OceanaGold
(New Zealand) Limited

Waihi Gold Mine: Annual Compliance Monitoring Report 2020/21

July 2021

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Prepared for OceanaGold (New Zealand) Limited

by

Deni Murray, MSc.
Melanie Vermeulen, BSc. (Hons)
Greg Ryder, PhD.

Ryder Environmental Limited
195 Rattray Street
PO Box 1023
DUNEDIN, 9054
New Zealand
Phone: 03 477 2119

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Cover page: Setting up for an electric-fishing run on the Ohinemuri River at site OH6 (March 2021) (Photo: G. Ryder).

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1. Introduction

1.1. Background

OceanaGold (New Zealand) Limited (OGNZL) owns and operates open pit and underground mines in Waihi. As part of mining operations, treated mine water is discharged to the Ohinemuri River at two discharge points (Discharge Permit 971318.01.12). These discharges, referred to as E1 (upper) and E2 (lower) are shown on Figure 1 together with 5 water monitoring sites on the Ohinemuri River and 1 site on the Ruahorehore Stream, as described in Section 2 of this report.

Resource consent conditions require OGNZL to undertake a range of biological, sediment and water quality monitoring of local surface waters, and report these results annually to Waikato Regional Council in addition to an interim report that must be provided to WRC within two months of spring sampling.

This annual report presents:

- analysis of the volume and quality of water discharged from the water treatment plant to the Ohinemuri River, volumes of water discharged from the tailing storage facility (TSF2), direct discharges to the Ruahorehore Stream and discharges from silt ponds;
- in-river water quality monitoring undertaken by OGNZL between 1 May 2020 and 30 April 2021;
- sediment quality monitoring undertaken by Ryder Environmental during December 2020 and March 2021 ecological surveys;
- results of ecological surveys undertaken by Ryder Environmental in spring and autumn including habitat characteristics, periphyton, macrophytes, benthic macroinvertebrates and fish.

1.2. Resource Consent Requirements

Discharge Permit 971318.01.12 authorises OGNZL to discharge treated water from the water treatment plant to the Ohinemuri River. The relevant consent conditions of the discharge permit, with regards to this interim report, are as follows:

16. *Unless otherwise agreed with Waikato Regional Council the consent holder shall undertake the following monitoring throughout the period of wastewater discharge to the Ohinemuri River (Table 5 and Figure 1);*

17. *Unless otherwise agreed by Waikato Regional Council in writing the results of the interim monitoring shall be reported to Council within two months of spring sampling. A full report detailing the results of all monitoring specified in condition 16, Table 5 shall be submitted to Waikato Regional Council by 30 July each year following the autumn*

sampling. This report shall include a comparison of the sediment data with the National Oceanic and Atmospheric Administration and Ontario Ministry of Environment sediment quality guidelines.

Should a more appropriate set of standards or guidelines be developed, then those could be substituted as the comparison guidelines by mutual agreement between Waikato Regional Council and the consent holder.

18. At any time following the completion of two seasonal monitoring events (e.g. spring to spring), if a significant difference is deemed to have occurred between sites on both occasions then the consent holder shall undertake immediate further monitoring. Should a significant difference be recorded during this contingency monitoring the consent holder shall inform Council and shall determine any mitigation measures that need to be implemented to ensure that significant effects are remedied or mitigated.

'Significant' is defined as follows:

- *a significant difference in macroinvertebrate biota will be deemed to have occurred following a statistically significant change at test sites B and DPD of 30% above the natural variation recorded at the control sites A and UPD;*
- *a significant difference in total macroinvertebrate abundance will be deemed to have occurred following a statistically significant change at test sites B and DPD of 50% above the natural variation recorded at the control sites A and UPD.*

These monitoring requirements are summarised in Table 1.

Table 1 Biological, sediment and river water quality monitoring (Adapted from Table 5 of consent 917318).

Aquatic biota	**Frequency**	**Sites**	**Methods**	**Parameters**
Fish	Late summer (Feb-Mar)	OC2, OH5, RU1, OH1, OH6, a site on Mataura, (M1) Ratarua (R1) and Waitete (W1) Streams	Electric fishing	Species numbers Species abundance Fish lengths
Macro-Invertebrates	Spring (Oct-Dec) Autumn (Mar-May)	OH3, OH5 RU1, OH1, OH6	Surber sampling	Taxa richness Total abundance Key taxa abundance
Periphyton	Spring (Oct-Dec) Autumn (Mar-May)	OH3, OH5 RU1, OH1, OH6	Rock scrape sampling	Chl-*a*, AFDW, taxa richness
Water Quality	Spring (Oct-Dec) Autumn (Mar-May)	OH3, OH5 RU1, OH1, OH6	Spot Sampling	All parameters listed in condition 14, Table 1, and NO_3
Sediment	Spring (Oct- Dec) Autumn (Mar- May)	OH3, OH5 RU1, OH1, OH6	Sediment Coring	Metals listed in condition 14, Table 1
Fish (bully)	Once during summer (January to March)	OC2, OH6	Analysed in accordance with appropriate USEPA procedures as agreed with Waikato Regional Council	Composite whole body selenium concentration (dry weight)
Periphyton and macrophyte	Autumn (Mar-May)	OC2, OH6	Analysed in accordance with appropriate USEPA procedures as agreed with Waikato Regional Council	Total Selenium (both wet weight and dry weight)

2. Methods

The sampling and processing methods used in the 2020/21 surveys to assess surface water and sediment quality, physical habitat, and periphyton and benthic invertebrate communities, were largely identical to those employed in recent years as described in Golder (2017) and are briefly described below. See Golder (2017) for full details. Any differences in monitoring, sampling or processing methods between the methods used in the 2020/21 surveys and those used in other recent surveys are outlined in the appropriate sections below.

2.1. Monitoring Sites and Activities

Surveys were undertaken at 5 sites in the Ohinemuri River and at sites in Mataura, Ratarua, Ruahorehore and Waitete Streams (Figure 1, Table 2). Spring surveys were undertaken on 9-10 December 2020 while autumn surveys were conducted on 24-26 March 2021 (Summer/Autumn).

The sampling activities undertaken at each of the monitoring sites are outlined in Table 3.

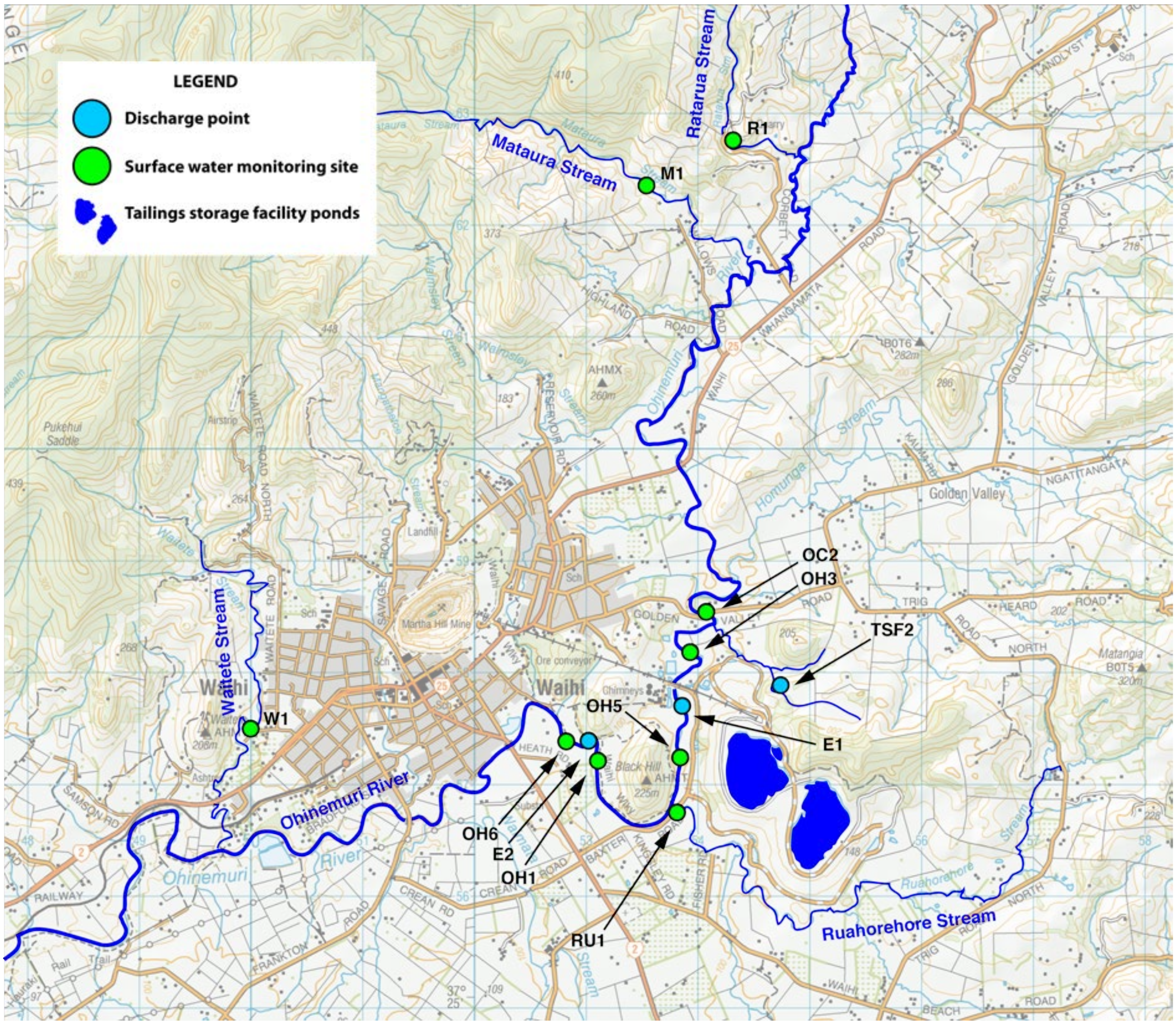


Figure 1 Map showing location of surface water monitoring sites and mine discharge points.

Table 2 Summary of receiving water monitoring site names, locations and map references.

Monitoring site	Surface water	Location description	Map reference (NZTM)
OC2	Ohinemuri River	Upstream of all mine related discharges	N 5858577 E 1854003
OH3	Ohinemuri River	600 m upstream of E1 but downstream of an unnamed tributary of the Ohinemuri River into which Tailing Storage Facility 2 discharges	N 5858176 E 1853904
OH5	Ohinemuri River	500 m downstream of E1	N 5857176 E 1853806
OH1	Ohinemuri River	Approximately 150 m upstream of E2	N 5857174 E 1853106
OH6	Ohinemuri River	Approximately 500 m downstream of E2	N 5857545 E 1852763
RU1	Ruahorehore Stream	Immediately upstream of confluence with Ohinemuri River	N 5856750 E 1853798
M1	Mataura Stream	Through farm at end of Willows Road	N 5862271 E 1853635
R1	Ratarua Stream	Downstream of road bridge	N 5862830 E 1854263
W1	Waitete Stream	Vicinity of bridge at Orchard Road	N 5857455 E 1850058

Table 3 Monitoring activities undertaken at each site.

Type of monitoring	Activity	Site								
		OC2	OH3	OH5	OH1	OH6	RU1	M1	R1	W1
River water quality	Sampling	✓	✓	✓	✓	✓	✓	✓	✓	✓
Habitat	Visual assessment	✓	✓	✓	✓	✓	✓			
Sediments	Metal/metalloid concentrations	✓	✓	✓	✓	✓	✓			
Periphyton	Cover and biomass	✓	✓	✓	✓	✓	✓			
	Selenium concentrations	✓				✓				
Macrophytes	Cover	✓	✓	✓	✓	✓	✓			
	Selenium concentrations	✓				✓				
Macroinvertebrates	Biological indices	✓	✓	✓	✓	✓	✓			
Fish	Population counts	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Selenium concentrations	✓				✓				

2.2. Water

Treated water discharged to the Ohinemuri River was monitored by OGNZL in general accordance with Condition 15 of the discharge permit. The receiving water was monitored in accordance with Conditions 15 and 16 of the permit.

The pH, temperature and conductivity of the treated water and river water at each site were measured by OGNZL in situ. Samples collected from these sites at the same time as the biological monitoring were forwarded to Hill Laboratories for analysis. Continuous river flow, pH and temperature data were measured by OGNZL at the Frendrups site. All parameters (refer Appendix A) were also measured in the river during biological sampling.

2.3. Sediment

2.3.1. Sample collection

Sediments were collected within the survey reach at each of Sites OC2, OH3, OH5, OH1, OH6 and RU1 in the spring and autumn surveys. The method employed was adapted from USEPA (1998). Each reach extended at least five channel widths upstream and the same distance downstream.

A small plastic scoop was used to collect surficial sediment, which was transferred to a pre-labelled plastic container. Any visible organisms and larger stones were removed before the container was placed into a cooler. The sample was kept cool until analysis.

The scoop was cleaned and rinsed at each site following sampling. The equipment was also rinsed thoroughly at the next site prior to sampling to prevent any potential cross-contamination.

2.3.2. Sample analysis

Sediment samples were analysed at Hill Laboratories. Samples were wet-sieved to separate the <63 µm and <2 mm fractions. Sediment fractions were then air dried at 35°C prior to digestion with nitric acid and hydrochloric acid. Following digestion, each fraction was analysed for the elements listed in Table 6 of the discharge permit (reproduced in Appendix A) using inductively coupled plasma mass spectrometry (ICP-MS); chromium (VI) concentrations were also measured in both fractions. As specified in Condition 17 of the discharge permit, data were compared to NOAA (1999), Buchman (2008) and OME (1993) sediment quality guidelines.

2.4. In-Stream and Riparian Habitat

In-stream and riparian habitat characteristics were assessed at each of sites OC2, OH3, OH5, OH1, OH6 and RU1 to assist with interpreting biological community data. Habitat characteristics assessed included estimates of channel width, depth, substrate composition, proportion of each habitat type (e.g., run, riffle, pool and cascades), streambank erosion and riparian shading. The methods used were the same as used during previous annual monitoring (e.g., Golder 2017) and allow for comparisons over time to be made.

2.5. Periphyton

2.5.1. *Cover*

Periphyton (algae) cover and associated calculation of periphyton indices followed methodologies set out in a Waikato Regional Council technical report (Collier & Champion 2014).

2.5.2. *Biomass*

Sample collection

Samples for periphyton biomass assessments were collected by scraping a fixed area (0.0039 m^2 – or two circles each with a diameter of 50 mm) of stone surface for each replicate at each site. This follows method QM-1b of Biggs & Kilroy (2000). Previous surveys followed a different sampling protocol (method QM-1a of Biggs & Kilroy 2000), which involved scraping the entire stone surface then measuring the surface area to derive a figure for periphyton biomass per unit area of stone surface).

Laboratory analysis

Algae identification was undertaken by the Cawthron Institute (Nelson) using in-house methods based on Biggs & Kilroy (2000).

Periphyton biomass analyses (chlorophyll-*a* and Ash Free Dry Weight or AFDW) were undertaken by the Cawthron Institute using methods described in the NIWA Periphyton Monitoring Manual (chlorophyll-*a*) and APHA 10200-1 (AFDW).

2.5.3. *Selenium analysis*

A single composite sample comprising between 150 g and 200 g of filamentous green algae (periphyton) was collected from a range of large gravel and cobble sized substrates at each of Sites OC2 and OH6. Samples were chilled and returned to the laboratory for the removal of any benthic macroinvertebrates, organic material and sediment, and rinsed four times in deionised water before being dispatched to Hill Laboratories for analysis. Selenium was analysed in each of the periphyton samples using ICP-MS following aqueous tetramethylammonium hydroxide (TMAH) digestion at 90°C for one hour.

2.6. Macrophytes

2.6.1. Cover

Macrophyte percentage coverage was estimated at each of Sites OC2, OH3, OH5, OH1, OH6 and RU1, and the species present and type of macrophytes present (i.e., submerged or emergent) were recorded.

2.6.2. Selenium analysis

Since changes to the resource consent in 2015, only macrophyte stems and leaves are analysed for selenium concentration. At both sites, approximately 500 g (wet weight) of plant stems were collected from at least two separate macrophyte beds and combined to form a single sample. The plant material was rinsed in river water, placed in a plastic bag and stored on ice until returned to the laboratory. All non-target species were then removed from the plant material, which was then rinsed in de-ionised water before being sent to Hills Laboratory for analysis. Selenium was analysed in each sample using ICP-MS following aqueous TMAH digestion at 90°C for one hour.

2.7. Benthic Macroinvertebrates

2.7.1. Sample collection

Benthic macroinvertebrate samples were collected using the same methods as employed in previous years. At each of sites OC2, OH3, OH5, OH1, OH6 and RU1, six individual replicates were collected from riffle habitats using a Surber sampler (0.1 m^2; 300 µm mesh) following Protocol C3 for quantitative sampling in stony streams (Stark *et al.* 2001). Samples were preserved in 95% ethanol in the field.

Benthic macroinvertebrates were processed using a modified version of Protocol P3 (full count with sub-sampling option). The sub-sampling option involved picking out abundant taxa from 12.5% or 25% of the total sample and multiplying the count by eight or four, respectively. Benthic macroinvertebrates were identified to the minimum level in Stark (1998) using keys in Winterbourn *et al.* (2006) and Chapman *et al.* (2011).

2.7.2. Macroinvertebrate indices

The following biological indices were calculated from macroinvertebrate community data to assess river health: Taxa richness, abundance, EPT taxa richness and %EPT, macroinvertebrate community index (MCI) and the quantitative MCI (QMCI).

Taxa richness is a measure of the number of macroinvertebrate taxa in a sample. In general, streams that support a high number of macroinvertebrate taxa are more likely to be of a higher environmental quality than streams with few taxa present. However, interpretation of taxa richness data as an environmental indicator is dependent on the pollution sensitivity or tolerance of taxa present.

Abundance is a measure of the total number of macroinvertebrates in a sample. Macroinvertebrate abundance can increase in the presence of mild organic or nutrient enrichment but decreases in the presence of gross enrichment. Abundance is a useful measure for comparison between sites but can be highly variable.

EPT refers to the number of taxa that belong to the Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) groups. EPT taxa are generally considered to be ‘sensitive’ to reductions in water/habitat quality. Percentage EPT (%EPT) is a measure of the abundance of EPT taxa making up the community (Lenat 1988). The caddisflies *Oxyethira* and *Paroxyethira* are not sensitive to nutrient enrichment and are excluded from EPT and %EPT calculations (Collier 2005). EPT and %EPT values can provide a good indication of environmental quality, with high values indicating good water/habitat quality and low values poor water/habitat quality.

The MCI (Stark 1985) and QMCI (Stark 1998) are biological indices based on the organic enrichment tolerance values assigned to individual taxa. These indices have been adapted as general indicators of stream health. MCI scores are based on presence/absence data while the QMCI includes an abundance component. Higher MCI and QMCI scores generally indicate better water and habitat quality with scores interpreted following the thresholds and classes provided in Table 3 (Stark & Maxted 2007).

An assessment of the change in taxa number and abundance between sites upstream and downstream from each discharge is undertaken as part of Condition 18 of the discharge permit (refer Section 9.4). MCI, QMCI and %EPT indices are not defined in the discharge permit and are provided as an additional means of assessing stream health.

Table 4 Interpretation of macroinvertebrate community index values from Stark and Maxted (2007).

