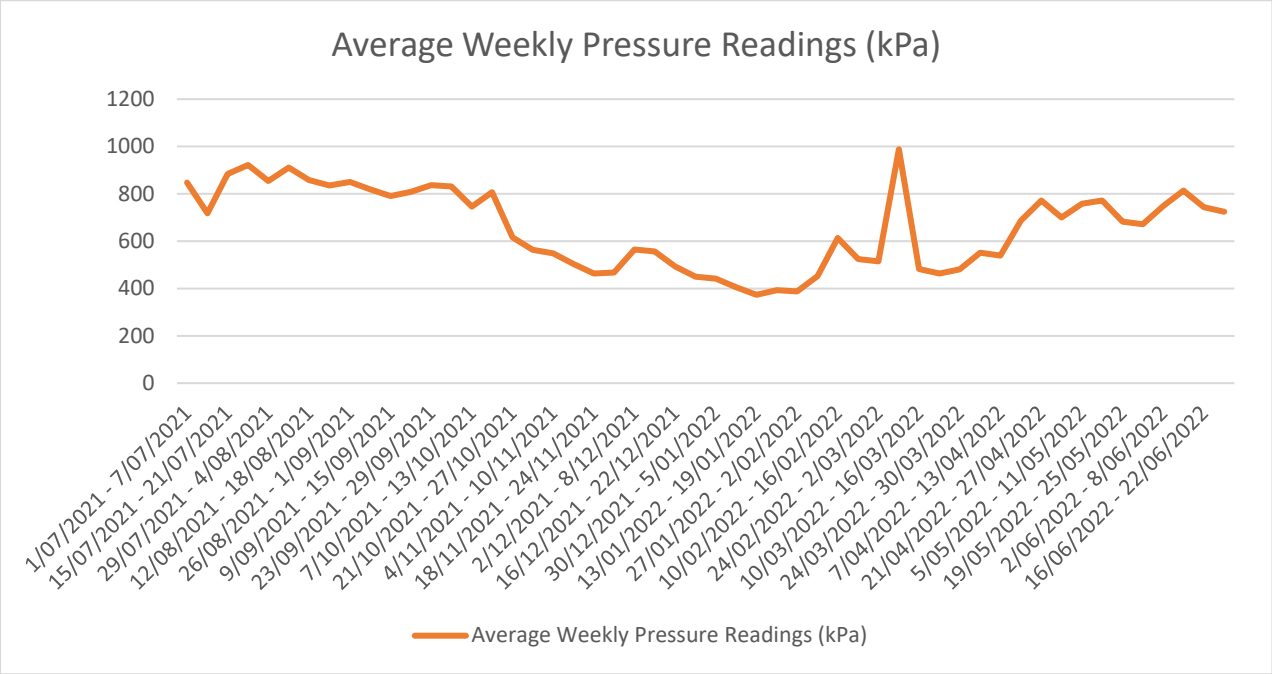


Figure 17: Average Weekly Pressure Readings in Biofilter

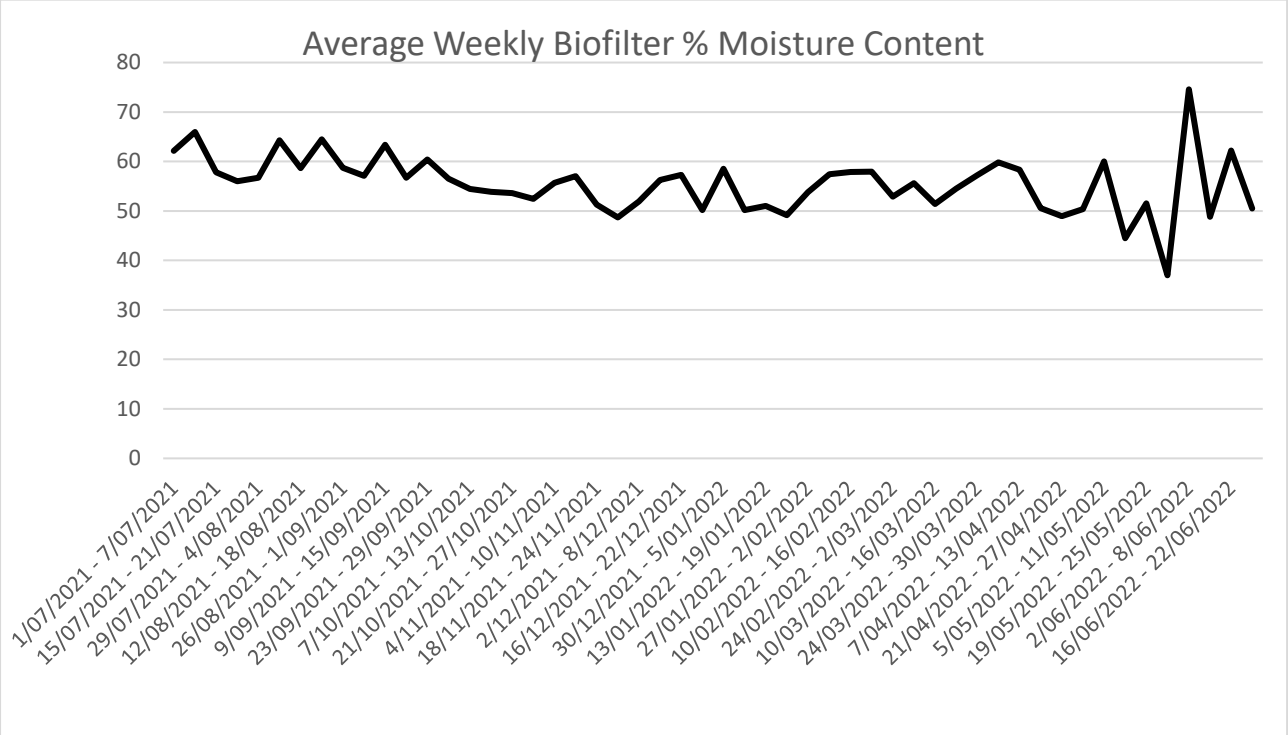


Figure 18: Average Weekly % Moisture Content in Biofilter

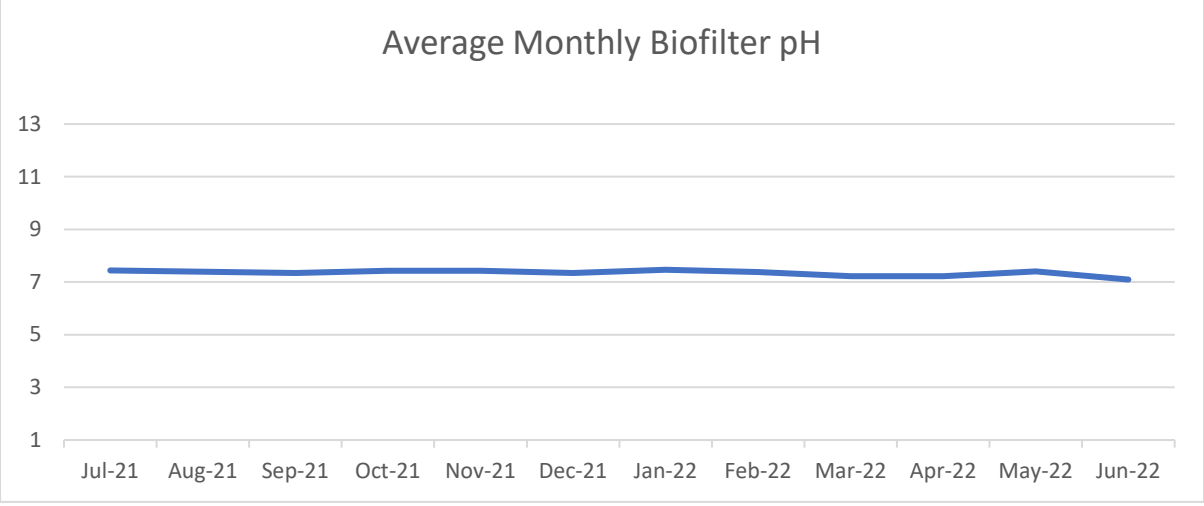


Figure 19: Average Monthly Biofilter pH

Condition (10)