Quality Class	MCI	QMCI
Excellent	> 120	> 6.00
Good	100 – 119	5.00 – 5.99
Fair	80 – 99	4.00 – 4.99
Poor	< 80	< 4.00

2.8. Fish

2.8.1. Sample collection

As specified in Condition 16 of the discharge permit, fish populations were surveyed at each of sites OC2, OH5, OH1, OH6, RU1, M1, R1 and W1 by three-pass depletion electric fishing using a Kainga EFM300 backpack electric fishing machine. Each reach consisted of riffle and run habitat. The area of each reach was estimated in order to allow the calculation of fish densities (fish/m^2). Fish captured during each pass were kept in separate buckets filled with river water. All fish collected were identified, counted and their lengths measured. Fish species caught were identified in the field using taxonomic keys provided in McDowall (1990, 2000). A note was made of any skin lesions or deformities before returning the fish to the river.

The estimated (maximum likelihood) fish populations at each site were determined using MicroFish 3.0 (van Deventer & Platts 1989). Fish abundance data for each of the three passes was entered into the MicroFish 3.0 model, which estimates the fish population using the Burnham maximum likelihood population formula. The result was converted to fish density (fish/m^2) for each species.

2.8.2. Whole body selenium analysis

Sampling was conducted in accordance with the methods provided in USEPA (1998). As specified under the most recent consent version (December 2019), one species of fish was targeted at sites OC2 and OH6 (the common bully, *Gobiomorphus cotidianus*).

Composite samples comprising of between 10 and 15 bullies were collected from each site. Bully samples were washed four times in river water and four times in deionised water. Once washed, the sample was placed into a labelled plastic bag. All samples were kept frozen prior to sending to the laboratory.

The bully samples were homogenised at the laboratory (Hill Laboratories). Selenium was determined in each of the homogenised samples following aqueous TMAH digestion at 90°C for one hour.

2.9. Statistical analysis

For both the periphyton biomass (ash free dry mass (AFDM) and chlorophyll-*a*) and macroinvertebrate biological indices, differences between sites were determined by 1-way ANOVA, followed by post-hoc Tukey HSD test in R statistical software and Excel. Pairwise comparisons using Tukey tests were calculated using the formula:

$$\frac{m_i - m_j}{\sqrt{MS_{within} * \frac{1}{n}}}$$

Where:

m_i is the mean for group i

m_j is the mean for group j

MS_{within} is the mean square within-groups, or residual mean square from the 1-way ANOVA

n is the number of replicates per group.

The significance of differences between each pair of groups was determined by comparing the Tukey HSD statistic for each pairwise comparison to the corresponding critical value for the Studentised Range Distribution (α = 0.05, k = 5, df = 20; critical value = 4.232).

To investigate relationships between environmental variables and the periphyton and macroinvertebrate communities, first Bray-Curtis similarity index and nonmetric multidimensional scaling (NMDS) were used to construct a map of similarity between samples using R statistical software (vegan package). This method systematically groups and ranks replicates based on similarities between the communities at each site. Macroinvertebrate data were $\log_{10}(x+1)$-transformed before Bray-Curtis similarities between replicate samples were calculated.

3. Treated Water Discharge

Treated water from the mine is discharged to the Ohinemuri River at two locations: the upper (E1) and lower (E2) discharge points (Figure 1). These discharges are permitted under Resource Consent number 971318 and are subject to a number of conditions, particularly relating to the volume and quality of water discharged.

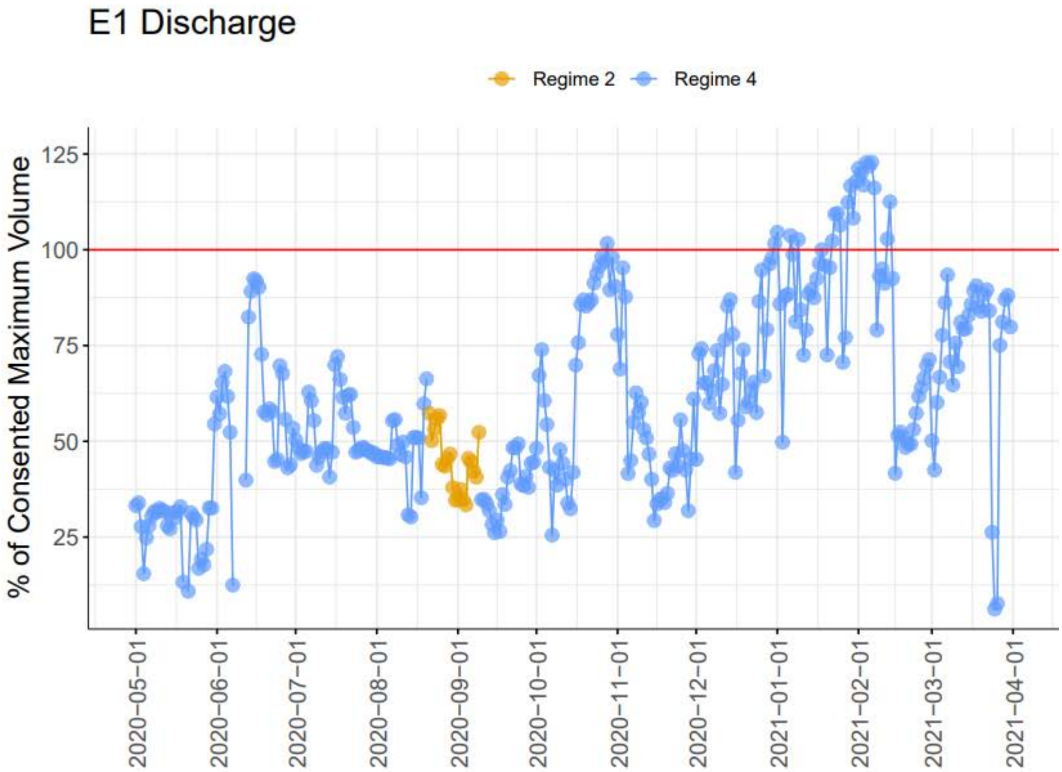
3.1. Discharge Volumes

3.1.1. Water treatment plant

Table A of Discharge Permit 971318 sets out discharge criteria for the different operating regimes (the discharge permit is reproduced in full in Appendix A). These limits specify the maximum combined total daily volume discharged and the maximum combined rate of discharge as well as setting out a limit on the discharge from the upper discharge point (E1) as a percentage of the instantaneous flow in the Ohinemuri River. Raw data and discharge regime information are provided in Appendix B. The combined volume of treated water is discharged to the Ohinemuri River each day through both discharge points, and the volume of water discharged from the upper discharge point (E1) are shown as a percentage of the applicable limit on Figure 2.

Over the period 1 May 2020 to 30 April 2021, the WTP operated under Regime B for 20 days and Regime D for 335 days (Figure 2). Regimes A and C were not used over this period. Treated water was discharged to the Ohinemuri River from the upper discharge (E1) for 331 days (99%), whereas the lower discharge was also used on 182 days (54%). The average daily volume of treated water discharged via the upper discharge (E1) was 9,771 m^3/day and the average daily discharge volume from the lower discharge (E2) was 2,626 m^3/day, with a combined daily discharge average of 11,214 m^3/day [average over the days for which water was discharged (e.g. days with zero discharge were excluded from the calculation)].

The daily volume of the upper discharge (E1) and the combined discharge (E1 + E2) of the treated water discharged to the Ohinemuri River exceeded the applicable limit multiple times between 1 May 2020 and 30 April 2021 (Figure 2). Specifically, the percent of consented maximum volume for the E1 discharge exceeded one-hundred percent on twenty-three days during the 2020 to 2021 monitoring period, with the maximum exceedance occurring between February 1 2021 to February 7 2021 (123% of maximum consented volume). The percent of consented maximum volume for the combined discharge exceeded the one-hundred percent on twenty-one days during the 2020 to 2021 monitoring period, with the maximum exceedance occurring between February 12 2021 to February 14 2021 (128% of the maximum consented volume). OGNZL provided a memo to the Waikato Regional Council outlining the exceedance of the allowable volume of discharge for 10 days during February 2021, claiming that the exceedance was due to calculations from an older version of a rating table that is used to outline the relationship between river level and flow. The new version of the rating table was not implemented until mid-February. All surface water quality results in February were within receiving water quality limits.



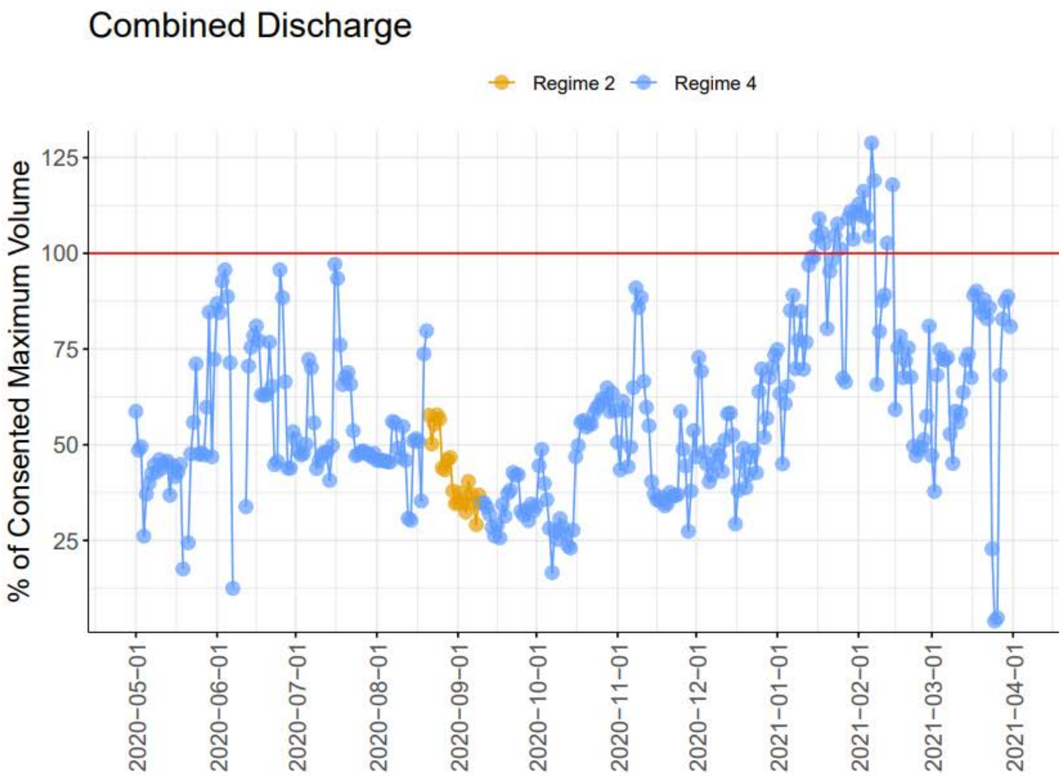


Figure 2 Daily volumes of treated water discharged from the WTP to Ohinemuri River between 1 May 2020 and 30 April 2021 as a percentage of the consented maximum volume (red line).

3.1.2. Tailings Storage Facility 2

As part of mining operations, OGNZL holds resource consent (Discharge Permit 971323) to discharge water from TSF2 into an unnamed tributary (TB1) of the Ohinemuri River. The conditions of Discharge Permit 971323 prohibit the discharge of water from TSF2 if the resultant receiving water quality will not meet criteria described in Table 1 of Discharge Permit 971318 after reasonable mixing (reproduced in Appendix A). To ensure this condition is met, water is discharged from TSF2 only when TSF2 water quality meets these criteria. A summary of TSF2 discharges between 1 May 2020 and 30 April 2021 is provided in Table 5. Raw data are provided in Appendix B. We note that the five smaller volumes listed in Table 5 (marked with an *) are related to flow meter or totaliser errors and are not actual discharges.

*Table 5 Summary of discharges from Tailings Storage Facility 2 (TSF2) over the period 1 May 2020 to 30 April 2021. Note that volumes marked with an * are related to flow meter or totaliser errors and are not actual discharges.*

Start date	End date	Duration (days)	Discharge volume	
			Mean daily (m^3/d)	Total volume (m^3/d)
23-Jul-20	30-Jul-20	8	4,156	33,251
4-Aug-20	5-Aug-20	2	52	103*
9-Aug-20	9-Aug-20	1	13	13*
24-Aug-20	28-Aug-20	5	3,503	17,517
29-Sep-20	29-Sep-20	1	1	1*
12-Nov-20	12-Nov-20	1	1	1*
17-Nov-20	17-Nov-20	1	1	1*

3.1.3. Direct discharges

OGNZL holds resource consent (Discharge Permit 971312) to discharge water from collection ponds to the Ohinemuri River and Ruahorehore Stream if the resultant receiving water quality meets relevant criteria (refer Table 1 in Appendix A). Condition 13 of Discharge 971312 permits the direct discharge from these ponds provided the consent holder can demonstrate to the WRC *"the quality of the water entering the ponds is of a sustainable quality such that on a continuous basis the effects of the discharge from these ponds after mixing meets or is better than the receiving water criteria."*

OGNZL was granted approval in July 2014 to commence direct discharge of the water from the S3, S4 and S5 collection ponds to the Ruahorehore Stream. Table 6 provides a summary of direct discharges between 1 May 2020 and 30 April 2021. Raw data are provided in Appendix B.

Table 6 Summary of direct discharges from collection ponds between 1 May 2020 to 30 April 2021.

Collection pond	Total number of days discharging	Discharge volumes	
		Mean (m^3/day)	Total (m^3)
S3	91	2,624	238,764
S4	61	1,958	119,412
S5	68	2,341	159,185

3.2. Discharge quality

The treated water quality data in this report relates to samples collected from polishing pond 2 (PP2), as the water in PP2 represents the treated water that is discharged to the Ohinemuri River. Samples were collected from PP2 twice daily and analysed for pH, TSS, total ammonia, CNWAD[1], copper, iron, manganese and silver. Weekly samples are collected for the additional analysis of dissolved and acid soluble antimony and selenium, and monthly samples are collected for the additional analysis of acid soluble arsenic, cadmium, chromium, cobalt, lead, mercury, nickel and zinc plus, calcium, magnesium, Cr^{+6}, sulfate, and electrical conductivity.

The discharge permit (Resource Consent 971318) sets out “Normal” and “Maximum” Compliance Values for each operating regime that ensure the resultant in-river concentrations are lower than relevant criteria. Maximum Compliance Values (MCV) for each parameter are to be met at all times. A Normal Compliance Value (or trigger limit in the case of antimony and selenium) is also specified for TSS, ammonia, CNWAD, antimony, copper, iron, manganese, selenium and silver. The Normal Compliance Value (NCV) are to be met 97% of the days during which the WTP is discharging in any three-month period.

For the purposes of calculating means as well as graphing the data, values below their respective detection limits were assigned the value of half the detection limit, as is accepted practice.

3.2.1. Daily measured parameters

The results of daily monitoring between 1 May 2020 and 30 April 2021 are presented in Figure 3 and the results over this period are summarised in Table 7. All values were within the compliance range (Table 7). Normal Compliance Values are shown as an orange line and daily measurements should be lower than this value in 97% of samples, while the red line identifies the MCV, which should not be exceeded. Raw data are provided in Appendix C.

[1] Cyanide weak acid dissociable, refers to a group of cyanide species that form free cyanide when exposed to weakly acidic conditions (pH 4.5-6).

*Table 7 Summary of daily water quality measurements in treated water taken between 1 May 2020 and 30 April 2021. *median for pH, mean for all other variables. Units are in mg/L for all variables except pH, which is unitless.*

Statistic	pH	TSS	Ammonia	CNWAD	Copper	Iron	Manganese	Silver
Mean*	8.8	2.1	0.97	0.087	0.002	0.03	0.01	0.0004
Minimum	7.7	2.0	0.17	0.007	0.001	0.008	0.001	0.0004
Maximum	9.0	7.0	4.7	0.07	0.02	0.088	0.05	0.0007
Count	359	359	359	359	359	359	359	359
Historical range	6.6-10.9	<2-48	0.1-15	<0.0035-0.35	<0.00049-0.41	<0.004-0.85	0.001-0.75	<0.0002-0.047

3.2.2. Less frequently monitored parameters

The concentration of some metals and metalloids in the treated water were measured on a weekly (antimony and selenium), monthly (arsenic, cadmium, hexavalent chromium, lead, mercury, nickel and zinc) or less frequent (cobalt[2]) basis. Table 8 presents a summary of the average concentration, range and number of measurements for each these over the period 1 May 2020 to 30 April 2021 and the historical concentration range.

*Table 8 Summary of the concentration of acid-soluble metals in treated water (1/5/20 to 30/4/21). All units are mg/L. * = The means for nickel and zinc were affected by most values being below the detection limit. † = the cobalt analysis was for the dissolved form. †† = the highest actual value recorded, where detection limit was less than for other samples.*

Statistic	Antimony	Arsenic	Cadmium	Chromium (VI)	Cobalt†
Mean	0.003	0.002	0.00008	<0.010	0.001
Minimum	0.001	<0.001	0.00002	<0.010	0.001
Maximum	0.01	0.002	<0.0001††	<0.010	0.001
Count	51	12	12	12	1
Historical range	<0.0001-0.19	<0.001-0.005	<0.00005-0.0003	<0.01-0.012	<0.0001-0.17

Statistic	Lead	Mercury	Nickel	Selenium	Zinc
Mean	0.0002	<0.00008	0.0009*	0.002	0.0017*
Minimum	<0.0001	<0.00008	<0.001	0.0004	<0.001
Maximum	0.0002	<0.00008	0.001	0.0077	0.002
Count	12	12	12	40	12
Historical range	<0.0001-0.0013	<0.00008-0.0001	<0.0005-0.036	<0.0002-0.058	<0.001-0.037

Concentrations of cadmium, hexavalent chromium, and mercury were below the laboratory detection limits on all occasions that these variables were sampled (Figure 4). Additionally, concentrations of arsenic, lead, nickel, and zinc were below the laboratory detection limit on the majority of sampling occasions. While the concentrations of antimony, cobalt, selenium (acid-soluble and dissolved), and hardness were above laboratory detection limits, they were

[2] Cobalt has no compliance limit.

below the relevant NCV or MCV during the 1 May 2020 to 30 April 2021 monitoring period (Figure 4).

Figure 3 Daily measurements of pH, total suspended solids (TSS), ammonia, CNWAD, copper, iron, manganese and silver concentrations in treated ponds between 1 May 2020 and 30 April 2021 along with the corresponding NCV (orange line, where applicable) and MCV (red line) for each variable. Values that were below the laboratory detection limit are shown as half of the detection limit for that test.

Figure 4 *Acid-soluble metal (except cobalt, which was dissolved) and metalloid concentrations in treated water between 1 May 2020 and 30 April 2021 along with the corresponding NCV (orange line, where applicable) and MCV (red line) for each variable. Detection limits (dark grey line) are shown for some variables that had a consistent detection limit over the reporting period. Values that were below the laboratory detection limit are shown as half of the detection limit for that test.*

3.3. Summary

The daily volume of the upper discharge (E1) and the combined discharge (E1 + E2), and the maximum volume for the combined discharge of the treated water discharged to the Ohinemuri River exceeded the applicable limit on occasions between 1 May 2020 and 30 April 2021. OGNZL was fully compliant with Condition 14 of the discharge permit, with concentrations complying with the compliance values specified in Tables 1 to 3 of the discharge permit. Parameters that are measured daily from the discharge quality were not measured during June 7th-11th 2020 as no discharge occurred over this period.

4. Receiving Water

4.1. River Flows

The flows in the Ohinemuri River and the Ruahorehore Stream are monitored continuously by OGNZL to satisfy the requirements of Condition 6 of the discharge permit. This condition specifies that the consent holder establish and maintain river gauging facilities to determine the river flow at the points of discharge. The flow in the Ohinemuri River at the upper discharge (E1) is measured at the Frendrups site, approximately 5 m upstream of the upper discharge. The river flow at the lower discharge (E2), which is downstream of the confluence with the Ruahorehore Stream, is calculated by adding Ohinemuri River flow (measured at Frendrups) to Ruahorehore Stream flow (measured at Ruddock).

Daily river flows at upstream of E1 and at E2 from 1 May 2020 to 30 April 2021 are presented in Figure 5. Raw data are provided in Appendix B. The mean flow in the Ohinemuri River at Frendrups over this period was 103 x 10^3 m^3/d (1.2 m^3/s), which is below the long term mean flow at this site (142 x 10^3 m^3/d, or 1.65 m^3/s). The highest flow in the 2020/21 monitoring period was 1,553 x 10^3 m^3/day (17.97 m^3/s). This flow was recorded on 17 July 2020 and was likely the result of 24 mm of rain that fell over a 3-day period (July 15th- 17th 2020). Waihi also experienced a 1 in 5-year storm event on the 14th and 15th of February 2021 with 110 mm of rain falling in a 6-hour period, resulting in flows of up to 9 m^3/s (Figure 5). As a result of heavy rainfall and loss of monitoring communications on-site (associated with a power outage), trickled out from the Mill Collection Pond for 3.5 hours. Details of the overflow event can be found in Appendix J. The water quality ramifications of this event are discussed in more detail below.

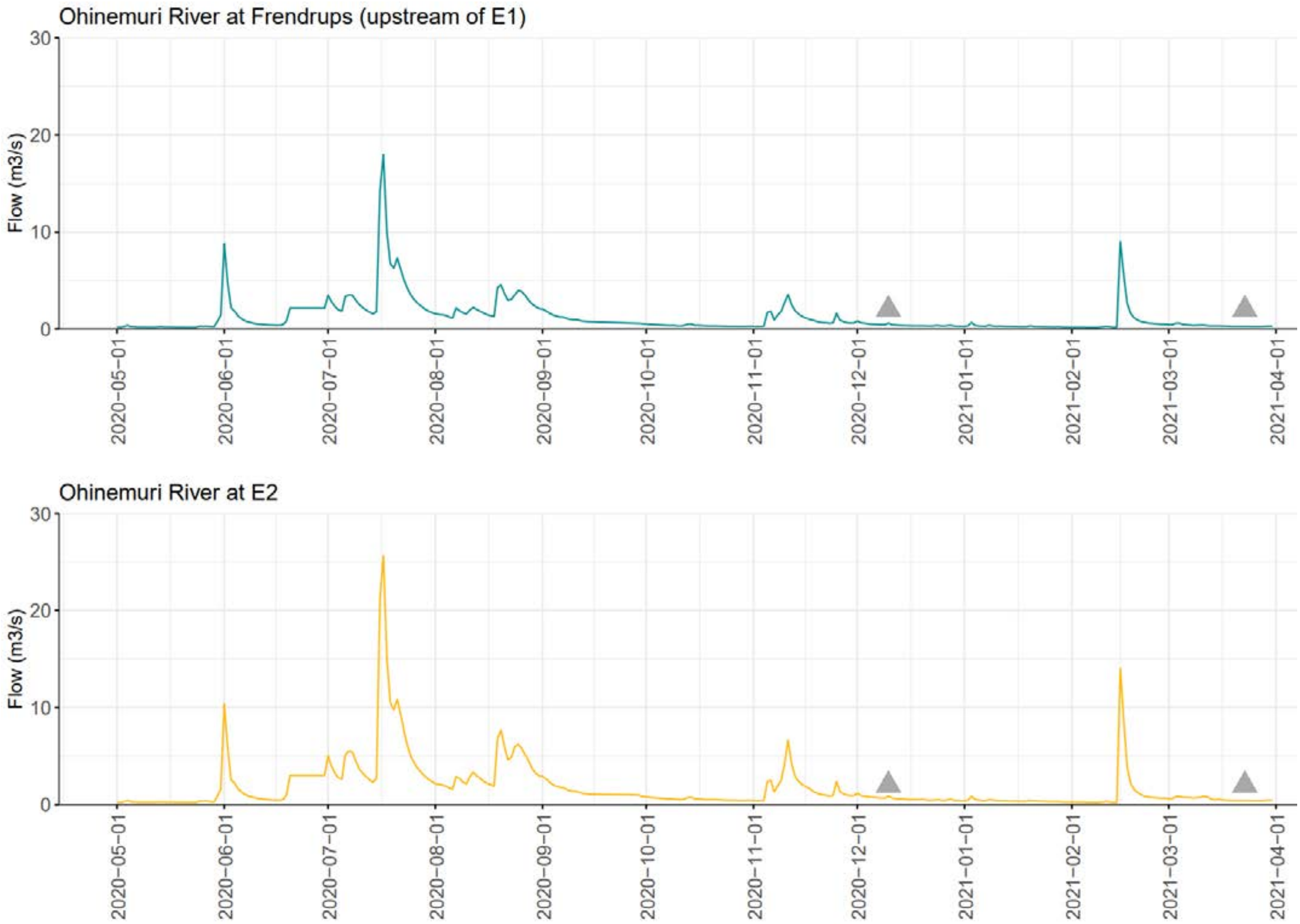


Figure 5 *Ohinemuri River flow at the upper (E1) and lower (E2) discharge points from 1 May 2020 to 30 April 2021. Grey triangles denote the timing of biological surveys.*

4.2. River Water Quality

Condition 16 of Discharge Permit 971318 specifies that river water samples are to be collected from Sites OH3, OH5, OH1, OH6 and RU1 in spring and autumn each year and are to be analysed for the parameters listed in Table 1 of the discharge permit, and for nitrate-nitrogen (NO_3-N). In addition, several consent conditions (refer to Appendix A) provide receiving water limits that apply to these sites.

OGNZL monitors water quality at the sites listed above more frequently than required by the consent, with many parameters measured weekly. Water quality is also measured on a voluntary basis at Site OC2, upstream of all mine related inputs, to allow comparison with sites downstream. The receiving water quality data measured between 1 May 2020 and 30 April 2021 are presented in Sections 4.2.1 to 4.2.3. Raw data are provided in Appendix D.

OGNZL monitors the water quality at Sites OH3, OH5, OH6 and RU1 on a more frequent basis, but only collects samples from Site OH1 (which is located upstream of the lower discharge) when the lower discharge (E2) is operating singly or when biomonitoring is conducted, which did not occur during the 2020/2021 monitoring, however samples were collected from OH1 on October 20th 2020.

4.2.1. General water quality characteristics

The general water quality characteristics of the Ohinemuri River and Ruahorehore Stream monitoring sites from 1 May 2020 to 30 April 2021 are summarised by site in Table 9 with relevant compliance limits and the historical range for each parameter. Compliance limits apply only to Sites OH1, OH3, OH5, OH6, and RU1.

pH

During the period 1 May 2020 to 30 April 2021, the pH of the receiving waters ranged from 6.4 to 8.8, and the pH at Site OC2 ranged from 6.4 to 8.2. The median pH for all sites was at or slightly above neutral (Table 9). pH did not exceed the upper (pH 9.0) compliance limit at any sites. However, the lower compliance limit (pH 6.5) was exceeded at OH6 on June 22nd 2020 (pH 6.4), at OC2 and RU1 on July 6th 2020 (pH 6.4), and at OH3 on February 15th 2021 (pH 6.4). The pH exceedance event in July 2020 was also thought to be a result of heavy rainfall and likely not related to mine operations. Details of this pH exceeded statement can be found in Appendix K.

Temperature

Temperature compliance limits are applicable to Site OH5, downstream from the upper discharge, and Site OH6, downstream from the lower discharge. The surface water temperature at Site OH5 must be no more than 3°C higher than that measured upstream of the upper discharge at Site OH3 (or Site OC2). On 2 November 2020, water temperature was 18.0°C at OH3 and 22.0°C at OH5, which is an increase of 4.0°C. However temperature in the treated water discharge at the time was only 17°C, so there may have been some other reason for the temperature increase, including a possible error in either reading or recording the temperature. Similar conditions apply to Site OH6, where the surface water temperature must be no more than 3°C higher than that upstream of the lower discharge but downstream of the upper discharge (i.e., Site OH5 or OH1). Temperature increase between OH5 or OH1 to OH6 was never greater than 3°C during the 2020/21 monitoring period (Table 9).

Total suspended solids

TSS compliance was assessed relative to the Receiving Water Quality Standards outlined in Table 1 of Resource Consent 971323: "*For upstream concentrations of less than or equal to 100 g/m^3 the increase shall be no greater than 10 g/m^3. For upstream concentrations of greater than 100 g/m^3 the increase shall be no greater than 10%*." Due to the rain event on February 15th 2021, TSS at OH3 reached 300 g/m^3 and 270 g/m^3 at site OH5.

Table 9 *pH, water temperature and total suspended solids (TSS) at the receiving water monitoring sites in the Ohinemuri River (OC, OH) and Ruahorehore Stream (RU) between 1 May 2020 and 30 April 2021. * likely a technical error as discussed above.*

		Site				
Parameter	**Statistic**	**OC2**	**OH3**	**OH5**	**OH6**	**RU1**
pH (unitless)	Median	7.2	7.1	7.3	7.1	7.0
	Minimum	6.4	6.4	6.5	6.4	6.4
	Maximum	8.1	8.7	8.8	8.5	7.3
	Count	52	13	53	52	12
	Limit	-	***6.5-9.0***			
	Exceedances	NA	**1**	0	**1**	**1**
	Historic range	6.2-8.4	6.08-8.7	6.1-8.7	6.2-8.4	6-8.1
Temperature (˚C)	Average	16.0	16.3	17.2	17.1	17.4
	Minimum	10.9	11.1	11.1	11.3	12.9
	Maximum	22.8	23.0	24.7	23.7	22.5
	Count	51	13	52	51	11
	Limit	-	NL	***<3˚C increase***	***<3˚C increase***	-
	Exceedances	NA	NA	1*	0	NA
	Historic range	8-24.5	8.4-24.8	8.2-24.8	8.5-25.8	9.5-23.4
TSS (g/m^3)	Average	2.05	25.9	7.1	2.01	2.5
	Minimum	1.5	1.5	1.5	1.5	1.5
	Maximum	16	300	270	15	10
	Count	52	13	53	52	12
	Limit	-	NL	***<10 g/m^3 increase***	***<10 g/m^3 increase***	-
	Exceedances	NA	NA	0	0	NA
	Historic range	<3-650	<3-1200	<3-590	<3-350	<3-385

Upstream discharge (E1)

Compliance with receiving water standards for the upper discharge (E1) was assessed by comparison of TSS concentrations at upstream sites (OC2 or OH3) with TSS concentration at the site immediately downstream of the discharge (OH5). There were no violations of the consent condition with respect to TSS despite the overflow event.

Downstream discharge (E2)

Compliance with receiving water standards for the lower discharge (E2) was assessed by comparison of TSS concentrations at upstream sites (OH1 or OH5) with TSS concentration at the site immediately downstream of the discharge (OH6). There were no violations of the consent condition with respect to TSS despite the overflow event.

4.2.2. Nitrogen Compounds

Concentrations of ammonia, NO_3-N and CNWAD between 1 May 2020 to 30 April 2021 are summarised by site in Table 10 along with relevant consent limits and the historical range for each parameter. As in previous years, ammonia concentrations were consistently below the temperature and pH-dependent limits (Figure 6). Nitrate concentrations measured at all sites were within the historical range at each monitoring site, as were CNWAD concentrations. While there is no compliance limit for nitrate, maximum nitrate concentrations at all sites in 2020/2021 were above the maximum nitrate concentrations historically. In-river concentrations of CNWAD were consistently less than the compliance limit of 0.093 g/m^3.

Table 10 Receiving water ammonia, nitrate and cyanide data for the period 1 May 2020 and 30 April 2021. N/A = Not applicable or no consent limit; CNWAD is weak acid dissociable cyanide. Historical range derived from data measured May 2005 to April 2019.

		Site				
Parameter	**Statistic**	**OC2**	**OH3**	**OH5**	**OH6**	**RU1**
Ammonia (mg/L)	Average	0.01	0.02	0.13	0.1	0.018
	Minimum	0.006	0.01	0.01	0.01	0.006
	Maximum	0.05	0.11	0.38	0.34	0.11
	Count	12	13	13	12	12
	Limit	NL	***Temperature and pH dependent***			
	Exceedances	NA	0	0	0	0
	Historic range	0.006-0.3	0.006-1.7	0.006-1.46	0.0061-1.8	0.0061-0.6
Nitrate nitrogen (mg N/L)	Average	0.52	0.52	1.01	1.08	0.68
	Minimum	0.05	0.05	0.15	0.21	0.05
	Maximum	2.3	2.3	2.8	2.9	3.2
	Count	12	13	13	12	12
	Limit	NL				
	Exceedances	NA	0	0	0	0
	Historic range	0.024-1.3	0.01-1.7	0.044-1.5	0.022-1.5	0.001-2.7
CNWAD (mg/L)	Average	0.001	0.002	0.003	0.001	0.001
	Minimum	0.001	0.001	0.002	0.001	0.001
	Maximum	0.001	0.02	0.02	0.001	0.001
	Count	12	13	13	12	12
	Limit	NL	***0.093***			
	Exceedances	NA	0	0	0	0
	Historic range	<0.001-0.002	<0.001-0.021	<0.001-0.073	<0.001-0.022	<0.002-0.013

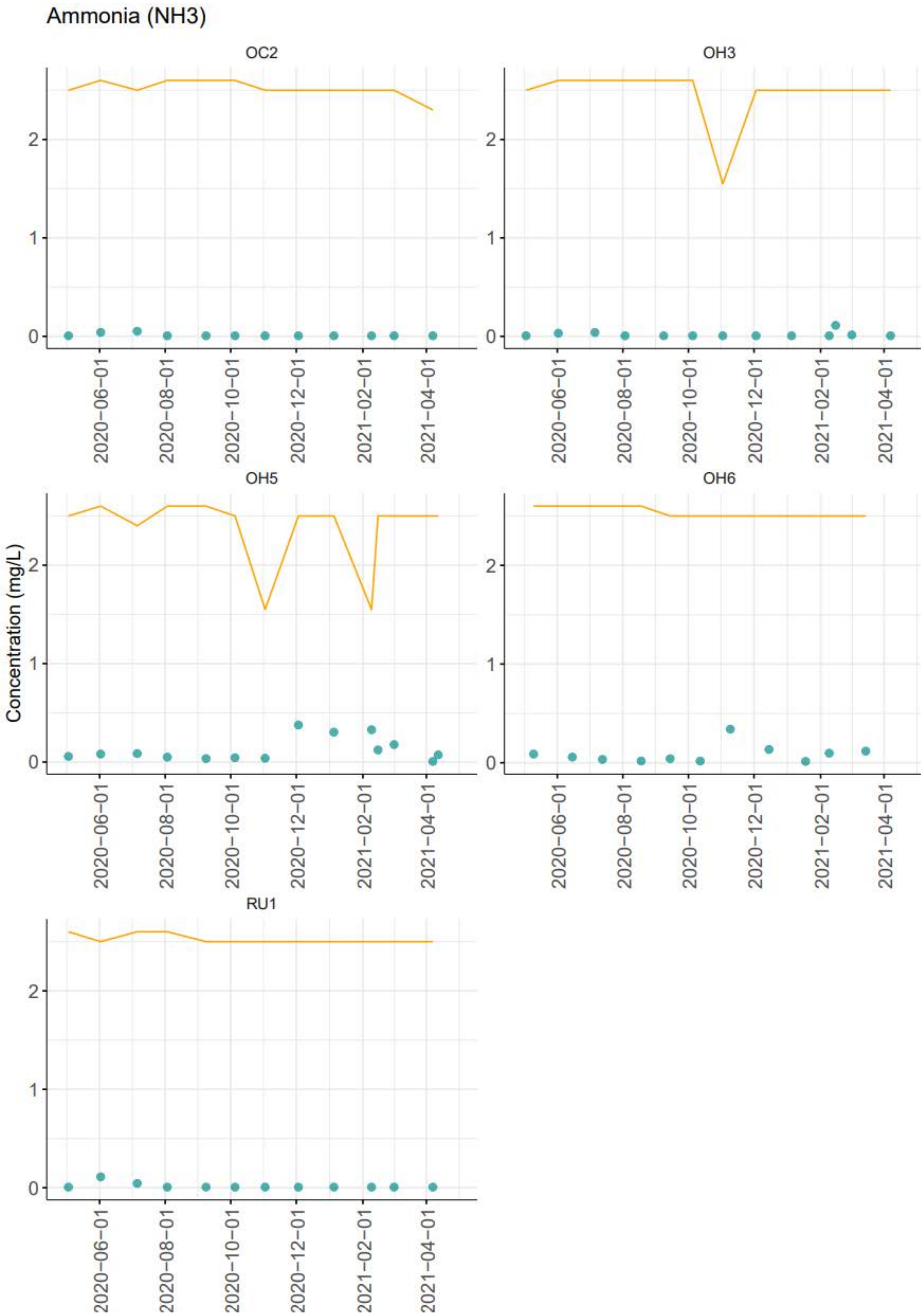


Figure 6 *Ammonia concentrations at Sites OC2, OH3, OH5, OH6 and RU1 between 1 May 2020 and 30 April 2021. Orange lines represent the compliance limit (which is temperature and pH dependent).*

4.2.3. Metals and metalloids

Dissolved metal and metalloid concentrations in the receiving waters between 1 May 2020 and 30 April 2021 measured at each site are summarised in Table 11 with compliance limits and the historical range for each element. Concentrations of most metals and metalloids in river water samples were below compliance limits, and often below detection limit (Table 11). Site OH3 is upstream of discharge E1 but downstream of an unnamed tributary of the Ohinemuri River into which TSF2 discharges. TSF2 was not discharging during these sampling events (Table 5). Manganese concentrations at sites downstream of OH3 were below 0.05 g/m^3, indicating that the high concentrations were localised to site OH3.

It is not possible to assess water quality against the mercury compliance limit because the laboratory detection limit (0.00008 mg/L) is greater than the consented compliance limit (0.000012 mg/L). Mercury concentrations were below detection limits on all sampling occasions during the 2020-2021 period.

Table 11 Receiving water metal/metalloid concentrations for the period 1 May 2020 and 30 April 2021. NA = Not applicable or no consent limit; NL = No consent limit.