The permit holder shall keep a permanent record of any complaints received alleging adverse effects from the permit holder's operations. The complaints record shall contain the following where practicable:

a) the name and address of the complainant, if supplied;

b) identification of the nature of the complaint;

c) date and time of the complaint and alleged event;

d) weather conditions at the time of the alleged event;

e) results of the permit holder's investigations; and

n any mitigation measures adopted.

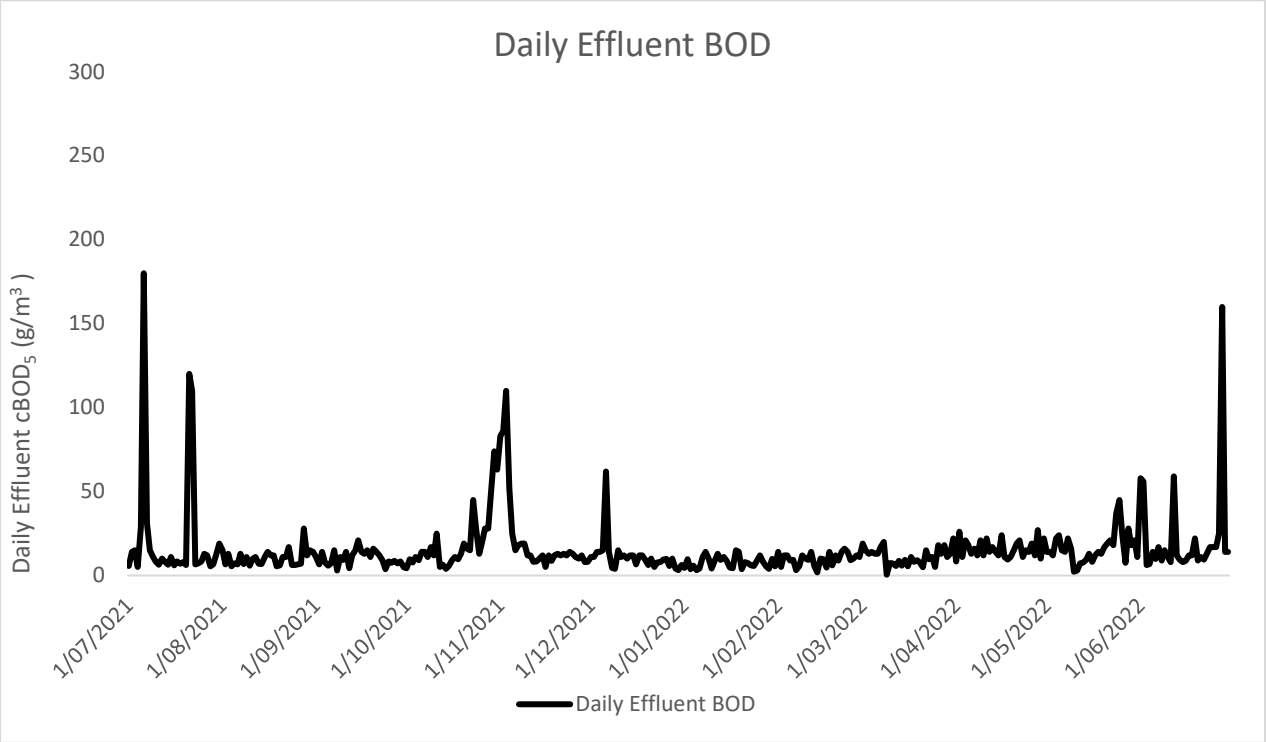
The permit holder shall notify the Manager, Environmental Regulation, Wellington Regional Council of any complaints relating to the exercise of this permit, within twenty-four hours of being received by the permit holder or the next working day.

The permit holder shall forward to the Manager, Environmental Regulation, Wellington Regional Council a copy of any complaints recorded in the annual report required by condition (8) of this permit.

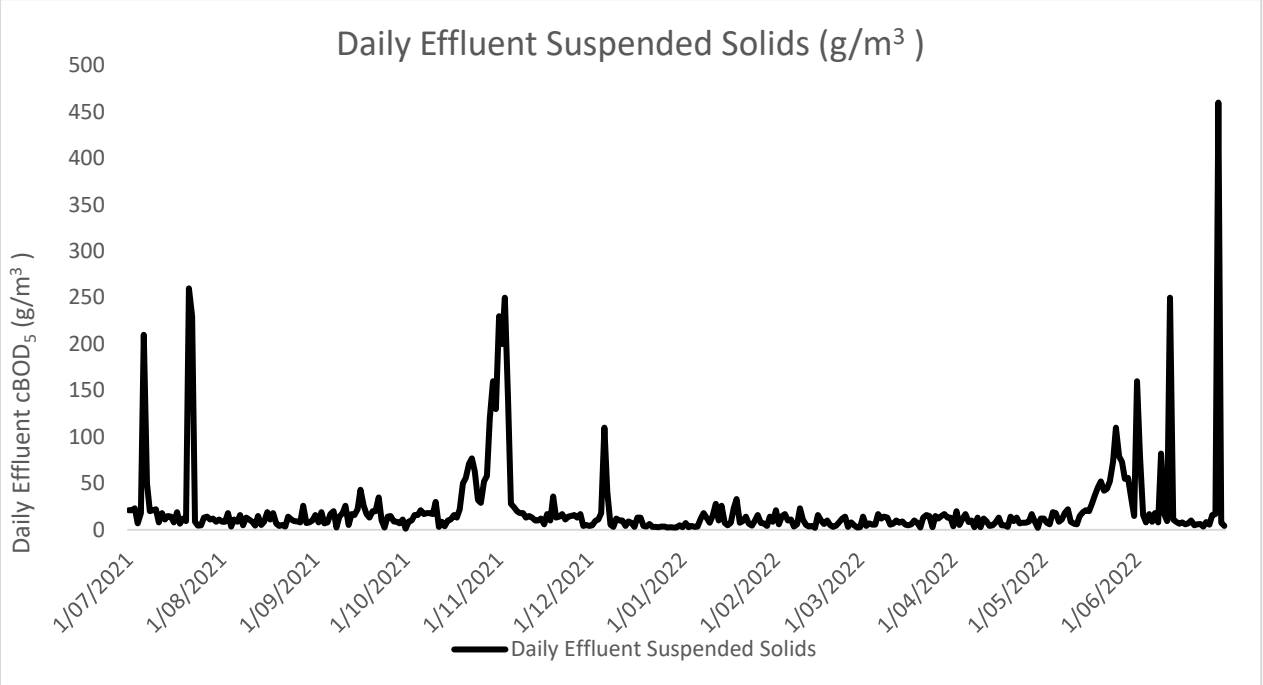
There were no complaints during the 2021/2022 reporting period.