Parameter	Statistic	OC2	OH3	OH5	OH6	RU1
		Site				
Antimony	Average	0.00011	<0.0002	0.00053	0.0005	<0.0002
	Minimum	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
	Maximum	0.0004	<0.0002	0.0025	0.0028	<0.0002
	Count	52	13	53	52	12
	Limit	NL	***0.03***			
	Exceedances	NA	0	0	0	0
	Historic range	<0.0002-0.0008	<0.0002-0.0091	<0.0002-0.011	<0.0002-0.0256	<0.0002-<0.0002
Arsenic	Average	<0.001	<0.001	<0.001	<0.001	<0.001
	Minimum	<0.001	<0.001	<0.001	<0.001	<0.001
	Maximum	<0.001	<0.001	<0.001	<0.001	<0.001
	Count	12	13	13	12	12
	Limit	NL	***0.19***			
	Exceedances	NA	0	0	0	0
	Historic range	<0.0002-0.0005	<0.001-<0.001	<0.001-0.0013	<0.001-0.0046	<0.001-<0.001
Cadmium	Mean	<0.00005	<0.00005	<0.00005	<0.00005	0.000036
	Minimum	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
	Maximum	<0.00005	<0.00005	<0.00005	<0.00005	0.00011
	Count	12	13	13	12	12
	Limit	NL	***Hardness dependent***			
	Exceedances	NA	0	0	0	0
	Historic range	<0.00005-<0.00005	<0.00005-<0.00005	<0.00005-<0.00005	<0.000005 – 0.000025	<0.000005-0.00007
Chromium (VI)	Average	0.005	0.0047	0.0046	<0.01	<0.01
	Minimum	<0.01	<0.001	<0.001	<0.01	<0.01
	Maximum	0.01	0.005	0.005	<0.01	<0.01
	Count	12	13	13	12	12
	Limit	NL	***0.01***			
	Exceedances	NA	0	0	0	0
	Historic range	<0.001-0.015	<0.001-0.017	<0.001-0.005	<0.001-<0.01	<0.001-<0.01
Copper	Mean	<0.0005	0.0004	0.0034	0.0027	<0.0005
	Minimum	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Maximum	<0.0005	0.001	0.001	0.0005	<0.0005
	Count	12	13	13	13	12
	Limit	NL	***Hardness dependent***			
	Exceedances	NA	0	0	0	0
	Historic range	<0.0005-0.004	<0.0005-0.008	<0.0005-0.0119	<0.0005-0.01	<0.0005-0.0031

* Selenium trigger limit requires concentrations remain below 0.02 g/m^3 97 % of the time on an annual basis, and are not permitted to exceed 0.035 g/m^3 in any single analysis;

Table 11 (cont'd) Receiving water metal/metalloid concentrations for the period 1 May 2020 and 30 April 2021. NA = Not applicable or no consent limit; NL = No consent limit.

		Site				
Parameter	**Statistic**	**OC2**	**OH3**	**OH5**	**OH6**	**RU1**
Iron	Mean	0.13	0.14	0.11	0.085	0.16
	Minimum	0.05	0.05	0.04	0.05	0.070
	Maximum	0.25	0.33	0.31	0.16	0.33
	Count	12	13	13	12	12
	Limit	NL	***1***			
	Exceedances	NA	0	0	0	0
	Historic range	<0.02-0.25	0.03-0.45	0.03-0.38	<0.02-0.27	0.03-0.64
Lead	Mean	<0.0001	0.0001	0.00006	0.0006	0.00006
	Minimum	<0.0001	0.0001	<0.0001	<0.0001	<0.0001
	Maximum	<0.0001	0.0002	0.0002	0.0002	0.0001
	Count	12	13	13	12	12
	Limit	NL	***Hardness dependent***			
	Exceedances	NA	0	0	0	0
	Historic range	<0.0001-0.001	<0.00005-0.0013	<0.00005-0.00025	<0.00005-0.00084	<0.00005-0.0003
Manganese	Mean	0.012	0.017	0.019	0.024	0.047
	Minimum	0.0019	0.0009	0.005	0.005	0.01
	Maximum	0.046	0.069	0.083	0.083	0.24
	Count	12	13	13	12	12
	Limit	NL	0			
	Exceedances	NA	0	0	0	0
	Historic range	0.0011-0.077	0.0016-0.49	0.0044-0.32	0.0016-0.26	0.008-0.88
Mercury	Mean	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
	Minimum	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
	Maximum	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
	Count	12	13	13	13	12
	Limit	NL	***0.000012***			
	Exceedances	NA	***Consent limit currently > detection limit.***			
	Historic range	<0.00008-0.00017	<0.00008-<0.00008	<0.00008-<0.00008	<0.00008-0.0001	<0.00008-<0.00008
Nickel	Mean	<0.0005	<0.0005	<0.0005	0.0004	0.00054
	Minimum	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Maximum	<0.0005	<0.0005	<0.0005	0.001	0.003
	Count	12	13	13	12	12
	Limit	NL	***Hardness dependent***			
	Exceedances	NA	0	0	0	0
	Historic range	<0.0005-0.0018	<0.0005-0.001	<0.0005-0.0036	<0.0005-0.0025	<0.0005-0.0058

* Selenium trigger limit requires concentrations remain below 0.02 g/m^3 97 % of the time on an annual basis, and are not permitted to exceed 0.035 g/m^3 in any single analysis.

Table 11 (cont'd) Receiving water metal/metalloid concentrations for the period 1 May 2020 and 30 April 2021. NA = Not applicable or no consent limit; NL = No consent limit.

		Site				
Parameter	**Statistic**	**OC2**	**OH3**	**OH5**	**OH6**	**RU1**
Selenium (mg/L)	Mean	0.0004	0.00017	0.00086	0.0009	0.0002
	Minimum	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002
	Maximum	0.002	0.001	0.002	0.002	0.0005
	Count	52	13	53	52	12
	Limit	NL				
	Exceedances	NA	0	0	0	0
	Historic range	<0.0002-0.001	<0.0002-0.0029	<0.0002-0.0053	<0.0002-0.0095	<0.0002-0.001
Silver (mg/L)	Mean	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Minimum	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Maximum	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Count	13	13	13	12	12
	Limit	NL			***Hardness dependent***	
	Exceedances	NA	0	0	0	0
	Historic range	<0.00001-0.00014	0.00001-0.0004	0.00001-0.0015	0.00001-0.0014	0.00001-0.00005
Zinc (mg/L)	Mean	0.002	0.003	0.0022	0.003	0.005
	Minimum	<0.001	<0.001	<0.001	0.001	0.001
	Maximum	0.0054	0.007	0.005	0.008	0.02
	Count	12	13	13	12	12
	Limit	NL			***Hardness dependent***	
	Exceedances	NA	0	0	0	0
	Historic range	<0.001-0.016	<0.001-0.055	<0.001-0.013	<0.001-0.055	<0.001-0.014

* Selenium trigger limit requires concentrations remain below 0.02 g/m³ 97 % of the time on an annual basis, and are not permitted to exceed 0.035 g/m³ in any single analysis;

4.3. Summary

The lower pH compliance limit (6.5) was exceeded at OH6 on 22 June 2020 (pH = 6.4), at OC2 and RU1 on 22 June 2020 (pH = 6.4), and at OH3 on 15 February 2021 (pH = 6.4). The July 2020 and exceedances were likely due to sampling during heavy rain. Additionally, the surface water temperature downstream increase compliance limit (no more than 3°C) was exceeded on 2 November 2020 wherein surface water temperature was 18.0°C at OH3 and 22.0°C at OH5, which is an increase of 4.0°C. However, most likely this was unrelated to the treated water discharge. OGNZL complied with all other receiving water consent conditions between 1 May 2020 and 30 April 2021.

5. Sediment

5.1. Sediment texture (grain size analysis)

The sediment characteristics of each site are outlined in Section 6. Fine sediments (<2 mm) at each site were selectively sampled for metals analysis, as concentrations of metals and metalloids are typically higher in finer grained sediments, which have relatively larger surface area to volume ratios than coarser-grained sediments. Variability in sediment textures between sites has the potential to affect elemental concentrations, thus the relative proportion of silts (<63 µm) and sand (<2 mm) fractions at each site are considered in this section.

Across all sites, sand-size sediment (63 µm-2 mm) was more abundant in collected samples than silt-size sediment (<63 µm) (Table 12). For the spring survey (December 2020), fine sediments at sites OC2 and OH3 were predominantly sand (>90%), with a small proportion of silt, while sites OH5, OH1 and RU1 all had fine sediment fractions less than 85% (Table 12). Site OH5 had the highest proportion of silt in spring 2020 (16.5%). For the autumn survey (March 2021), the fine sediments at all sites were dominated by sands (>80%). The composition of fine sediments at all sites was within the historical ranges (Table 12).

Table 12 Grain size analysis for fine sediments collected from sites in the Ohinemuri River and Ruahorehore Stream. Units are g/100 g.

Fraction	Survey date	Site					
		OC2	OH3	OH5	OH1	OH6	RU1
Silt	Dec-20	5.8	0.8	16.5	3.8	1	2.5
(<63 µm)	Mar-21	1.5	0.5	1.3	1.1	1.4	4.1
	Historical range	0.7 - 48.9	0.5 - 19.1	0.7 - 23.3	0.05 - 31.5	1.0 - 40.0	0.3 - 10.4
Sand	Dec-20	90.4	90.7	83	69.3	47.8	75.7
(63 µm-2 mm)	Mar-21	83.5	93.5	97.1	94.3	90	90.1
	Historical range	40.1 - 96.9	54.2 - 94.2	54.8 - 99.1	58.4 - 99.1	56.6 - 97.8	78.3 - 98.6

5.2. Sediment quality

5.2.1. 2020/21 concentration data

Condition 17 of the discharge permit requires that metal sediment concentrations are compared to relevant OME[3] (1993) and NOAA[4] (1999) and Buchman (2008) sediment quality guidelines, which are described in Golder (2017), and summarised in Table 13. The NOAA guidelines were updated in 2008 (Buchman 2008), and discussion of sediment results will

[3] Ontario Ministry of Environment
[4] National Oceanic and Atmospheric Administration

hereafter refer to these guidelines as NOAA (2008). Total recoverable metal and metalloid dry weight concentrations in the 63 µm-2 mm sediment fraction are provided in Table 14 and concentrations in the <63 µm fraction are provided in Table 15, along with historical ranges for each site. Raw data are presented in Appendix E.

At all sites, concentrations of antimony, arsenic, cadmium, hexavalent chromium, copper, lead, nickel, selenium, silver, iron, mercury, and zinc in the <2.0 mm fraction were all within the historical range (December 2005 to March 2020). At site OC2 in autumn 2021, the manganese concentration in the <2.0 mm fraction was above the historical range by 10 mg/kg dry weight (Table 14). In the <63 µm fraction, concentrations of chromium, nickel, selenium, mercury, and silver were within the historical range or concentrations fell below the historical range (Tables 14 and 15), however, many sites were above the historical range for other metal/metalloids. In spring 2020, zinc concentration was outside the historical range at site OH6, manganese concentration was outside the historical range at site OH3, and cadmium concentration was outside the historical range at sites OH3 and OH6 (Table 15). In autumn 2021, concentrations of lead and cadmium at site OC2 were outside the historical range, site OH3 had concentrations of antimony, manganese, and copper that were outside the historical range, and site OH6 has concentrations of iron and arsenic that were outside the historical range (Table 15). While some concentrations of metals/metalloids were elevated at site OC2 (e.g., lead and cadmium), other sites (e.g., OH3 and OH6) that are downstream of the discharge points also had elevated concentrations of metals/metalloids (Tables 14 and 15).

Table 13 Sediment quality guidelines.

Metal	**OME (1993)**		**NOAA (2008)**	
	Lowest effect level* (mg/kg) dry wt.	**Severe effect level**** (mg/kg) dry wt.	**Threshold effects level***** (mg/kg) dry wt.	**Probable effects level****** (mg/kg) dry wt.
Antimony	-	-	-	-
Arsenic	6.0	33	5.9	17
Cadmium	0.6	10	0.6	3.5
Chromium	26	110	37	90
Copper	16	110	36	197
Iron (%)	2.0	4.0	-	-
Lead	31	250	35	91
Manganese	460	1100	-	-
Mercury	0.2	2.0	0.17	0.49
Nickel	16	75	18	36
Selenium	-	-	-	-
Silver	-	-	-	-
Zinc	120	820	123	315

* Lowest effect level: indicates a level of contamination which has no effect on the majority; of the sediment-dwelling organisms. The sediment is clean to marginally polluted.

** Severe effect level: sediment is considered heavily polluted and likely to affect the of sediment-dwelling organisms. If exceeded, testing is required to determine whether or not the sediment is acutely toxic.

*** Threshold effects level: the concentration of a chemical below which adverse effects only rarely occurred.

**** Probable effects level: concentration above which adverse effects frequently occurred.

*Table 14 Total recoverable metal and metalloid abundances in **<2.0 mm** sediment fraction. All units, with the exception of Fe, mg/kg dry weight; units for Fe are wt % (dry weight); historical range from December 2005 through March 2020 inclusive; results highlighted in red indicate concentrations above lowest guideline; orange values indicate concentrations that were above the historical range, blue values indicate concentration that were below the historical range.*

Metal	Survey period	Site OC2 <2mm	 OH3 <2mm	 OH5 <2mm	 OH1 <2mm	 OH6 <2mm	 RU1 <2mm
Antimony	Dec-20	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
	Mar-21	0.58	<0.08	<0.08	<0.08	0.1	<0.08
	Historical range	<0.04-0.097	<0.04-0.079	<0.04-0.47	<0.04-0.67	<0.04-2.7	<0.04-0.06
Arsenic	Dec-20	3	2.7	3.2	1.5	4.5	1.6
	Mar-21	3.2	2.5	2.7	2.5	3.8	1.7
	Historical range	1.9-7.0	1.7-5.4	2.1-6.3	1.5-6.8	1.8-7.1	0.9-6.0
Cadmium	Dec-20	0.105	0.079	0.118	0.041	0.25	0.193
	Mar-21	0.077	0.044	0.046	0.055	0.069	0.114
	Historical range	0.050-0.43	0.04-0.20	0.04-0.22	0.040-0.33	0.039-0.49	0.05-0.60
Chromium (hexavalent)	Dec-20	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
	Mar-21	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
	Historical range	<0.4-<2.0	<0.4-<2.0	<0.4-<2.0	<0.4-<2.0	<0.4-<2.0	<0.4-<2.0
Copper	Dec-20	6.6	4.2	10.4	3.2	7.7	1.8
	Mar-21	6	4.4	6.1	5	5.4	2.6
	Historical range	4.8-11	4.2-10	3.7-13	3.7-14	4.5-24	1.0-13
Iron (% dry wt.)	Dec-20	2	1.59	1.43	1.12	1.75	0.78
	Mar-21	2.2	1.54	1.99	1.59	1.67	0.9
	Historical range	1.6-4.2	1.23-2.6	1.25-2.7	0.93-3.4	1.26-2.8	0.44-2.2
Lead	Dec-20	8	4.9	10.1	4.6	8	6
	Mar-21	8	5.3	7.6	5.4	6.9	5.6
	Historical range	5.7-12	4.5-14	4.4-13	3.7-15	5.0-14	3.1-14
Manganese	Dec-20	220	340	120	106	83	300
	Mar-21	590	280	175	140	170	330
	Historical range	230-580	122-750	94-680	150-1,100	102-590	163-1,200
Mercury	Dec-20	0.33	0.27	0.51	0.19	0.3	0.08
	Mar-21	0.2	0.24	0.29	0.27	0.29	0.13
	Historical range	0.21-0.63	0.18-9.8	0.18-3.1	0.14-0.75	0.20-0.65	0.045-0.20
Nickel	Dec-20	6.7	4.7	8.9	3.7	6.8	2.2
	Mar-21	5.3	4.6	6.7	6.3	6	2.8
	Historical range	5.1-9.4	4.2-8.2	3.5-10.2	3.7-9.9	4.2-11.3	1.0-6.0
Selenium	Dec-20	<0.5	<0.5	1.2	<0.5	0.8	<0.5
	Mar-21	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Historical range	<0.50-2.0	<0.50-1.25	<0.50-1.7	<0.50-2.5	<0.50-6.1	<0.50-2.6
Silver	Dec-20	0.07	0.03	0.07	0.04	0.25	0.05
	Mar-21	0.03	0.04	0.06	0.07	0.11	0.05
	Historical range	0.037-0.49	<0.04-0.35	0.091-1.3	0.06-1.5	0.18-4.8	0.03-1.4
Zinc	Dec-20	52	36	49	26	55	38
	Mar-21	46	34	43	38	39	34
	Historical range	31-85	27-57	24-67	19-80	28-89	21-120

*Table 15 Total recoverable metal and metalloid abundances in **<63 µm** sediment fraction. All units, with the exception of Fe, mg/kg dry weight; units for Fe are wt % (dry weight); historical range from December 2005 through March 2020 inclusive; results highlighted in red indicate abundance elevated above lowest guideline; orange values indicate concentration that were above the historical range, blue values indicate concentration that were below the historical range. * indicates abundance is above lowest guideline and outside of historical range.*

Metal	Survey period	Site OC2 <63µm	OH3 <63µm	OH5 <63µm	OH1 <63µm	OH6 <63µm	RU1 <63µm
Antimony	Dec-20	0.10	0.11	<0.08	0.21	0.30	0.13
	Mar-21	0.09	0.31	0.21	0.13	0.34	0.16
	Historical range	0.06-2.0	0.08-0.23	0.13-0.94	0.13-0.90	0.2-1.7	0.12-0.33
Arsenic	Dec-20	4.80	5.90	3.30	5.00	5.50	7.50
	Mar-21	6.00	8.00	7.70	5.70	11.80*	7.10*
	Historical range	4.7-11	3.4-8.0	5.9-9.8	5.2-10	5.4-9.0	7.6-11.3
Cadmium	Dec-20	0.52	0.93	0.12	0.29	0.64*	1.24
	Mar-21	0.72	0.45	0.25	0.45	0.45	0.72
	Historical range	0.21-0.70	0.2-0.82	0.20-1.36	0.24-0.76	0.28-0.54	0.57-1.4
Chromium (hexavalent)	Dec-20	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
	Mar-21	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
	Historical range	<0.4-<2.0	<0.4-<2.0	<0.4-<2.0	<0.4-<2.0	<0.4-<2.0	<0.4-<2.0
Copper	Dec-20	14.70	15.70	14.10	14.20	16.90	12.50
	Mar-21	15.00	19.90	18.50	15.70	18.10	14.00
	Historical range	12-18	12-19	15.5-27	14.5-34	14.8-27	10.2-20
Iron (% dry wt.)	Dec-20	2.80	3.00	1.71	1.99	2.30	3.30
	Mar-21	3.20	3.90	3.60	3.30	4.60	3.30
	Historical range	2.8-5.0	1.63-3.9	2.4-4.2	2.1-3.9	2.4-4.0	2.9-4.7
Lead	Dec-20	18.20	16.80	13.50	18.70	16.10	18.90
	Mar-21	21.00	17.60	23.00	21.00	18.10	24.00
	Historical range	16-19	13-19	16-78	15.8-19	14.1-22	19.5-32
Manganese	Dec-20	470.00	1350.00	103.00	350.00	210.00	1660.00
	Mar-21	1400.00	1640.00	560.00	1300.00	650.00	1620.00
	Historical range	510-1,940	390-1,330	240-1,170	590-1,330	360-1,860	1,420-3,200
Mercury	Dec-20	0.59	0.54	0.74	0.58	0.57	0.20
	Mar-21	0.64	0.43	0.70	0.43	0.52	0.28
	Historical range	0.40-0.69	0.38-1.8	0.43-1.2	0.40-0.78	0.39-1.1	0.18-0.30
Nickel	Dec-20	9.10	11.10	8.00	8.10	8.80	9.50
	Mar-21	10.40	11.60	9.20	10.90	8.80	10.60
	Historical range	6.5-12.2	7.8-14	7.8-14	8.3-21	7.8-14	5.8-11.4
Selenium	Dec-20	1.50	2.00	1.80	2.00	1.90	2.20
	Mar-21	1.80	1.70	2.00	2.40	2.80	2.10
	Historical range	1.7-2.9	1.2-3.0	<2.0-4.3	<2.0-5.3	1.9-7.2	<2.0-4.7
Silver	Dec-20	0.30	0.36	0.17	0.18	0.58	0.22
	Mar-21	0.29	0.36	0.65	0.47	0.83	0.39
	Historical range	0.20-0.92	0.13-0.94	0.92-4.9	0.32-5.4	0.34-7.5	0.31-1.16
Zinc	Dec-20	118.00	116.00	52.00	77.00	128.00	156.00
	Mar-21	124.00	98.00	88.00	105.00	105.00	127.00
	Historical range	65-140	62-122	66-104	70-124	67-108	94-189

5.2.2. Comparison with sediment quality guidelines

Overall, concentrations of metals/metalloids were elevated more frequently in the silt fraction compared to the sand fraction, however iron, manganese and mercury values all exceeded the lowest guideline value in the sand fraction at some sites. Higher concentrations of metals/metalloids in the silt size fraction are expected as there is greater surface area for adsorption. Concentrations of metals/metalloids that exceed guideline values are discussed below.

Arsenic

The concentration of arsenic in the silt size fraction (<63 µm) at site RU1 in spring 2020 and autumn 2021 (7.5 and 7.1 mg/kg dry wt., respectively) exceeded the NOAA (1999) threshold effects level (TEL) (5.9 mg/kg) and the OME (1993) lowest effect level (LEL) of 6.0 mg/kg, however both values were below the historical range for this site (Table 15). Elevated concentrations of arsenic in silt were also found at sites OH5 (7.7 mg/kg dry wt.) and OH6 (11.8 mg/kg dry wt.) in autumn 2021, both of which exceed the NOAA (1999) threshold effects level (TEL) (5.9 mg/kg) and the OME (1993) lowest effect level (LEL) of 6.0 mg/kg. The arsenic concentration at site OH6 in autumn 2021 was the highest observed since monitoring began in 2005 (Table 15). Sites OH5 and OH6 are downstream of mine discharges, while site OC2 is upstream of all mine-related discharges and therefore acts as a reference for the catchment's geology. The historical range of arsenic at site OC2 (4.7 – 11 mg/kg) encompasses the concentrations of arsenic found at sites RU1 and OH5, while the 11.8 mg/kg dry wt. observed in autumn 2021 at site OH6 is slightly higher than the reference site range.

Cadmium

In the silt size fraction (<63 µm) in spring 2020, cadmium concentrations were above the NOAA TEL and OME LEL guidelines (both 0.6 mg/kg dry wt.) at sites OH3, OH6 and RU1. Sites OH3 and OH6 had cadmium concentrations that were also higher than historical concentrations. In autumn 2021, cadmium concentrations were elevated at site OC2 (reference site) and RU1 (both 0.72 mg/kg dry wt.), but were within the higher end of the historical range for both sites (Table 15).

Copper

The concentration of copper in the silt size fraction (<63 µm) at site OH6 in spring 2020 was just above the OME LEL guideline (16 mg/kg dry wt.). In autumn 2021, sites OH3, OH5, and OH6 in were above the OME LEL guidelines, but below the NOAA TEL guidelines (36 mg/kg dry wt.). Copper concentrations were within the historical range for sites OH5 and OH6, but at site OH3 copper concentration was the highest recorded since monitoring began in 2005, and was higher than the reference site (OC2) historical range (Table 15).

Iron

Iron concentrations were above guidelines in both the sand and silt fraction of sediment in spring 2020 and autumn 2021. Specifically, in the sand fraction (<2.0 mm), the upstream reference site OC2 exceeded the OME LEL guideline (2.0 % dry weight) in spring 2020 and autumn 2021, however the values were within the historical range (Table 14). In the silt size fraction (<63 µm), the concentration of iron at the reference site OC2 and at site OH3 also exceeded the OME LEL guideline in spring 2020 and autumn 2021 (Table 15). Sites OH5, OH1, and OH6 also exceeded the OME LEL guideline in autumn 2021, while sites OH5 and OH1 were within the historical range, and site OH6 exceeded the historical range, but was within the historical range of the reference site OC2 (Table 15).

Manganese

The concentration of manganese was elevated above the OME (1993) LEL (460 mg/kg) in the sand size fraction (63 µm - 2 mm) at reference site OC2 in autumn 2021, and was outside the historical range (Table 14). In the silt size fraction (<63 µm), in both spring 2020 and autumn 2021, sites OC2, RU1, OH1, and OH6 were elevated above the OME LEL guideline, but were within their respective historical ranges (Table 15). In contrast, manganese concentrations at site OH3 in 2020 and 2021 were elevated above the OME guideline and were the highest values recorded at the site since monitoring began in 2005, however, these manganese concentrations were within the historical range for the reference site OC2 (Table 15). As such these levels of manganese are likely to be a result of catchment geology.

Mercury

The concentration of mercury was elevated above the NOAA (2008) TEL (0.17 mg/kg) and OME (1993) LEL (0.2 mg/kg) in the sand size fraction (63 µm - 2 mm) at all sites except OH1 and RU1, and at all sites in the silt size fraction (<63 µm) in the December 2020 survey. In the March 2021 survey, for the silt size fraction, all sites exceeded the OME and NOAA guidelines, however, they were within the historical range of each respective site and the reference site (Table 15).

Zinc

For the December 2020 survey, the concentration of zinc at sites OH6 and RU1 in the silt size fraction exceeded the NOAA (2008) TEL (123mg/kg) OME (1993) LEL (120 mg/kg) guideline. Zinc concentrations at site RU1 was within its historical range, while site OH6 exceeded the historical range, but was within the reference site (OC2) historical range (Table 15). In the March 2021 survey, sites OC2 and RU1 were above the NOAA and OME guidelines, but were within their respective historical ranges (Table 15).

6. Habitat characteristics

6.1. Aquatic & Riparian Habitat

The spring survey was undertaken on 9-10 December 2020 and the autumn survey on 24-26 March 2021. Aquatic and riparian habitat characteristics were recorded during the December 2020 survey, and presented in Table 16. Substrate composition is summarised in Figure 7. Photos showing general site conditions and stream bed character during the surveys are presented in Figure 8.

As in previous years, survey sites were dominated by run and riffle habitat confined by steep banks. Most sites were generally open or only partly shaded. The Ruahorehore Stream monitoring site (RU1) is narrower and more shaded than the Ohinemuri River monitoring sites. The Ohinemuri River experienced stable flows leading up to the December 2020 survey and a small flood preceded the March 2021 survey (Figure 5).

Table 11 Habitat characteristics at monitoring sites during the spring survey (December 2020).

Habitat parameter	Unit	Site					
		OC2	OH3	OH5	OH1	OH6	RU1
Run	%	60	65	90	80	60	50
Riffle	%	40	35	0	20	40	20
Pool	%	0	0	10	0	0	30
Chute	%	0	0	0	0	0	0
Shading	open/closed/partly	partly	open	open	partly	open	partly
TLB stability	stable/moderate/unstable	stable	mod	mod	mod	mod	stable
TRB stability	stable/moderate/unstable	stable	stable	mod	mod	mod	stable

6.2. Stream Bed Substrate Characteristics

Stream bed substrate character at the Ohinemuri River and Ruahorehore Stream sites in December 2020 and March 2021 is presented in Figure 7, and photos from the sites in Figure 8. In December 2020, most Ohinemuri River sites were dominated by gravels with areas of cobbles and sand (Figure 7). Site OC2 was dominated by cobbles with some boulders and small areas of gravel and sand. Some bedrock was present at OH5 and, as for previous surveys, bedrock cover was significant at Site RU1 (Figure 7). Substrate character was similar in March 2021, with most sites dominated by gravel and coarse sand (Figure 7).

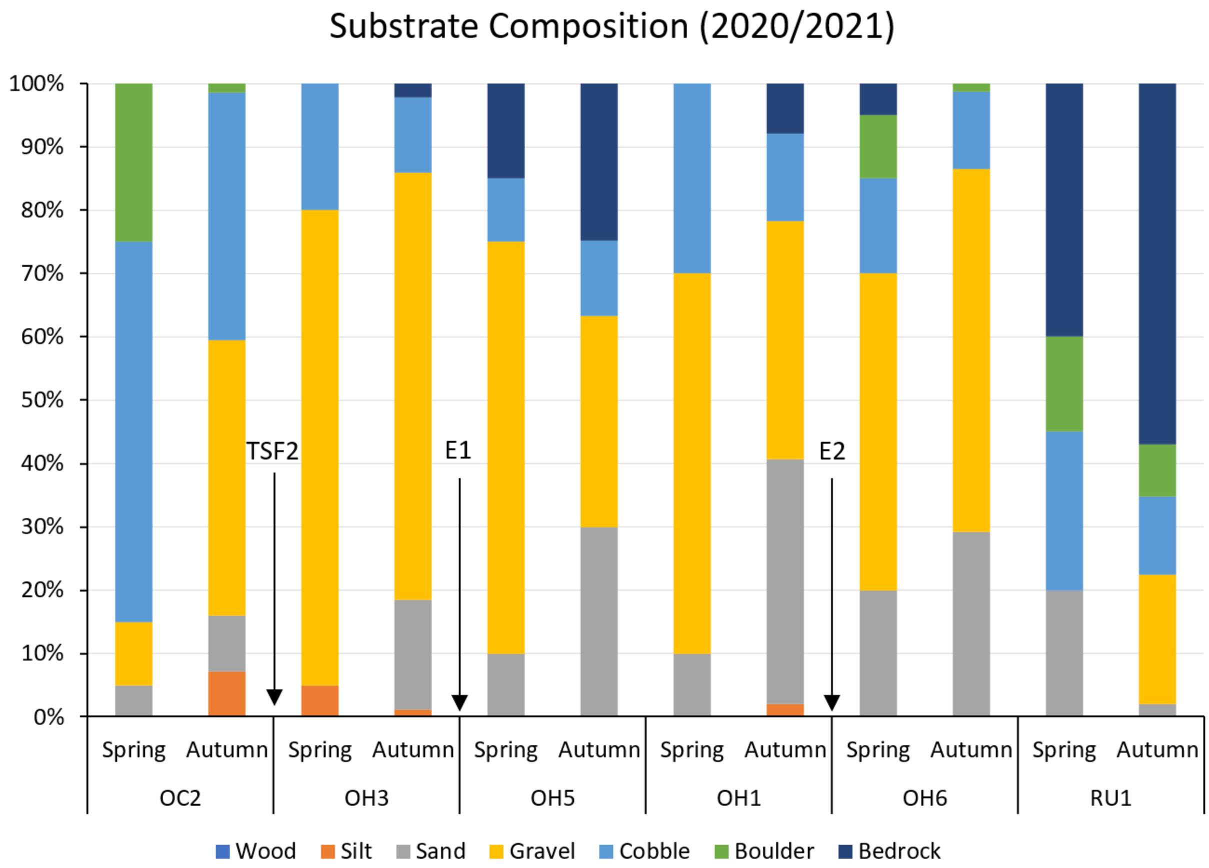


Figure 7 *Ohinemuri River and Ruahorehore Stream bed substrate composition recorded during spring (December 2020) and autumn (March 2021) surveys. Arrows indicate location of discharges.*

Figure 8 *Instream and riparian habitat conditions at Ohinemuri River site OC2, December 2020 (top group of photos) and March 2021 (bottom group of photos).*

Figure 8 (cont'd) Instream and riparian habitat conditions at Ohinemuri River site OH3, December 2020 (top group of photos) and March 2021 (bottom group of photos).

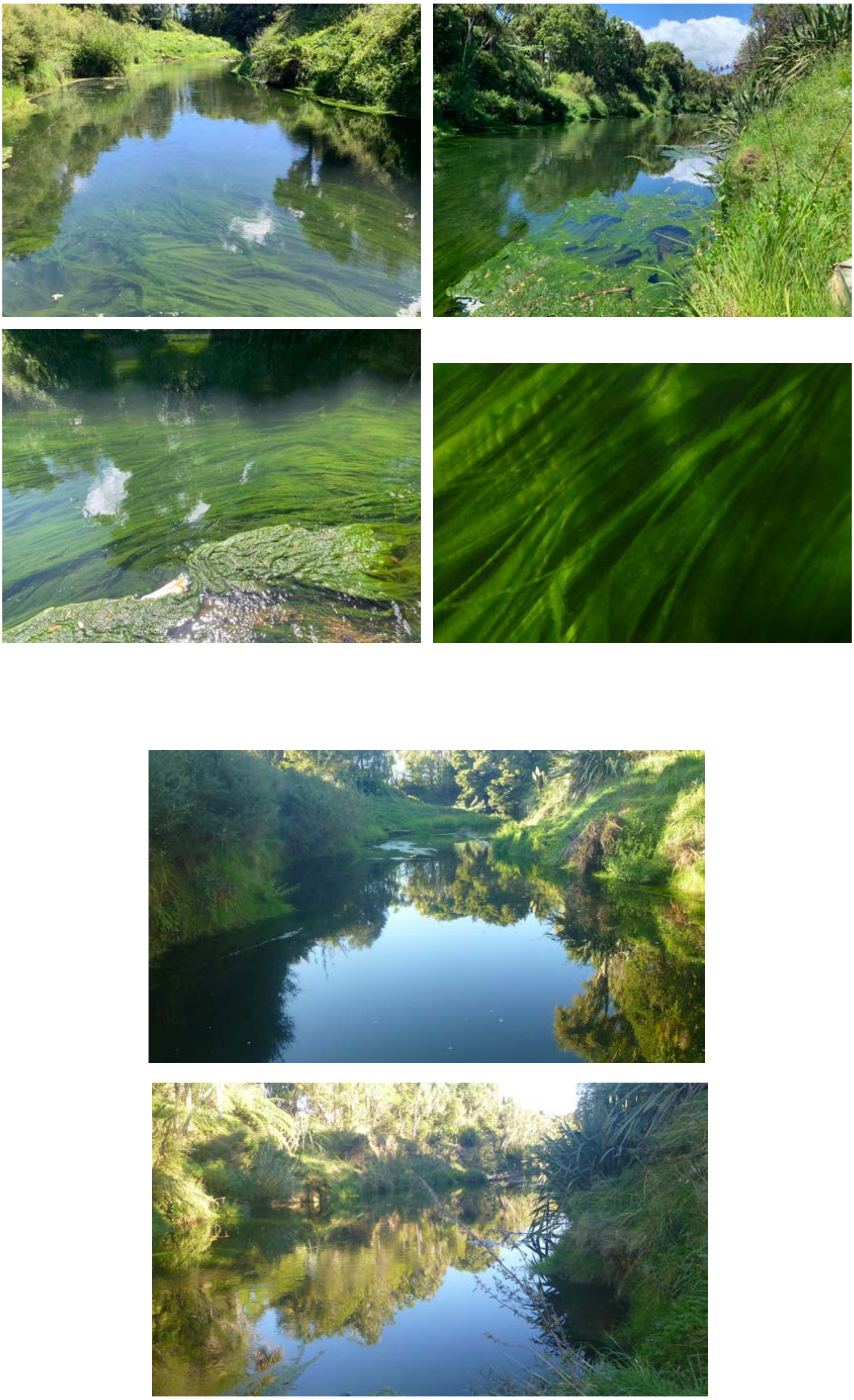


Figure 8 (cont'd) Instream and riparian habitat conditions at Ohinemuri River site OH5, December 2020 (top group of photos) and March 2021 (bottom group of photos).

Figure 8 (cont'd) Instream and riparian habitat conditions at Ohinemuri River site OH1, December 2020 (top group of photos) and March 2021 (bottom group of photos).

Figure 8 (cont'd) Instream and riparian habitat conditions at Ohinemuri River site OH6, December 2020 (top group of photos) and March 2021 (bottom group of photos).

Figure 8 (cont'd) Instream and riparian habitat conditions at Ohinemuri River site RU1, December 2020 (top group of photos) and March 2021 (bottom group of photos).

7. Periphyton

7.1. Periphyton cover

Estimated stream bed algae cover recorded at Ohinemuri River and Ruahorehore Stream monitoring sites during the spring (December 2020) and autumn (March 2021) surveys is presented in Table 17 and Table 18, respectively. Stream bed algae cover data were used to calculate periphyton indices presented in Collier & Champion (2014).

In spring 2020, the proportion of the bed covered by visible periphyton growths at Ohinemuri River sites ranged from 78% (OH3) to 100% (OH5) (Table 17). Long green filamentous algae dominated cover at all sites, ranging from between 54% (RU1) and 100% (OH5) (Table 17). Long filamentous algae cover at all mainstem Ohinemuri River sites exceeded 60% (Table 17). RU1 is more shaded than the Ohinemuri mainstem sites, and this probably influences (lower) periphyton cover at RU1. Estimated cover by long filamentous green algae (i.e., >20 mm long) at all Ohinemuri River sites exceeded the New Zealand periphyton guideline of a maximum cover of 30% cover between 1 November and 30 April[5].

In autumn 2021, the percentage of bed covered by visible periphyton ranged from 66.5% at OH1 to 94.5% at sites OH5 and RU1. Periphyton cover was also dominant (78 – 94 %) at sites OC2, OH3, and OH6 (Table 18). Thin films (any colour) was found at all sites, as well as long green filaments; bryophytes were found at all sites except for OH5 (Table 18). Estimated cover by long filamentous green algae (i.e., >20 mm long) at OH5, OH1, OH6, and RU1 exceeded the New Zealand periphyton guideline of a maximum cover of 30% cover between 1 November and 30 April. Short green filaments were also present, but not common, at all sites except OH5 (Table 18). Medium green and brown mat algae were also present at sites OH5, OH1, and RU1 (Table 18).

[5] In relation to aesthetics/recreation guidelines, the NZ guidelines for periphyton cover are given in terms of maximum cover and are only expected to be applied over the summer months (1 November – 30 April).

Table 12 Estimated stream bed algae cover (%) in Ohinemuri River and Ruahorehore Stream in Dec 2020.

Category	Thickness	Site					
		OC2	**OH3**	**OH5**	**OH1**	**OH6**	**RU1**
Thin green film	<0.5 mm	31.3	11.5	-	3.0	-	-
Thin light brown film	<0.5 mm	-	-	-	-	-	-
Thin black/dk brown film	<0.5 mm	-	-	-	-	-	-
Sludge		-	-	-	-	-	-
Medium green mat	0.5-3mm	-	-	-	-	-	-
Medium brown mat	0.5-3mm	-	-	-	-	-	-
Medium black mat	0.5-3mm	-	-	-	-	-	-
Thick black/dark brown mat	>3mm	-	-	-	-	-	-
Short green filaments	<2cm	-	4.5	-	-	-	-
Long green filaments	>2cm	63.8	61.8	100.0	75.3	79.0	54.0
Bryophytes		-	-	-	-	-	-
Total alga % cover		**95.0**	**77.8**	**100.0**	**78.3**	**79.0**	**54.0**
No. transects with periphyton cover		5	5	5	5	5	5
Periphyton Enrichment Index		63.15	72.49	90.00	86.88	90.00	90.00
Periphyton Proliferation Index		63.75	61.75	100.00	75.25	79.00	54.00
Periphyton Slimyness Index		57.25	53.50	80.00	60.80	63.20	43.20
Periphyton Weighted Composite Cover		63.75	66.25	100.00	75.25	79.00	54.00

Table 13 Estimated stream bed algae cover (%) in Ohinemuri River and Ruahorehore Stream in Mar 2021.