Appendix i: Effluent Quality Results

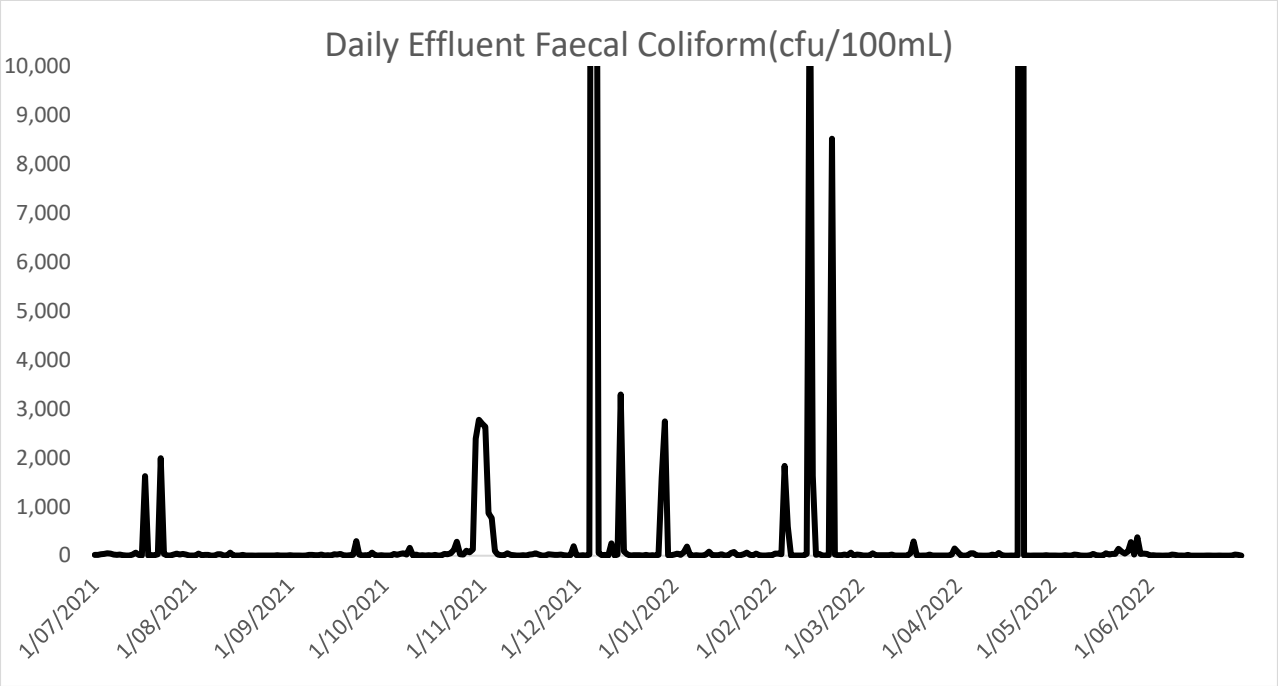
Effluent Biological Oxygen Demand Results



Effluent Suspended Solids Results



Effluent Faecal Coliform Results



Appendix ii:
Biofilter Monitoring Report

Veolia Water Services (ANZ) Pty Ltd Wellington

WESTERN TREATMENT PLANT BIOFILTER ASSESSMENT, JUNE 2022

Issue

July 2022

Veolia Water Services (ANZ) Pty Ltd Wellington

WESTERN TREATMENT PLANT BIOFILTER ASSESSMENT, JUNE 2022

Issue

July 2022

Source Testing New Zealand Ltd
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Document history and status

Revision	Date issued	Issued by	Reviewed by	Date reviewed	Revision type
Draft	25 July 2022	M. Newby	N. Bailey	25 July 2022	Minor amendments
Issue	25 July 2022	M. Newby			

Approved by

Name	Title	Signature
Matthew Newby, CAQP	Senior Air Quality Scientist	

Distribution of copies

Revision	Copy no	Quantity	Issued to
Issue	1	Electronic	Veolia Western Wastewater Treatment Plant South Karori Rd PO Box 3253 Wellington

Printed:	25 July 2022
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Author:	M. Newby
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Name of project:	Western Treatment Plant, Biofilter Assessment June 2022
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Document version:	Issue
Project number:	ST1055

Contents

1. Executive Summary

Source Testing New Zealand Limited (STNZ) was commissioned by Veolia to carry out an assessment of the biofilter located at the Western Treatment Plant (WTP), South Karori Rd, Wellington. The WTP biofilter consists of two cells with a bark/soil media and is used to treat the air extracted from the plants process areas. In 2015 the media in both cells was replaced. The objective of the current assessment was to determine the operational status of the biofilter including flow/ventilation rates and the condition of the biofilter media.

The results of the WTP Biofilter assessment conducted on 21 June 2022 showed the total flow to the biofilter was approximately 15,500 m^3/hr which was approximately 15 % lower than observed in October 2020. The ventilation rate of the biofilter averaged 75 m^3/m^3/hr and the retention time averaged 102 seconds. This would suggest that the biofilter is operating at a lower flow rate than the volume available to treat any potential odours.

Cell 1 had recently been replaced and the media was in a good condition, however, insufficient media had been added resulting in up to 300 mm of additional media being required. It is recommended that additional media be added to Cell 1. Cell 2 had significant areas covered in lichen and moss. There were also signs of short circuiting of the media around the edge of the biofilter. The media was compact and damp. There was a significant amount of degradation of the bark nuggets and lime chips with a high degree of fines. While the pH of the media was in the appropriate range, the moisture content was slightly elevated, and the bacteria counts were less than ideal.

Given the issues with the Cell 2 media, it is recommended that the media be completely replaced as soon as possible.

2. Introduction

Source Testing New Zealand Limited (STNZ) was commissioned by Veolia Water Services (ANZ) Pty Ltd (Veolia) to carry out an assessment of the biofilter located at the Western Treatment Plant (WTP), South Karori Rd, Wellington. The WTP biofilter consists of two cells with a bark/soil media and is used to treat the air extracted from the plants process areas. In late 2021 the media in Cell 1 was replaced. The objective of the current assessment was to determine the operational status of the biofilter including flow/ventilation rates and the condition of the biofilter media.

Matthew Newby, Senior Air Quality Scientist with STNZ conducted the WTP biofilter assessment on 21 June 2022. Matthew has 25 year's air quality monitoring and consulting experience and is designated as a Key Technical Person under STNZ's IANZ accreditation. Matthew is also a Certified Air Quality Professional (CAQP) under the Clean Air Society of Australia and New Zealand (CASANZ) certification programme.