Category	Thickness	Site					
		OC2	**OH3**	**OH5**	**OH1**	**OH6**	**RU1**
Thin film (any colour)	<0.5	61.5	77.0	26.8	23.5	14.8	16.0
Sludge		-	-	-	-	-	-
Medium green mat	0.5-3mm	-	-	18.0	3.0	-	2.5
Medium brown mat	0.5-3mm	-	-	5.0	5.0	-	0.0
Medium black mat	0.5-3mm	-	-	-	-	-	-
Didymo	>3mm	-	-	-	-	-	-
Thick green/light brown mat	>3mm	-	1.0	-	-	-	-
Thick black/dark brown mat	>3mm	-	-	-	-	-	14.5
Short filaments	<2cm	10.9	-	-	0.8	5.0	3.5
Long green filaments	>2cm	5.6	16.0	44.8	34.3	64.0	58.0
Long brown filaments	>2cm	-	-	-	-	-	-
Bryophytes		33.8	4.0	-	36.0	57.3	3.3
Sponge		-	1.0	-	-	-	-
Liverworts		-	-	-	-	-	-
Total alga % cover		**78.0**	**94.0**	**94.5**	**66.5**	**83.7**	**94.5**
No. transects with periphyton cover		5	5	5	5	5	5
Periphyton Enrichment Index		22.90	32.48	58.72	62.53	76.86	60.77
Periphyton Proliferation Index		5.60	27.80	42.00	33.80	66.36	68.00
Periphyton Slimyness Index		21.14	35.76	54.92	36.68	57.05	64.80
Periphyton Weighted Composite Cover		47.24	60.80	66.90	50.90	76.26	76.20

7.2. Periphyton Community Composition

For the spring 2020 survey, a range of cyanobacteria, diatoms and chlorophytes were present at all monitoring sites. Potentially toxic forms of cyanobacteria were present at all six monitoring sites. The filamentous green algae *Oedogonium* was present at all sites and was likely to be the dominant green filamentous alga that was observed smothering the river bed. Sites OC2, OH3, OH6, and RU1 were dominated by cyanobacteria species, whereas sites OH5 and OH1 were dominated by chlorophytes and filaments, and diatoms, respectively.

During the autumn 2021 survey, cyanobacteria was common to dominant at most sites. At sites OH3, OH5, and OH1, *Heteroleibleinia* sp. were dominant, however these are not known to be toxic. In contrast, at site OH6, *Phormidium* sp. (which are potentially toxic) were abundant to dominant. At sites OC2 and RU1, diatoms were abundant to dominant., specifically *Gomphonema* sp. and *Pinnularia* sp. Full algae taxonomic composition data is presented in Appendix F.

7.3. Periphyton Biomass

7.3.1. Chlorophyll-a

Chlorophyll-*a* concentrations recorded at sites in the Ohinemuri River and Ruahorehore Stream in the spring and autumn surveys are provided in Table 19 and Figure 9. A one-way ANOVA test and a Tukey HSD post-hoc comparison was conducted to detect significant differences in chlorophyll-*a* concentrations between sites. Data was also compared with periphyton guidelines presented in Biggs (2000). Raw data are presented in Appendix F.

In December 2020, mean chlorophyll-*a* concentrations recorded at all sites were well above the New Zealand periphyton guidelines of 50 mg/m^2 for the protection of benthic biodiversity, 120 mg/m^2 for long filamentous green algae for the protection of trout habitat and angling, and 200 mg/m^2 for diatoms/cyanobacteria (Biggs 2000) (Table 19). There were no significant differences detected between the monitoring sites.

Chlorophyll-*a* concentrations were at least three times lower in the autumn 2021 survey. Sites OH3, OH6, and RU1 were above the New Zealand periphyton guideline of 50 mg/m^2 for the protection of benthic biodiversity (Table 19). Site OH6 was also above the guideline of 120 mg/m^2 for long filamentous green algae for the protection of trout habitat and angling (Biggs 2000). No sites exceeded the NZ periphyton guidelines for diatoms/cyanobacteria (200 mg/m^2).

In autumn 2021, the one-way ANOVA detected significant differences in chlorophyll-*a* concentrations at site OH6. Specifically, site OH6 had higher chlorophyll-*a* concentrations compared to upstream site OH1 and reference site OC2.

*Table 19 Chlorophyll-a concentrations at sites in the Ohinemuri River and Ruahorehore Stream, in spring (December 2020) and autumn surveys (March 2021). * Letters different from each other represent significantly different sites at the 95% level of confidence based on Tukey HSD pot-hoc test for comparison; ** site not included in statistical analysis.*

Site	Spring			Autumn		
	Chlorophyll-*a* (mg/m^2)		Tukey HSD means comparison (*p* value = 0.05)*	Chlorophyll-*a* (mg/m^2)		Tukey HSD means comparison (*p* value = 0.05)*
	Mean	±1 Standard Error		Mean	±1 Standard Error	
OC2	649.4	165.4	A	26.3	3.7	A
OH3	393.2	103.1	A	86.1	43.4	AB
OH5	498.6	136.2	A	29.5	11.8	AB
OH1	407.9	112.8	A	18.9	3.2	A
OH6	598.4	102.5	A	150.8	44.9	B
RU1	199.1	64.0	**	61.9	27.3	**

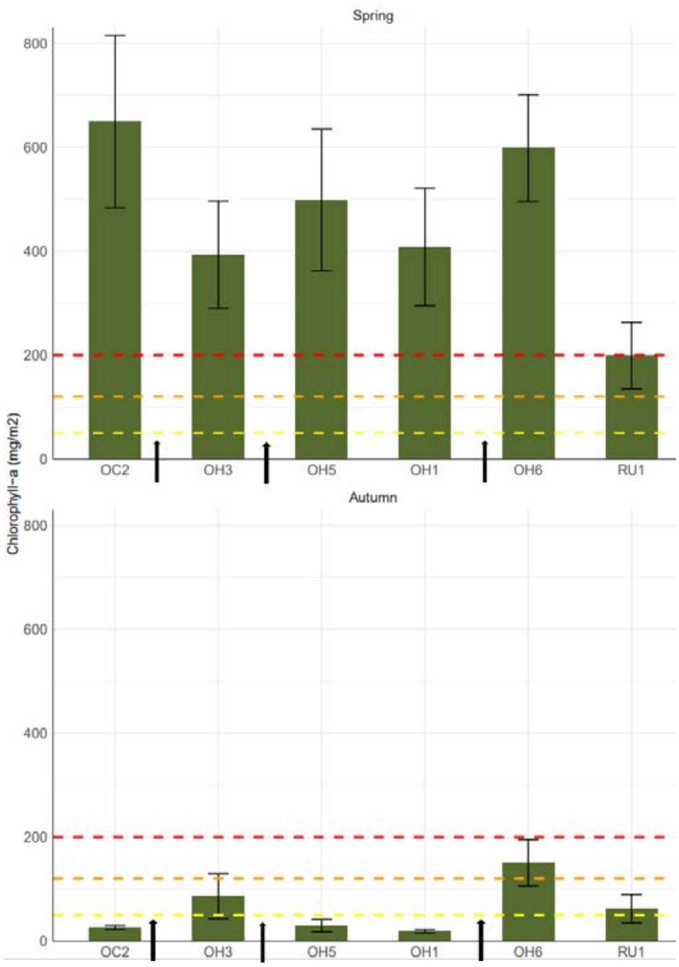


Figure 9 Chlorophyll-a biomass (±1 standard error) in site in the Ohinemuri River and Ruahorehore Stream during spring (December 2020) and autumn (March 2021) surveys. Arrows indicate the locations of discharge points relative to monitoring sites. The guideline for trout and angling (all periphyton) is shown in red (200 mg/m^2); the guideline for trout and angling (filamentous algae) is shown in orange (120 mg/m^2); the guideline for benthic biodiversity is shown in yellow (50 mg/m^2).

7.3.2. Organic content (ash free dry mass)

For the spring 2020 survey, mean AFDW biomass of periphyton was well above the New Zealand periphyton guideline of 35 g/m^2 for the protection of aesthetics/recreation and trout habitat and angling (Biggs 2000) (Table 20, Figure 10). In contrast, in the autumn 2021 survey, AFDW was at least twice as low, and no sites exceeded the guideline (Table 20). In autumn 2021, the one-way ANOVA detected a significantly greater AFDW concentration at site OH6 compared to concentrations at sites OC2, OH3, and OH1 (Table 20).

*Table 14 Periphyton AFDM at sites in the Ohinemuri River and Ruahorehore Stream, in spring (December 2020) and autumn surveys (March 2021). * Letters different from each other represent significantly different sites at the 95% level of confidence based on Tukey HSD test for comparison; ** site not included in statistical analysis.*

Site	Spring AFDM (g/m^2) Mean	Spring AFDM (g/m^2) ±1 Standard Error	Spring Tukey HSD means comparison (p value = 0.05)*	Autumn AFDM (g/m^2) Mean	Autumn AFDM (g/m^2) ±1 Standard Error	Autumn Tukey HSD means comparison (p value = 0.05)*
OC2	78.4	13.3	A	5.2	0.7	A
OH3	125.7	33.0	A	14.8	5.8	AB
OH5	58.7	15.8	A	8.2	2.1	A
OH1	63.2	10.8	A	5.9	1.2	A
OH6	70.3	7.8	A	24.8	4.2	B
RU1	38.6	12.3	**	20.4	7.6	**

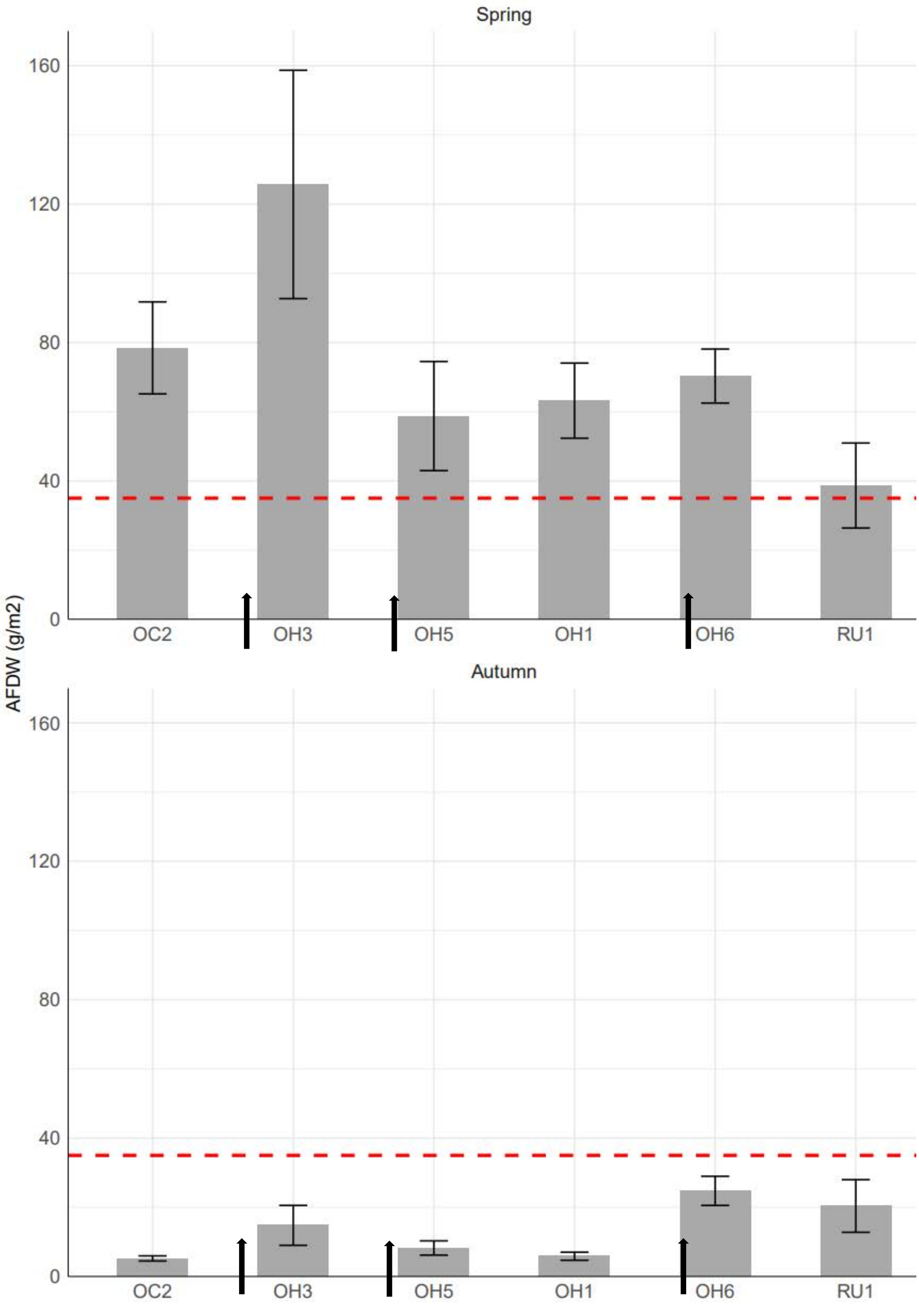


Figure 10 *AFDM biomass (±1 standard error) of periphyton at sites in the Ohinemuri River and Ruahorehore Stream during spring (December 2020) and autumn (March 2021) surveys. Arrows indicate the locations of discharge points relative to monitoring sites.* The guideline for trout and angling is shown in red (35 g/m^2).

7.4. Selenium concentrations

Following changes to its consents in September 2015, OGNZL is no longer required to assess selenium concentrations in periphyton on a biannual basis. This monitoring is now carried out in autumn only. Both the current and historic periphyton selenium concentrations measured at Sites OC2 and OH6 are shown in Figure 11. The analysis report for the 2020/21 period is provided in Appendix G.

The periphyton selenium concentration at OH6 (1.26 mg/kg dry weight) in 2021 was higher than that observed at OC2 (0.43 mg/kg dry weight) on the same occasion (Figure 11). Differences in selenium concentrations between the two sites have been inconsistent over time, with concentrations at Site OH6 exceeding OC2 by on average 1.1 mg/kg dry weight.

At Site OC2, the March 2021 selenium concentration was in the bottom 25% of the historic range, while the selenium concentration at Site OH6 in March 2021 was in the top 50% of the historic range.

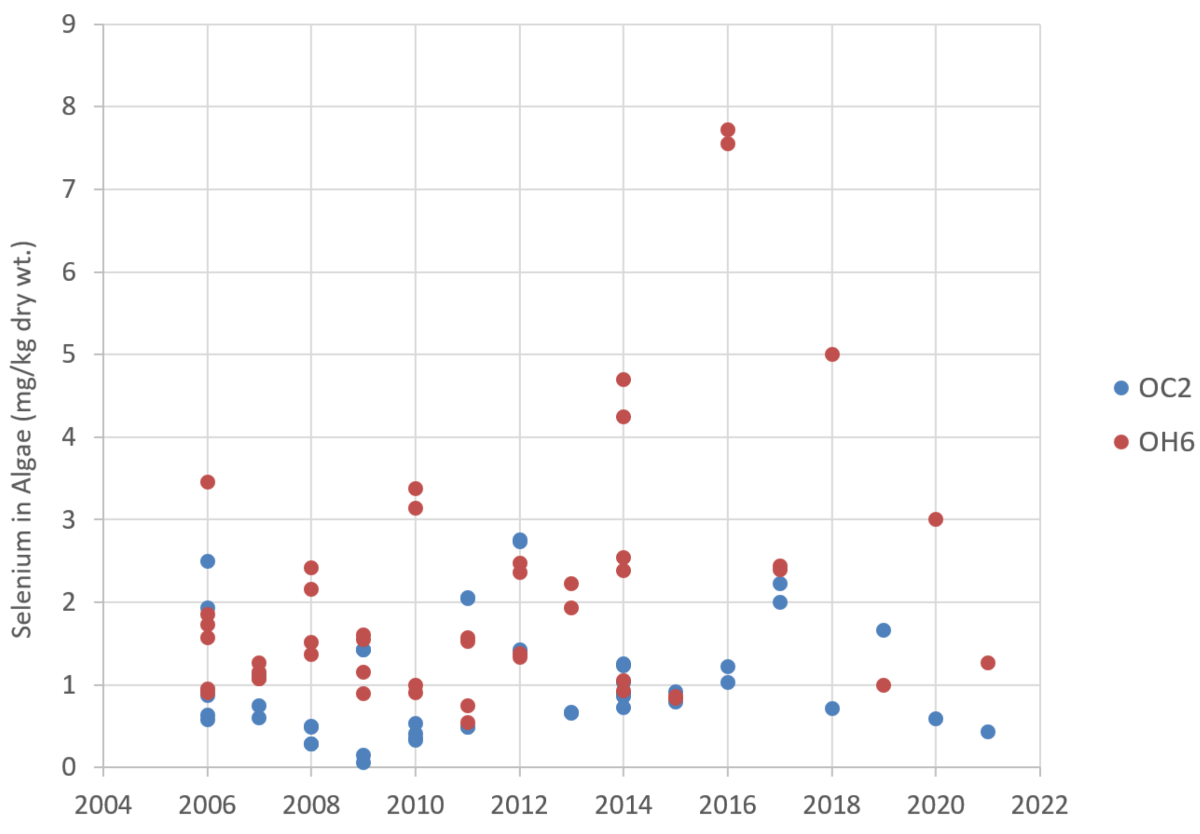


Figure 11. Selenium concentrations in periphyton collected from sites OC2 (upstream of all mining related discharge; blue) and OH6 (downstream of all mining related discharge; red) between 2006 and 2021.

8. Macrophytes

8.1. Macrophyte Cover

For the spring 2020 survey, macrophyte cover was highest at Site OH6 (24%), which had no shading. Sites OC2, OH3, OH5 and OH1 had macrophyte cover between 1% and 4.4%, and were either partly shaded or open. The introduced oxygen weed *Elodea canadensis* was present at all mainstem Ohinemuri sites except for site OH5 which was dominated by the invasive oxygen weed *Egeria densa*. The introduced curly pondweed (*Potamogeton crispus*) was observed at sites OC2, OH3, and OH6. Native *Persicaria decipens,* was observed at sites OH3, OH1, and OH6. Watercress (*Nasturtium officinale*) was also present at site OH6.

For the autumn 2021 survey, macrophyte cover was overall lower than in spring 2020. Cover was highest at site OH3 (11%) and lowest at site OC2 (6%). No macrophytes were observed at sites OH5, OH1, OH6, and RU1. In contrast to previous surveys, the oxygen weed *Elodea canadensis* was not found at any sites. Native *Persicaria decipens* was present at mainstem Ohinemuri River sites except OH6. Native stonewort (*Nitella hookeri*) was present at sites OH6, RU1, OC2, and OH1. Watercress (*Nasturtium officinale*) was present at sites OC2, OH3, OH1, OH6, and RU1.

8.2. Selenium Concentrations

The selenium concentration in macrophytes collected from site OH6 (0.7 mg/kg dry weight) was higher than that observed at site OC2 (0.25 mg/kg dry weight) for the autumn 2021 survey. Both sites had very low selenium concentration compared to the historical range, and were in the first percentile of the historical range (Figure 12). Differences in selenium concentrations between the two sites has been on average 3 mg/kg dry weight greater at site OH6 as compared to site OC2. However, differences have been inconsistent over time, with concentrations at least 0.2 mg/kg dry weight higher at site OH6 and at most 8.4 mg/kg dry weight. The laboratory report for March 2021 selenium testing (including macrophytes) is included in Appendix G.

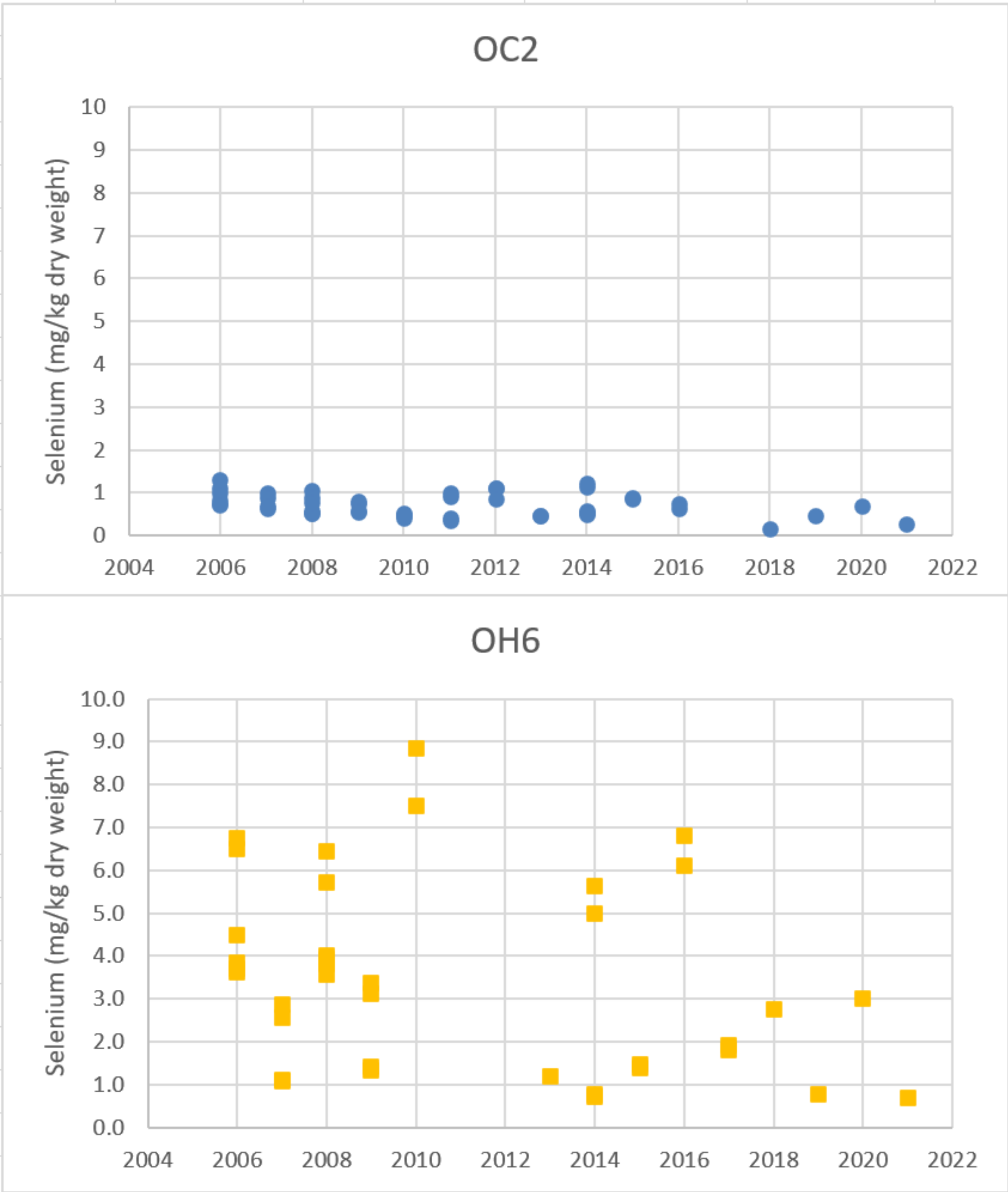


Figure 12 Selenium concentrations in macrophytes collected from sites OC2 and OH6 between 2006 and 2021.

9. Benthic macroinvertebrates

Condition 16 of the discharge permit requires OGNZL to monitor benthic macroinvertebrate populations at sites OH3, OH5, OH1, OH6 and RU1 on two occasions each year, once in spring (October through December) and once in autumn (March through May). Benthic macroinvertebrates are also measured by OGNZL on a voluntary basis at Site OC2, upstream of the upper discharge, to allow comparison with sites located downstream.

Analyses of the data include an assessment of community composition, key taxa, biological indices (i.e., abundance, taxa richness, MCI, QMCI, EPT and %EPT) and consideration of whether the change in macroinvertebrate taxa number and abundance between upstream and downstream sites complies with Condition 18 of the discharge permit.

The results of the spring and autumn benthic macroinvertebrate monitoring are reported in Sections 9.1 to 9.4. Raw benthic macroinvertebrate data are presented in Appendix H.

9.1. Community Composition

The percentage community composition of the main groups of macroinvertebrates recorded at Ohinemuri River and Ruahorehore Stream sites in December 2020 and March 2021 are presented in Figure 13, and non-metric multi-dimensional scaling (NMDS) plots showing community similarity between sites are shown in Figure 14.

For the December 2020 survey, macroinvertebrate communities at most sites were dominated by mollusca (e.g., the mud snail *Potamopyrgus antipodarum*) followed by trichoptera (e.g., *Hydropsyche*) and diptera (true flies). Mollusca was also the dominant taxa found in the March 2021 survey, however diptera dominated at site OH6 (Figure 13).

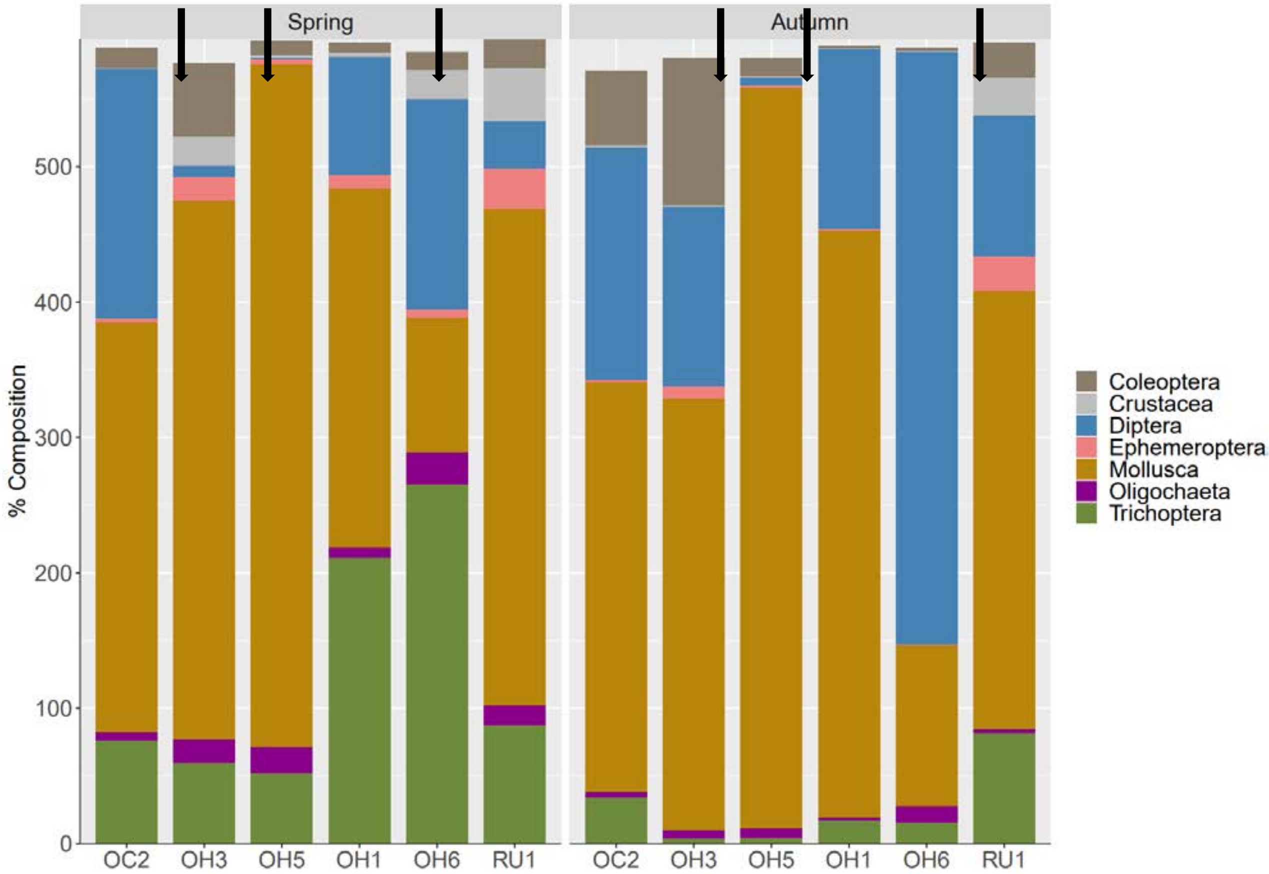


Figure 13 Macroinvertebrate community composition (%) at OC2, OH3, OH5, OH1 and OH6 on Ohinemuri River and RU1 on Ruahorehore Stream during the December 2020 and March 2021 surveys. Arrows indicate the location of discharges.

NMDS plots suggest that in spring, sites on the Ohinemuri River were generally similar to one another in terms of macroinvertebrate community composition (Figure 14). Samples from each site on the Ohinemuri River were more similar to other samples collected from that site than to samples from other sites. Samples collected from site OH5 were more distinct from other sites, likely because of high proportion of snails found in the samples (Figure 13).

The autumn NMDS suggests that macroinvertebrate community composition between and among sites is more variable (Figure 14). A more pronounced grouping of sites OH1, OH6, and some replicates of site RU1 is evident in the data (Figure 14). While sites OH1 and OH6 are close to the E2 discharge, RU1 was not affected by mine discharges and thus the group distinction is not likely due to mining activities. Similarly, a pronounced grouping of OC2, OH3, and OH5 is evident, however OC2 is upstream of any discharge whereas OH3 and OH5 are not, thus the group distinction is not likely due to mining activities.

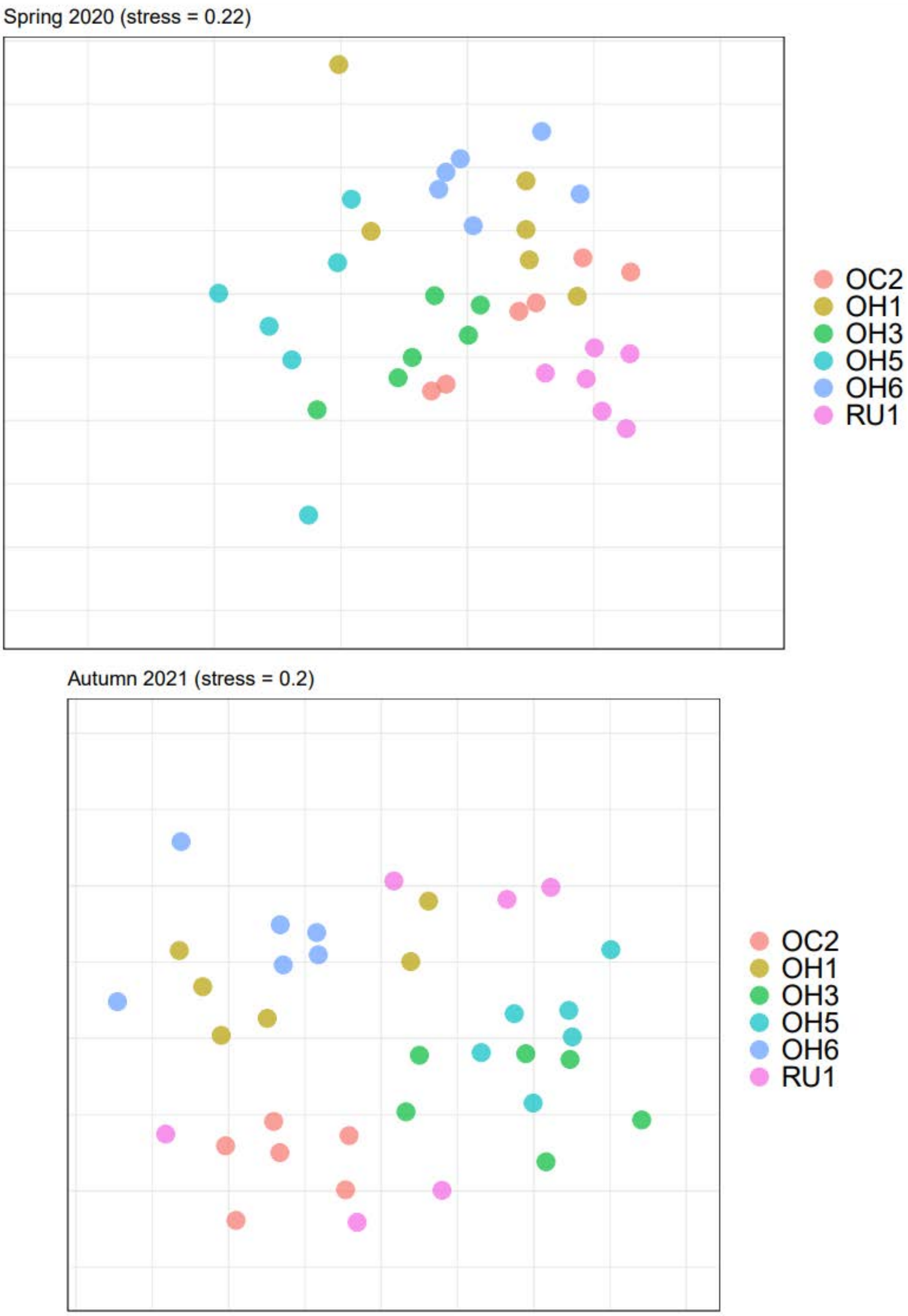


Figure 14 Non-metric multi-dimensional scaling plots based on Bray-Curtis similarity of the macroinvertebrate communities at all monitoring sites in December 2020 (Stress = 0.22) and March 2021 (Stress = 0.2).

9.2. Density

Total invertebrate density recorded at Ohinemuri River and Ruahorehore Stream monitoring sites in December 2020 and March 2021 are presented in Table 21 and Figure 15. In spring, mean invertebrate density at the five Ohinemuri River sites did not differ significantly from each other (Table 21, F = 1, *P* = 0.5). Invertebrate density was > 10,000 invertebrates per m^2 at sites OC2, OH3, OH5, and RU1, whereas sites OH1 and OH6 has densities of < 10,000 invertebrates per m^2 (Figure 15, Table 2).

In Autumn, mean invertebrate density was much lower than in the spring at sites OC2, OH3, OH5, and RU1, but much higher at sites OH1 and OH6 (Table 21). OH1 invertebrate density was significantly higher those found at sites OH3, OH5, and OC2 (Table 21, F = 16.4, *P* < 0.001). Furthermore, significantly more invertebrates per m^2 was found at the furthest upstream site (OC2) and the furthest downstream site (OH6).

*Table 21 Summary of mean invertebrate density (±1 standard error) and post-hoc comparisons of means for Ohinemuri River and Ruahorehore Stream sites in December 2020 and March 2021. * Letters different from each other represent significantly different sites at the 95 % level of confidence based on Tukey HSD test for comparisons; ** site not included in statistical analyses.*

Site	Spring			Autumn		
	Mean (# per m2)	±1 SE	Tukey HSD	Mean (# per m2)	±1 SE	Tukey HSD
OC2	12,792	3,014	A	2,923	966	C
OH3	10,115	1,396	A	1,844	348	AC
OH5	15,942	3,249	A	6,443	1,722	AC
OH1	8,468	1,178	A	12,118	1,561	B
OH6	8,867	2,548	A	11,875	1,658	AB
RU1	12,077	4,374	**	765	172	**

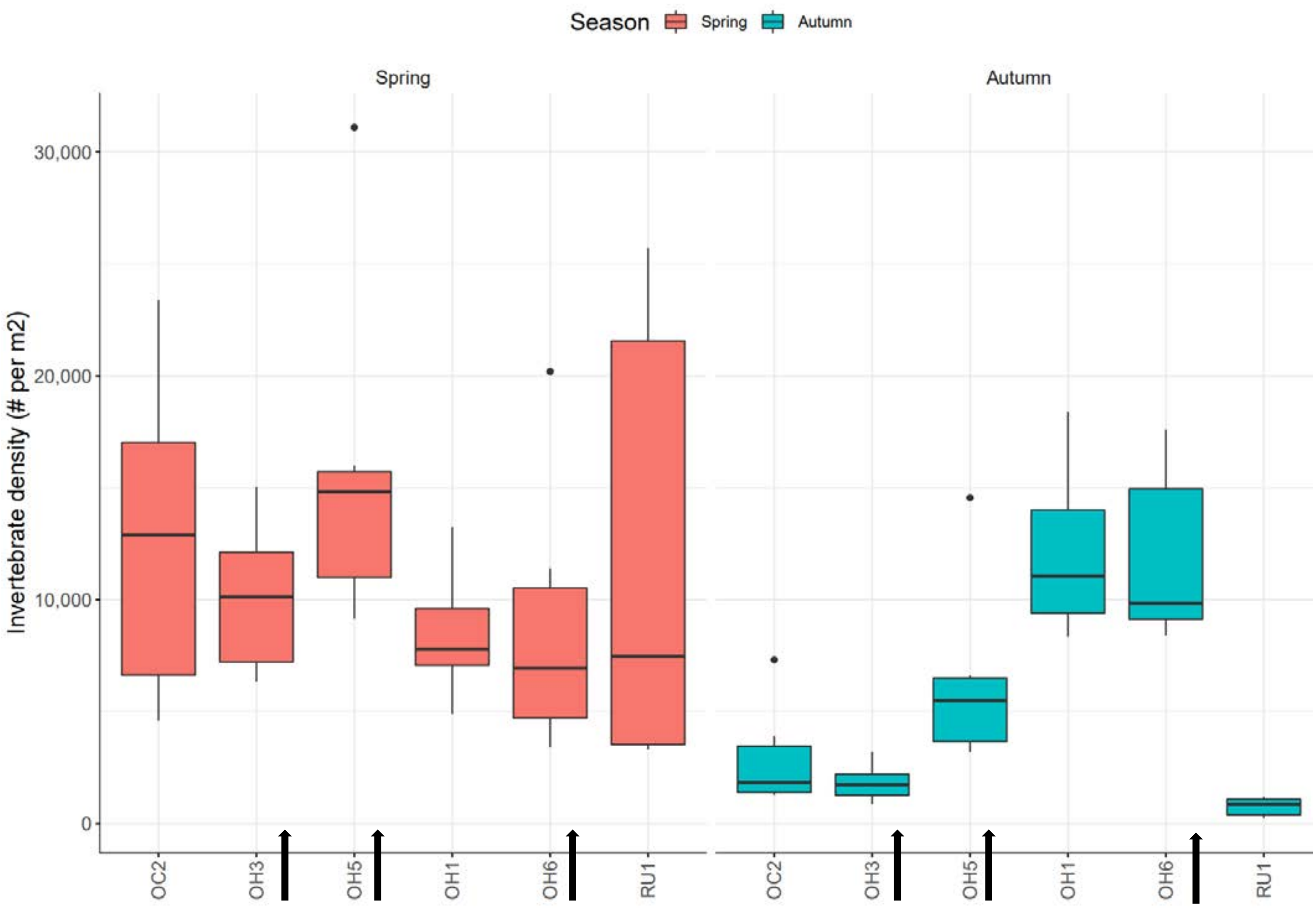


Figure 15 Macroinvertebrate density (# per m^2) in samples from sites on the Ohinemuri River and Ruahorehore Stream (RU1) collected during the December 2020 and March 2021 surveys. Discharge locations indicated by arrows.