The following report provides a background on the design of the biofilter, flow rate measurements and biofilter media description. Recommendations for the biofilter are then presented.

3. Biofilter Description

The WTP odour control system consists of extraction ducting from potentially odorous process areas of the plant, with the aim of minimising the release of potentially odorous emissions. The foul air from the plant is fed to a biofilter which consists of two independent cells containing a mixed bark soil media. The original lateral PVC piping was replaced with plastic boxing to better distribute the flow over the base of the bed. The crates are held in place with a layer of <40 mm aggregate which in turn is covered with a thin layer of course bark chips (<50 mm) with the remainder of the bed consisting of a fine bark chip (<20 mm) and soil matrix. This composition generally complies with the original design specifications (Drawing Reference 05-018 Soil Filter-Piping Aggt/Details Dated 11/09/97).

The surface area of each cell was measured to be 144 m^2 and 150 m^2 for Cells 1 and 2 respectively. With an estimated media depth of 700 mm the volumes of Cells 1 and 2 would be 101 m^3 and 105 m^3 respectively. The biofilter has two ID fans working in a duty stand-by configuration with a single duct splitting to each cell. The flow to each cell can be adjusted and on 21 June 2022 the flow was evenly distributed between both cells.

4. Biofilter Assessment

4.1 Introduction

On 21 June 2022, Matthew Newby Senior Air Quality Scientist with STNZ assessed the WTP biofilter. The assessment initially measured the flow rate to each cell to allow for the biofilter ventilation rates and retention time to be determined. The biofilter media was then assessed including the collection of media samples at 100 mm and 500 mm from one location in each cell. The media samples were then analysed for pH, moisture content and total bacteria count.

The following sections outline the results of the WTP biofilter assessment.

4.2 Flow Rate Assessment

The volumetric flows and temperature of the gas flow to each of the biofilter cells was determined using a TSI VelociCalc 9545 Hot Wire Anemometer while the back pressure was measured using the Colmark digital manometer. On the day of the assessment, the flow was distributed evenly to each cell. The results of the biofilter flow rate assessment conducted on 21 June 2022 are presented in Table 1.

- **Table 1 Biofilter Flow Rates, 21 June 2022**

	Velocity (m/s)	Gas Temp. (°C)	Back Pressure (mmH_2O)	Volumetric Flow Rate (m^3/hr)
Cell 1	12.3	13.6	82	7,041
Cell 2	13.7	13.6	76	8,532

The results of the WTP biofilter flow rate assessment showed the total flow to the biofilter was 15,573 m^3/hr, which was approximately 15% lower than observed in October 2020.

As noted in Section 2, the surface area of each cell was measured to be 144 m^2 and 150 m^2 for Cells 1 and 2 respectively. With an estimated media depth of 700 mm, the volumes of Cells 1 and 2 would be 101 m^3 and 105 m^3 respectively. Based on the measured volumetric flow rates, one can calculate the ventilation rates in m^3 of media per m^3 of foul air per hour and the effective retention time of the foul air within the biofilter media and for the data collected on 21 June 2022 is presented in Table 2.

- **Table 2 Biofilter Ventilation Rates, 21 June 2022**

Cell	Volumetric Flow Rate (m^3/hr)	Ventilation Rate (m^3/m^3/hr)	Retention time (s)
1	7,041	69.7	110
2	8,532	81.3	95

The resource consent for the Veolia Sludge Dewatering Plant located at Wellington Southern Landfill (SDP) recommends a ventilation rate not to exceed 40 m^3/m^3/hr and a minimum retention time of 90 seconds under normal operating conditions. While these consent conditions relate specifically to the SDP biofilter, they do provide a good guide for biofilters in general. As can be seen in Table 2, under the current operating conditions the ventilation rate was almost twice the recommended ventilation rate while the retention time was about right.

4.3 Biofilter Media Assessment

The assessment of the biofilter consisted of an initial assessment of the surface of the biofilter looking for any signs of short circuiting or degradation of the surface of the media. Samples for pH, moisture content and total bacterial count analysis were then collected at depths of 100 mm and 500 mm from a single location on each cell.

The surface of the biofilter was generally clear of any weeds, but there were significant areas on Cell 2 that was covered in a light mat of lichen and moss (See Figure 1). There were also signs of short circuiting of the media around the edge of the biofilter. This was evident by the way the media had been pushed away from the walls of the cell when the biofilter has been saturated (See Figure 2).

The media in Cell 1 consisted of large bark chip and large lime chips and had recently been replaced. However, the cell had not been completely filled and was lacking up to 300 mm of media in some places (See Figure 3). It is recommended that additional media be added to ensure there is sufficient media to treat the odour. The media in Cell 1 had a good mix of large and small bark chip/ composite with a good ratio of medium lime chip (2-10 mm). The media was friable and damp but not wet to the touch. Figure 4 depicts the media composition at 500 mm.

In comparison the media in Cell 2 was highly compacted with significant degradation of both the bark and lime chips. The lime chip was so degraded that it was able to be broken up between one's fingers. The bark chips were breaking down resulting in a high degree of fine mud like media appearance. The media was damp but not wet to the touch at 100 mm but at 500 mm the media was further degraded and was wet to touch and highly compacted.

The flow rate to Cell 2 was approximately 20 % higher than Cell 1 despite being highly compacted. This would suggest there is a significant amount of short circuiting occurring in Cell 2. It is recommended that the media in Cell 2 be replaced as soon as possible to prevent any possible odour complaints.

Figure 1: Biofilter Lichen/Moss Covering

Figure 2: Biofilter Short Circuiting

Figure 3: Missing Media in Cell 1

Figure 4: Media in Cell 1 at 500 mm

The results of the biofilter media analysis for the samples collected on 28 October 2020 are presented in Table 3 with Appendix A containing the raw analytical report.

- **Table 3 Biofilter Media Analytical Results, 21 June 2022**

Sample Description	pH	Moisture Content (% by weight)	Aerobic Plate Count @ 35 ºC (cfu/g)
Cell 1 100 mm	63.2	7.4	150,000
Cell 1 500 mm	49.8	7.7	4,200,000
Cell 2 100 mm	40.0	7.8	120,000
Cell 2 500 mm	61.0	7.9	1,600,000

For the biofilter to work effectively, the pH of the media should be within the range 5.5 to 8 with a moisture content between 40 and 60 % by weight. These conditions should allow for optimal bacterial growth. As can be seen in Table 3, all samples had a pH in the recommended range. However, the moisture content of the Cell 1 100 mm sample was above 60 % but was approximately 50 % at 500 mm. The elevated moisture content for Cell 1 100 mm was likely due to recent rain. In contrast Cell 2 had a higher moisture content at 500 mm compared to 100 mm which suggests the moisture is being held by the media and is not draining or being dried by the gas flow.

It is recommended that the bacteriological count for effective biofilters should be in the range 10^7 to 10^9 cfu/g. The bacteria counts for Cell 1 100 mm was lower than ideal but higher levels were observed at 500 mm. The bacteria counts for Cell 2 were lower than Cell 1. The lower bacterial counts may be due to the lower ambient temperatures observed in winter compared to summer conditions.

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5. Summary and Recommendations

The results of the WTP Biofilter assessment conducted on 21 June 2022 showed the total flow to the biofilter was approximately 15,500 m^3/hr which was approximately 15 % lower than observed in October 2020. The ventilation rate of the biofilter averaged 75 m^3/m^3/hr and the retention time averaged 102 seconds. This would suggest that the biofilter is operating at a lower flow rate than the volume available to treat any potential odours.

Cell 1 had recently been replaced and the media was in a good condition, however, insufficient media had been added resulting in up to 300 mm of additional media being required. It is recommended that additional media be added to Cell 1. Cell 2 had significant areas covered in lichen and moss. There were also signs of short circuiting of the media around the edge of the biofilter. The media was compact and damp. There was a significant amount of degradation of the bark nuggets and lime chips with a high degree of fines. While the pH of the media was in the appropriate range, the moisture content was slightly elevated, and the bacteria counts were less than ideal.

Given the issues with the Cell 2 media, it is recommended that the media be completely replaced as soon as possible.

Appendix A Laboratory Reports

This Appendix contains 17 pages including cover.

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AR-22-NW-022081-01 Page 1 of 2

Food & Water Testing

ANALYTICAL REPORT

REPORT CODE	**AR-22-NW-022081-01**	REPORT DATE	**04/07/2022**

Attention Source Testing New Zealand
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Phone 027 553 3210
Email m.newby@sourcetesting.co.nz

Contact for your orders:	Lauren May	**Order code:**	EUNZWE-00044070

SAMPLE CODE	**812-2022-00065495**
Sample described as:	ST1055/01
Reception Date & Time:	21/06/2022 14:30
Analysis Start Date & Time:	25/06/2022 13:09
Sampled Date & Time	21/06/2022
Analysis Ending Date:	04/07/2022

		RESULTS		LOQ
③ **NU223**	**Moisture**			
	Moisture	63.2	%	0.1
③ **NU012**	**pH**			
	pH	7.4		1

LIST OF METHODS

NU012 **pH:** Internal Method, Electrometry [pH Electrode]

NU223 **Moisture:** Internal Method, Thermo-gravimetry [Dried at 100°C]

Signature

Marylou Cabral Laboratory Manager

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Contact for your orders:	Lauren May	**Order code:**	EUNZWE-00044070

SAMPLE CODE	**812-2022-00065496**
Sample described as:	ST1055/02
Reception Date & Time:	21/06/2022 14:30
Analysis Start Date & Time:	25/06/2022 13:09
Sampled Date & Time	21/06/2022
Analysis Ending Date:	04/07/2022

		RESULTS		LOQ
③ **NU223**	**Moisture**			
	Moisture	49.8	%	0.1
③ **NU012**	**pH**			
	pH	7.7		1

LIST OF METHODS

NU012 **pH:** Internal Method, Electrometry [pH Electrode]

NU223 **Moisture:** Internal Method, Thermo-gravimetry [Dried at 100°C]

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Marylou Cabral Laboratory Manager

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Contact for your orders:	Lauren May	**Order code:**	EUNZWE-00044070
SAMPLE CODE	**812-2022-00065497**		
Sample described as:	ST1055/03		
Reception Date & Time:	21/06/2022 14:30		
Analysis Start Date & Time:	25/06/2022 13:09	**Analysis Ending Date:**	04/07/2022
Sampled Date & Time	21/06/2022		

		RESULTS		LOQ
③NU223	**Moisture**			
	Moisture	40.0	%	0.1
③NU012	**pH**			
	pH	7.8		1

LIST OF METHODS

NU012 **pH:** Internal Method, Electrometry [pH Electrode]

NU223 **Moisture:** Internal Method, Thermo-gravimetry [Dried at 100°C]

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Marylou Cabral Laboratory Manager

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Contact for your orders: Lauren May **Order code:** EUNZWE-00044070

SAMPLE CODE **812-2022-00065498**

Sample described as: ST1055/04
Reception Date & Time: 21/06/2022 14:30
Analysis Start Date & Time: 25/06/2022 13:09 **Analysis Ending Date:** 04/07/2022
Sampled Date & Time 21/06/2022

		RESULTS		LOQ
③NU223	**Moisture**			
	Moisture	51.0	%	0.1
③NU012	**pH**			
	pH	7.9		1

LIST OF METHODS

NU012 **pH:** Internal Method, Electrometry [pH Electrode]

NU223 **Moisture:** Internal Method, Thermo-gravimetry [Dried at 100°C]

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Contact for your orders:	Lauren May	**Order code:**	EUNZWE-00044070
SAMPLE CODE	**812-2022-00064150**		
Sample described as:	ST1055/04		
Reception Date & Time:	21/06/2022 14:30		
Analysis Start Date & Time:	25/06/2022 09:18	**Analysis Ending Date:**	27/06/2022
Sampled Date & Time	21/06/2022		

		RESULTS		LOQ
⑆ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	1.50×10^5	cfu/g	10

LIST OF METHODS

ZM1QB **Aerobic Plate Count 35°C E (Food & Feed) [NZ] <10 >30 000 000 /g (1-5) PCA Agar-P:** FDA BAM Chapter 3; Online Edition

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Sunita Raju Business Unit Manager
Microbiology

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SAMPLE CODE **812-2022-00064148**

Sample described as: ST1055/02
Reception Date & Time: 21/06/2022 14:30
Analysis Start Date & Time: 25/06/2022 09:17 **Analysis Ending Date:** 27/06/2022
Sampled Date & Time 21/06/2022

		RESULTS		LOQ
ⓓZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	4.20×10^6	cfu/g	10

LIST OF METHODS

ZM1QB **Aerobic Plate Count 35°C E (Food & Feed) [NZ] <10 >30 000 000 /g (1-5) PCA Agar-P:** FDA BAM Chapter 3; Online Edition

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Contact for your orders: Lauren May **Order code:** EUNZWE-00044070

SAMPLE CODE **812-2022-00064149**

Sample described as: ST1055/03
Reception Date & Time: 21/06/2022 14:30
Analysis Start Date & Time: 25/06/2022 09:17 **Analysis Ending Date:** 27/06/2022
Sampled Date & Time 21/06/2022

		RESULTS		LOQ
DZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	1.20×10^5	cfu/g	10

LIST OF METHODS

ZM1QB **Aerobic Plate Count 35°C E (Food & Feed) [NZ] <10 >30 000 000 /g (1-5) PCA Agar-P:** FDA BAM Chapter 3; Online Edition

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Sunita Raju Business Unit Manager Microbiology

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Not Detected means not detected at or above the Limit of Quantification (LOQ)
LOQ means Limit of Quantification and the unit of LOQ is the same as the result unit

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Food & Water Testing

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ANALYTICAL REPORT

REPORT CODE	**AR-22-NW-021118-01**	REPORT DATE	**28/06/2022**

Attention Source Testing New Zealand
Matthew Newby
PO Box 32-017
Maungaraki
Lower Hutt 5010
Wellington
NEW ZEALAND
Phone 027 553 3210
Email m.newby@sourcetesting.co.nz

Contact for your orders:	Lauren May	**Order code:**	EUNZWE-00044070
SAMPLE CODE	**812-2022-00064147**		
Sample described as:	ST1055/01		
Reception Date & Time:	21/06/2022 14:30		
Analysis Start Date & Time:	25/06/2022 09:11	**Analysis Ending Date:**	27/06/2022
Sampled Date & Time	21/06/2022		

		RESULTS		LOQ
⑆ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	1.60×10^6	cfu/g	10

LIST OF METHODS

ZM1QB **Aerobic Plate Count 35°C E (Food & Feed) [NZ] <10 >30 000 000 /g (1-5) PCA Agar-P:** FDA BAM Chapter 3; Online Edition

Signature

Sunita Raju Business Unit Manager
Microbiology

EXPLANATORY NOTE

① Test is not accredited
② Test is subcontracted within Eurofins group and is accredited
③ Test is subcontracted within Eurofins group and is not accredited
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Appendix iii:
Western Treatment Plant: Annual Outfall Pipeline Report

Appendix iv:
Western Treatment Plant: Annual Inflow and Infiltration Report FY2021/2022

Condition (12)

The permit holder shall provide the Manager, Environmental Regulation, Wellington Regional Council with an annual report detailing what steps have and will be taken to reduce infiltration and stormwater ingress into the Karori sewerage network.

The report shall be submitted to the Manager, Environmental Regulation, Wellington Regional Council by 31 July each year and shall include, but not be limited to, the following information:

a) Details of works that have been undertaken and what these works are expected to achieve;
b) An indication of when any ongoing works will be completed;
c) Details of any investigations undertaken with regard to inflow and infiltration in the Karori catchment; and
d) Details of any works or investigations planned for the next financial year.

Note: One annual inflow and infiltration report may be submitted to the Manager, Environmental Regulation, Wellington Regional Council to meet the requirements in this regard of permits WGN060283 [25226], [25227], [35674] and [25229].

Inflow and Infiltration Report

A variety of mitigation measures have been undertaken to reduce inflow and infiltration (I&I) and to contain wastewater within the reticulated wastewater network. This work aims to reduce the demand on the Western Wastewater Treatment Plant (WWTP) and to also improve waterway health. Sections (a), (b), (c) and (d) of Condition 12 are addressed below by the various activities and work programs contributing to inflow and infiltration reduction.

Inflow Surveys

Inflow surveys utilise smoke testing and dye testing to identify faults that contribute to I&I. Two inflow surveys commenced in 2018-2019 in Karori sub-catchments referred to as 18STH and 400STH as shown in Figure 1 below. These sub-catchments were identified from an initial rainfall derived inflow and infiltration (RDII) assessment utilising short term flow monitoring data.

In 2019-2020 faults were communicated to property owners and subsequent inspections were undertaken to resolve faults with customers. The final re-inspection of non-compliant properties with outstanding faults were undertaken in August 2020 and the project was completed in October 2020. The public faults identified from the inflow surveys and other faults requiring further investigation were completed with maintenance or repairs as required. There were no further inflow surveys completed for 2021-2022 in the Western WWTP Catchment.

A map showing where the recent Inflow Surveys Projects were completed is shown in Figure 1 below. The two Inflow Surveys that were completed are shown in green.

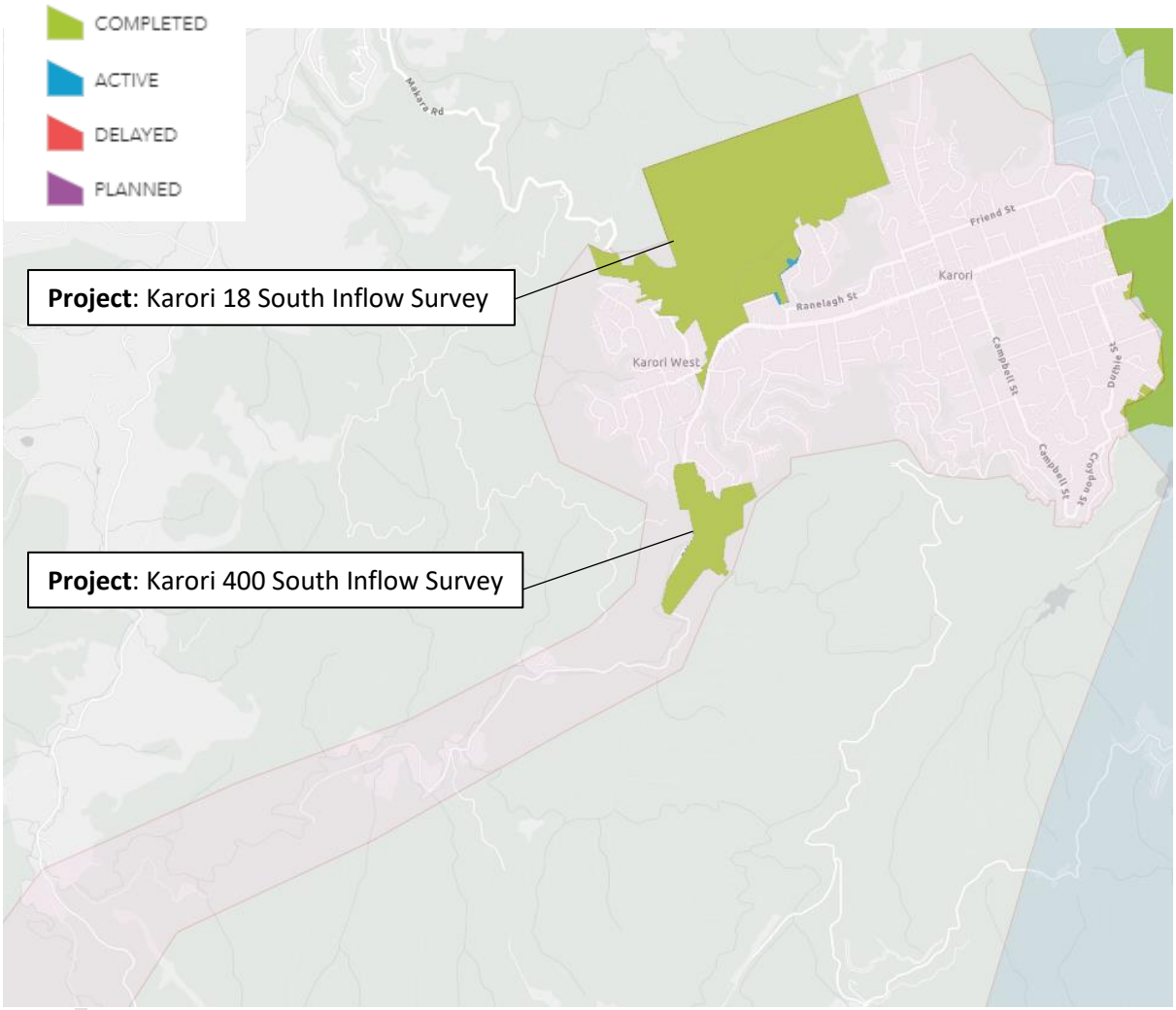

Figure 1 - Inflow Survey summary for Western WWTP catchment

Flow Monitoring and Rain Gauge Monitoring

There are two long term overflow monitoring sites at '62 South Karori Road' and '115 South Karori Road' and one long term flow monitoring site 'South Karori FM' in the Western WWTP Catchment as shown in Figure 2 below.

There are currently two rain gauges located in Karori which are Kaiwharawhara Stream at Karori Reservoir and Karori Res RG at Montgomery Avenue as indicated below in Figure 2.

Figure 2 - Map of Wastewater Long-term Flow and Overflow Monitoring Sites and Rain Gauges

Condition Assessments

Condition Assessment using closed circuit television (CCTV) footage and other inspection techniques of wastewater networks is used to identify faults, determine the condition of assets, and inform repair and renewal programs.

The Very High Critical Assets (VHCA) condition assessments completed as of June 2022 are shown in Figure 3 below. The primary inspection techniques were CCTV and laser profiling for wastewater pipes, and CCTV for stormwater pipes. For the inspections represented in the below map, approximately 10% were completed in 2020-2021 financial year and 90% completed in the 2021-2022 year.

The data from these condition assessment programs will be analysed and used to inform the repair and renewal programs in upcoming financial years.

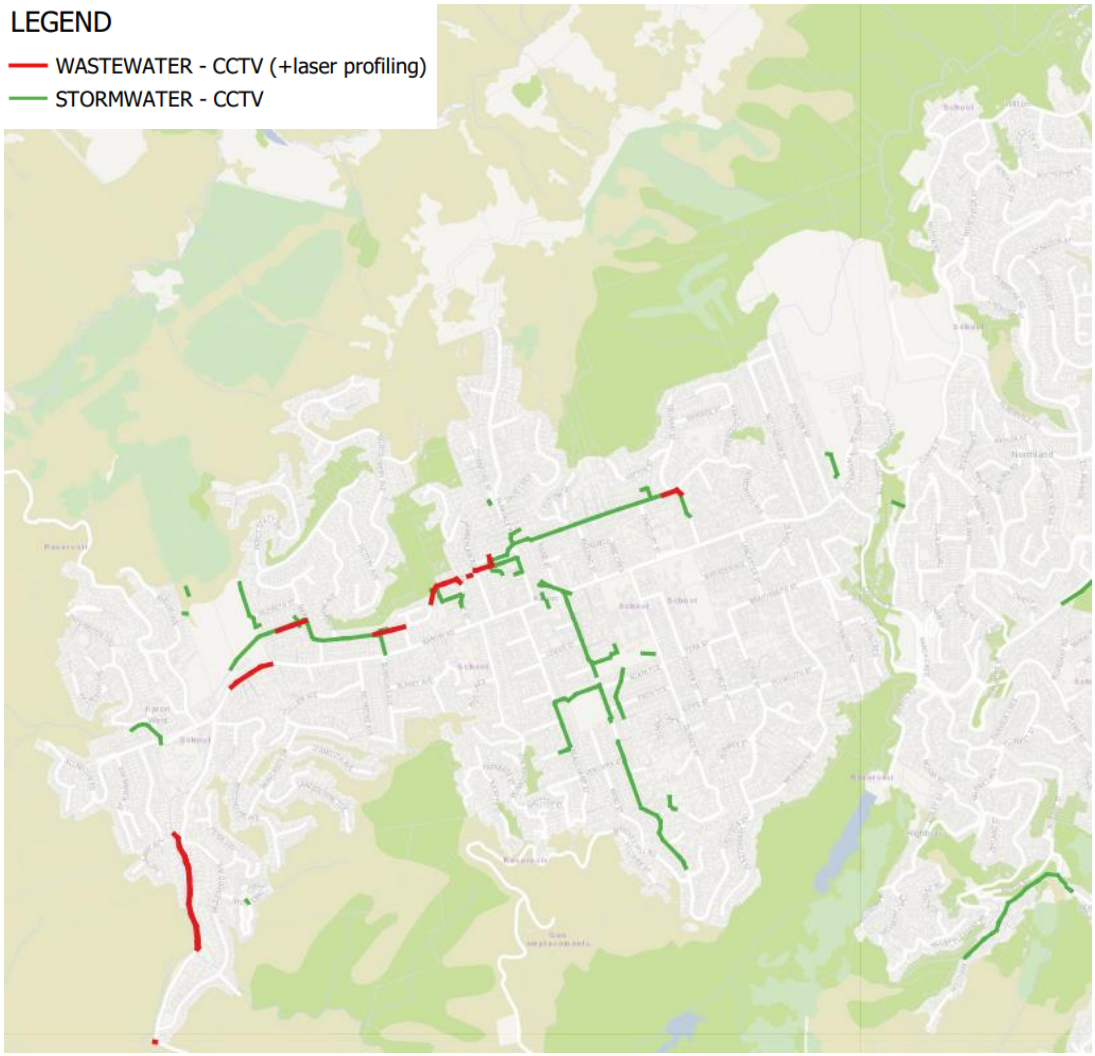

Figure 3 - Very High Critical Assets (VHCA) CCTV inspections completed as of June 2022.

Wastewater Modelling

The Karori wastewater model has been updated and an Options Report was issued in May 2021 summarising options for improving network performance. The recommendations from this report will be incorporated into a Network Improvement Plan to prioritise operational and capital projects to improve the network.

Stormwater and Wastewater Capital Projects

Table 1 below provides a summary of capital projects for wastewater and stormwater assets that were undertaken in 2021-2022 or planned for 2022-2023 financial year. The projects are proposed and subject to final approval by council. Ongoing operational work such as investigations, reactive maintenance and renewals are also carried out in addition to the planned work listed below.

Table 1 - Stormwater and Wastewater Capital Projects in the Western WWTP Catchment

Activity	2021/2022	2022/2023
Karori Stormwater	• Waikare Street (4-7) Stormwater Renewal • Newcombe Crescent Stormwater Renewal	• Waikare Street (4-7) Stormwater Renewal
Karori Wastewater	• Renewal of Wastewater Mains under the Stimulus Funding Programme	

Appendix v:
Western Treatment Plant: Karori Stream Monitoring

Karori Stream at Friend Street

Sample Date	Sample Time	Faecal Coliform (cfu/100 mL)	Wind Direction	Weather
1/07/2021	7:05:00 AM	2200	S	Cloudy
15/07/2021	7:06:00 AM	59000	N	Overcast
29/07/2021	7:15:00 AM	35000	N	Overcast
12/08/2021	7:07:00 AM	740	N	Overcast
26/08/2021	7:07:00 AM	480	NW	Overcast
9/09/2021	7:10:00 AM	70	N	Cloudy
23/09/2021	6:50:00 AM	620	N	Cloudy
8/10/2021	9:02:00 AM	440	SE	Clear
21/10/2021	7:44:00 PM	140	N	Cloudy
4/11/2021	9:00:00 AM	1700	SE	Overcast
18/11/2021	11:57:00 AM	17000	SW	Clear
2/12/2021	7:30:00 AM	1700	SW	Cloudy
17/12/2021	6:50:00 AM	2200	N	Overcast
31/12/2021	6:45:00 AM	1000	SW	Cloudy
13/01/2022	6:30:00 AM	2300	SE	Overcast
27/01/2022	7:10:00 AM	34000	S	Rain
11/02/2022	6:50:00 AM	13000	N	Overcast
25/02/2022	7:15:00 AM	3600	S	Mild
13/03/2022	7:00	1300	N	Overcast
24/03/2022	8:05	1800	S	Mild
07/04/2022	7:07	660	NE	Overcast
21/04/2022	7:11	140	NE	Overcast
5/05/2022	7:00	92000	E	Overcast
19/05/2022	6:55	710000	E	Overcast
3/06/2022	08:00	6100	S	Clear
30/06/2022	07:05	36000	N	Rain

Karori Stream at Campbell Street

Sample Date	Sample Time	Faecal Coliform (cfu/100 mL)	Wind Direction	Weather
1/07/2021	7:12:00 AM	600	S	Cloudy
15/07/2021	7:11:00 AM	210	N	Overcast
29/07/2021	7:23:00 AM	20000	N	Overcast
12/08/2021	7:12:00 AM	200	N	Overcast
26/08/2021	7:14:00 AM	38	NW	Overcast
9/09/2021	7:16:00 AM	620	N	Cloudy
23/09/2021	6:58:00 AM	86	N	Cloudy
8/10/2021	9:10:00 AM	110	SE	Clear
21/10/2021	7:39:00 PM	140	N	Cloudy
4/11/2021	9:07:00 AM	98	SE	Overcast
18/11/2021	11:47:00 AM	400	SW	Clear
2/12/2021	7:37:00 AM	6500	SW	Cloudy
17/12/2021	6:57:00 AM	480	N	Overcast
31/12/2021	6:53:00 AM	900	SW	Cloudy
13/01/2022	6:37:00 AM	720	SE	Overcast
27/01/2022	7:17:00 AM	8500	S	Rain
11/02/2022	6:56:00 AM	1000	N	Overcast
25/02/2022	7:22:00 AM	110	S	Mild
13/03/2022	7:07	1200	N	Overcast
24/03/2022	7:52	900	S	Mild
07/04/2022	7:00	160000	N	Mild
21/04/2022	7:05	51000	E	Mild
5/05/2022	7:07	620	N	Mild
19/05/2022	7:03	500	E	Mild
3/06/2022	08:06	880	S	Clear
30/06/2022	07:13	96	N	Rain

Karori Stream at South Karori Road

Sample Date	Sample Time	Faecal Coliform (cfu/100 mL)	Wind Direction	Weather
1/07/2021	7:21:00 AM	860	S	Cloudy
15/07/2021	7:20:00 AM	160	N	Overcast
29/07/2021	7:31:00 AM	420	N	Overcast
12/08/2021	7:21:00 AM	180	N	Overcast
26/08/2021	7:23:00 AM	78	NW	Overcast
9/09/2021	7:21:00 AM	140	N	Cloudy
23/09/2021	7:08:00 AM	400	N	Cloudy
8/10/2021	9:17:00 AM	96	SE	Clear
21/10/2021	7:30:00 PM	58	N	Cloudy
4/11/2021	9:16:00 AM	130	SE	Overcast
18/11/2021	11:36:00 AM	130	SW	Clear
2/12/2021	7:46:00 AM	200	SW	Cloudy
17/12/2021	7:09:00 AM	270	N	Overcast
31/12/2021	7:02:00 AM	350	SW	Cloudy
13/01/2022	6:47:00 AM	1600	SE	Overcast
27/01/2022	7:26:00 AM	26000	S	Rain
11/02/2022	7:09:00 AM	720	N	Overcast
25/02/2022	7:30:00 AM	700	S	Mild
13/03/2022	7:14	220	N	Overcast
24/03/2022	7:46	400	S	Mild
07/04/2022	7:36	720	N	Mild
21/04/2022	7:36	240	E	Mild
5/05/2022	7:15	140	N	Mild
19/05/2022	7:16	310	NE	Mild
3/06/2022	08:12	440	S	Clear
30/06/2022	07:21	480	N	Rain

Karori Stream at approximately 100 metres upstream of the Western Treatment Plant

Sample Date	Sample Time	Faecal Coliform (cfu/100 mL)	Wind Direction	Weather
1/07/2021	7:33:00 AM	1200	S	Cloudy
15/07/2021	12:00:00 AM	140	N	Overcast
29/07/2021	12:00:00 AM	110	N	Overcast
12/08/2021	7:37:00 AM	2200	N	Overcast
26/08/2021	7:36:00 AM	68	NW	Overcast
9/09/2021	7:35:00 AM	86	N	Cloudy
23/09/2021	7:36:00 AM	92	N	Cloudy
8/10/2021	9:29:00 AM	110	SE	Clear
21/10/2021	7:23:00 PM	33	N	Cloudy
4/11/2021	9:28:00 AM	390	SE	Overcast
18/11/2021	11:26:00 AM	62	SW	Clear
2/12/2021	8:02:00 AM	84	SW	Cloudy
17/12/2021	7:21:00 AM	420	N	Overcast
31/12/2021	7:20:00 AM	230	SW	Cloudy
13/01/2022	7:03:00 AM	980	SE	Overcast
27/01/2022	7:39:00 AM	13000	S	Rain
11/02/2022	7:27:00 AM	290	N	Overcast
25/02/2022	7:43:00 AM	440	S	Mild
13/03/2022	7:25	130	N	Overcast
24/03/2022	7:37	150	S	Mild
07/04/2022	7:31	1700	N	Mild
21/04/2022	7:29	300	E	Overcast
5/05/2022	7:26	110	N	Mild
19/05/2022	7:27	140	NE	Overcast
3/06/2022	08:26	460	S	Clear
30/06/2022	07:33	310	N	Rain

Karori Stream at approximately 100 metres downstream of the Western Treatment Plant

Sample Date	Sample Time	Faecal Coliform (cfu/100 mL)	Wind Direction	Weather
1/07/2021	7:41:00 AM	940	S	Cloudy
15/07/2021	7:41:00 AM	110	N	Overcast
29/07/2021	7:47:00 AM	94	N	Overcast
12/08/2021	7:46:00 AM	1600	N	Overcast
26/08/2021	7:42:00 AM	72	NW	Overcast
9/09/2021	7:43:00 AM	84	N	Cloudy
23/09/2021	7:43:00 AM	100	N	Cloudy
8/10/2021	9:36:00 AM	94	SE	Clear
21/10/2021	7:15:00 PM	35	N	Cloudy
4/11/2021	9:35:00 AM	310	SE	Overcast
18/11/2021	11:20:00 AM	110	SW	Clear
2/12/2021	8:16:00 AM	86	SW	Cloudy
17/12/2021	7:27:00 AM	460	N	Overcast
31/12/2021	7:30:00 AM	220	SW	Cloudy
13/01/2022	7:13:00 AM	740	SE	Overcast
27/01/2022	7:47:00 AM	15000	S	Rain
11/02/2022	7:34:00 AM	330	N	Overcast
25/02/2022	7:50:00 AM	280	S	Mild
13/03/2022	7:33	160	N	Overcast
24/03/2022	7:30	140	S	Mild
07/04/2022	7:16	2100	N	Mild
21/04/2022	7:19	560	E	Mild
5/05/2022	7:32	110	N	Mild
19/05/2022	7:33	140	NE	Mild
3/06/2022	08:32	460	S	Clear
30/06/2022	07:39	300	N	Rain