9.2.1. Compliance

Condition 18 of Discharge Permit 917318 states that if, at any time following the completion of two consecutive seasonal monitoring events (e.g., spring to spring), a significant difference in taxa number and density is deemed to have occurred between the paired sites upstream and downstream of each discharge on both occasions, then the consent holder shall undertake immediate further monitoring. A significant difference is deemed to have occurred if there is a greater than 50% change in macroinvertebrate abundance (density) over and above the natural variation between the paired sites upstream and downstream of each discharge.

It has previously been agreed by WRC that natural variation in abundance was determined by calculating the coefficient of variation for each season using data collected from Site OH3 between 2002 and 2007. During this period, Site OH3 served as an upstream control site, but from 2007 the TSF2 discharge to a tributary upstream of Site OH3 commenced, meaning that this site could no longer be used as a control site.

In spring 2020, the percentage change in abundance between sites located upstream (OH3) and downstream (OH5) of the upper discharge and between sites located upstream (OH1) and downstream (OH6) of the lower discharge were well inside the limit of ± 109 % (Table 22, Figure 16). However, in Autumn 2021, the percent change in abundance between the upper discharge (OH3 and OH5) was 249%, well above the 109% threshold (Table 22, Figure 16). This threshold was not exceeded in autumn 2020. Condition 18 states further monitoring is undertaken only when allowable limits are exceeded in two consecutive seasonal monitoring events (e.g., autumn to autumn), thus no further monitoring is required in 2021.

*Table 22 Change (%) in total benthic invertebrate density (# per m^2) between monitoring sites upstream and downstream of each discharge point. Notes: E1 = upper discharge; E2 = lower discharge; * allowable limit in abundance includes a natural variation component of ±59% in spring and ±54% in autumn, which is added to the 50 % threshold stated in the consent, to give allowable limit of ±109 % for spring and ±104% for autumn.*

Year	Allowable limit	Upper discharge (OH3 - OH5)		Lower discharge (OH1 - OH6)	
		Recorded change	Compliance status	Recorded change	Compliance status
Spring 2019	±109	45%	Within limit	-4%	Within limit
Spring 2020	±109	58%	Within limit	5%	Within limit
Autumn 2020	±104	-46%	Within limit	-17%	Within limit
Autumn 2021	±104	249%	Outside limit	-2%	Within limit

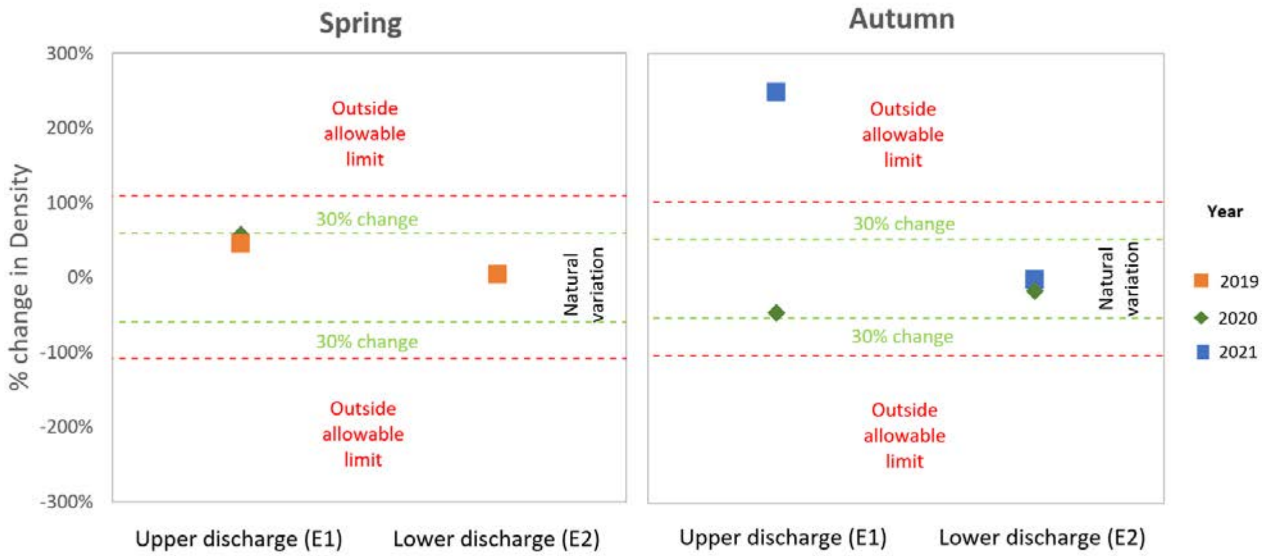


Figure 16 Percentage (%) change in invertebrate abundance (density) between sites upstream and downstream of the upper and lower discharges from spring (2019, 2020) and autumn (2020, 2021).

9.3. Taxonomic Richness

Mean invertebrate taxonomic richness (±1 standard error) recorded at Ohinemuri River and Ruahorehore Stream monitoring sites in December 2020 and March 2021 is presented in Figure 17 and in Table 23, along with the results of the *post-hoc* Tukey comparison of means.

For the spring 2020 survey, taxonomic richness was consistent across all sites, with the highest number of taxa recorded at site OC2 and the lowest number of taxa recorded at site OH5 (Table 23, Figure 17). Taxonomic richness was higher at most sites in the spring survey compared to the autumn survey. Results from the autumn 2021 survey suggest that taxonomic richness differed significantly between the sites on the Ohinemuri River (1-way ANOVA, $F_{4,25} = 5.8$ $p<0.01$). Specifically, site OC2 had a significantly higher mean taxonomic richness (15.8 species detected) compared to sites OH3, OH5, and OH1 (Table 23). While site OC2 is upstream of all mine discharges, it is also has more diverse habitat features, including a greater proportion of riffle-like habitats, coarse substrates (e.g., cobbles), and varying velocities, than other Ohinemuri sites. These features are likely to favour greater invertebrate diversity.

*Table 23 Summary of mean invertebrate taxonomic richness (±1 standard error) and post-hoc comparisons of means for Ohinemuri River and Ruahorehore Stream sites in December 2020 and March 2021. Letters different from each other represent significantly different sites at the 95 % level of confidence based on Tukey HSD test for comparisons; ** site not included in statistical analyses.*

	Spring			Autumn		
Site	**Mean richness**	**±1 SE**	**Tukey HSD**	**Mean richness**	**±1 SE**	**Tukey HSD**
OC2	17.3	1.2	A	15.8	1.4	B
OH3	13.8	1.5	A	10.8	1.0	A
OH5	12.5	1.0	A	8.3	0.6	A
OH1	16.3	1.4	A	10.7	1.5	A
OH6	15.3	0.9	A	11.3	0.8	AB
RU1	14.2	1.1	**	18.0	1.0	**

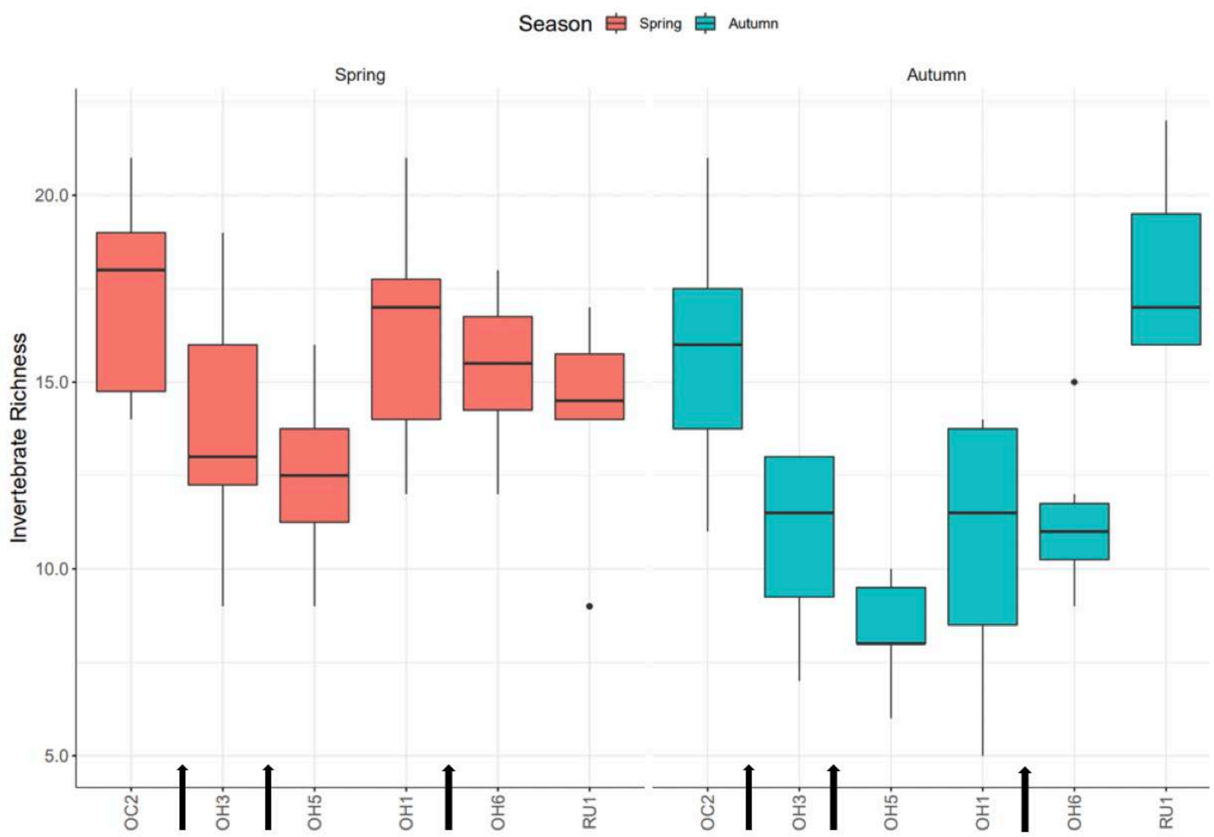


Figure 17 Number of taxa in samples from sites on the Ohinemuri River and Ruahorehore Stream (RU1) collected during the December 2020 and March 2021 surveys. Discharge locations indicated by arrows.

9.3.1. Compliance

Condition 18 of Discharge Permit 917318 states that if at any time following the completion of two consecutive seasonal monitoring events (e.g., spring to spring), a significant difference in taxa number and density is deemed to have occurred between the paired sites upstream and downstream of each discharge on both occasions then the consent holder shall undertake immediate further monitoring.

A significant difference is deemed to have occurred if there is a greater than 30% change in taxa number (referred to in this report as taxonomic richness) over and above the natural variation between the paired sites upstream and downstream of each discharge.

It has previously been agreed by WRC that natural variation in taxonomic richness was determined by calculating the coefficient of variation for each season using data collected from Site OH3 between 2002 and 2007. During this period, Site OH3 served as an upstream control site, but from 2007 the TSF2 discharge to a tributary upstream of Site OH3 commenced, meaning that this site could no longer be used as a control site.

Percentage change in taxonomic richness between sites upstream and downstream of each discharge from spring (2019, 2020) and autumn (2020, 2021) are presented in Table 24 and

Figure 18. The allowable percentage change in taxa number shown includes the natural variation component (±29% in spring and ±24% in autumn). For the lower discharge, the percentage change in taxa richness between sites upstream and downstream of each discharge was within allowable limits at the time of both spring surveys considered (2019, 2020) and both autumn surveys (2020, 2021) (Table 24, Figure 18). In autumn 2020, the percentage change in taxa richness was outside of the allowable limit of 53%. Specifically, there was a 123% change in taxonomic richness between site OH3 and OH5 (Table 24). However, in autumn 2021, the percent change in richness was well within the 53% threshold and thus follow-up monitoring is not required, as Condition 18 states further monitoring is undertaken only when allowable limits are exceeded in two consecutive seasonal monitoring events (e.g., autumn to autumn).

*Table 15 Change (%) in taxa richness between monitoring sites upstream and downstream of each discharge point. Notes: E1 = upper discharge; E2 = lower discharge; * allowable limit in taxa number includes a natural variation component of ± 29% in spring and ±24% in autumn, which is added to the 30% threshold stated in the consent, to give allowable limit of ± 59% in spring and ±54% in autumn.*

Year	Allowable limit	Upper discharge (OH3 - OH5)		Lower discharge (OH1 - OH6)	
		Recorded change	Compliance status	Recorded change	Compliance status
Spring 2019	±59	27%	Within limit	-15%	Within limit
Spring 2020	±59	-9%	Within limit	-6%	Within limit
Autumn 2020	±54	123%	Outside limit	-2%	Within limit
Autumn 2021	±54	-23%	Within limit	6%	Within limit

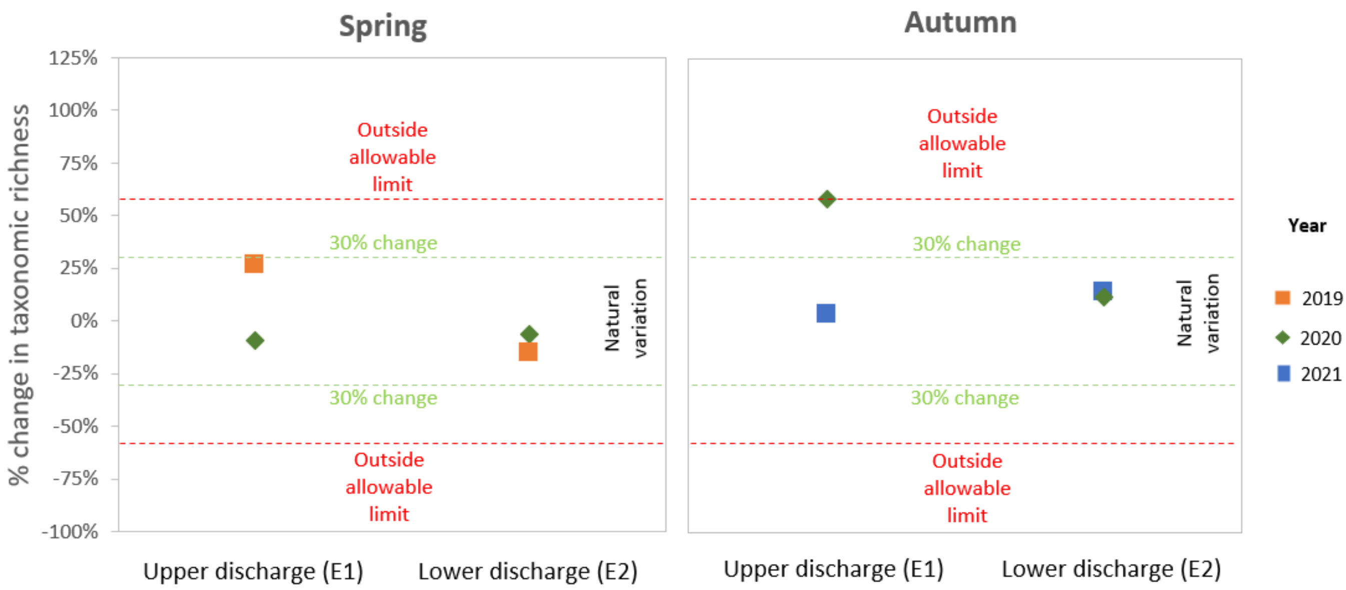


Figure 18 Percentage change in number of invertebrate taxa between sites upstream and downstream of the upper and lower discharges in spring (2019, 2020) and autumn (2020, 2021).

9.4. EPT taxa richness and percentage EPT

The mean abundance of EPT taxa collected from sites on the mainstem of the Ohinemuri River was consistent across all sites in spring 2020 (Figure 19). No EPT taxa were found at site OH5 in spring 2020. The percentage of EPT taxa found in samples from the autumn 2021 survey was significantly different between Ohinemuri River sites (1-way ANOVA, $F_{4, 25}$ =4.4, P < 0.01). Specifically, site OC2 has significantly higher EPT abundance as compared to sites OH3 and OH5 (Figure 19). The percentage of EPT taxa were similar across all sites in spring 2020 and to a lesser extent in autumn 2021 (Figure 20).

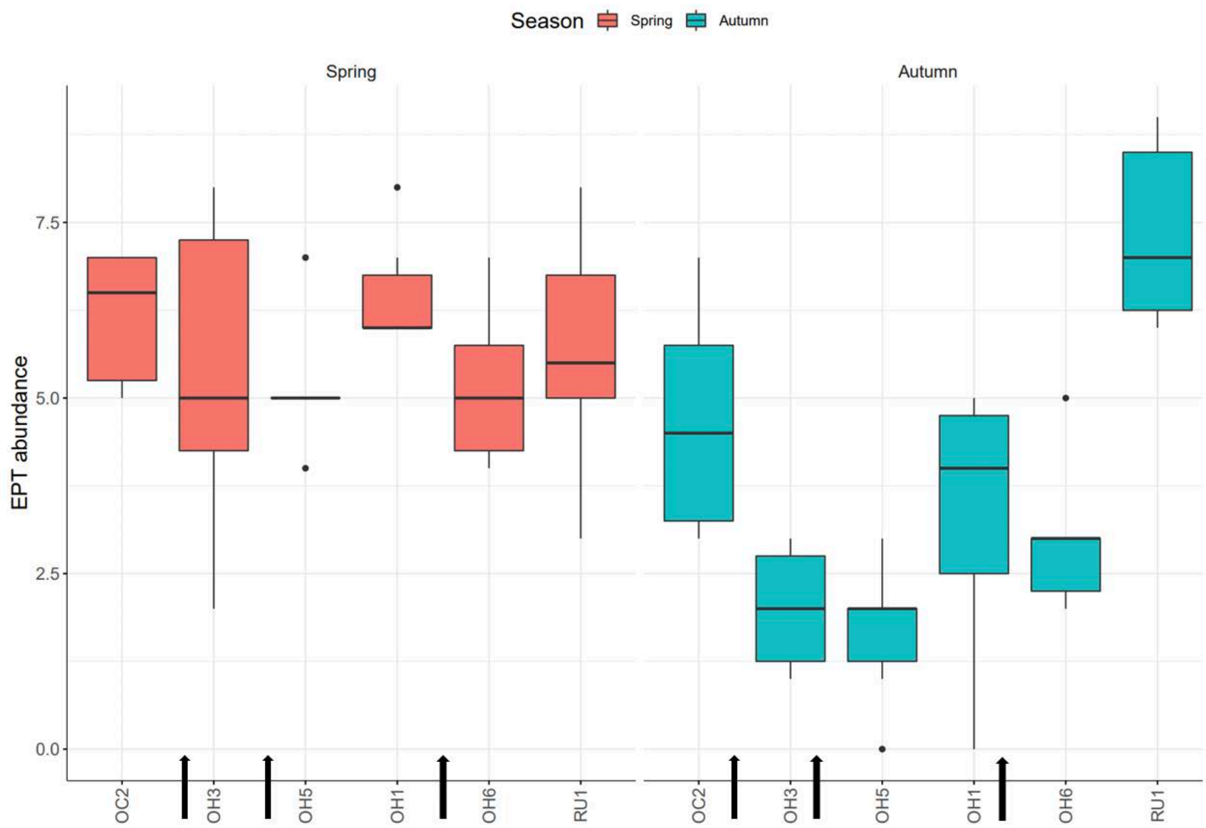


Figure 19 Number of EPT taxa in samples from sites on the Ohinemuri River and Ruahorehore Stream (RU1) collected during the December 2020 and March 2021 surveys. Discharge locations indicated by arrows.

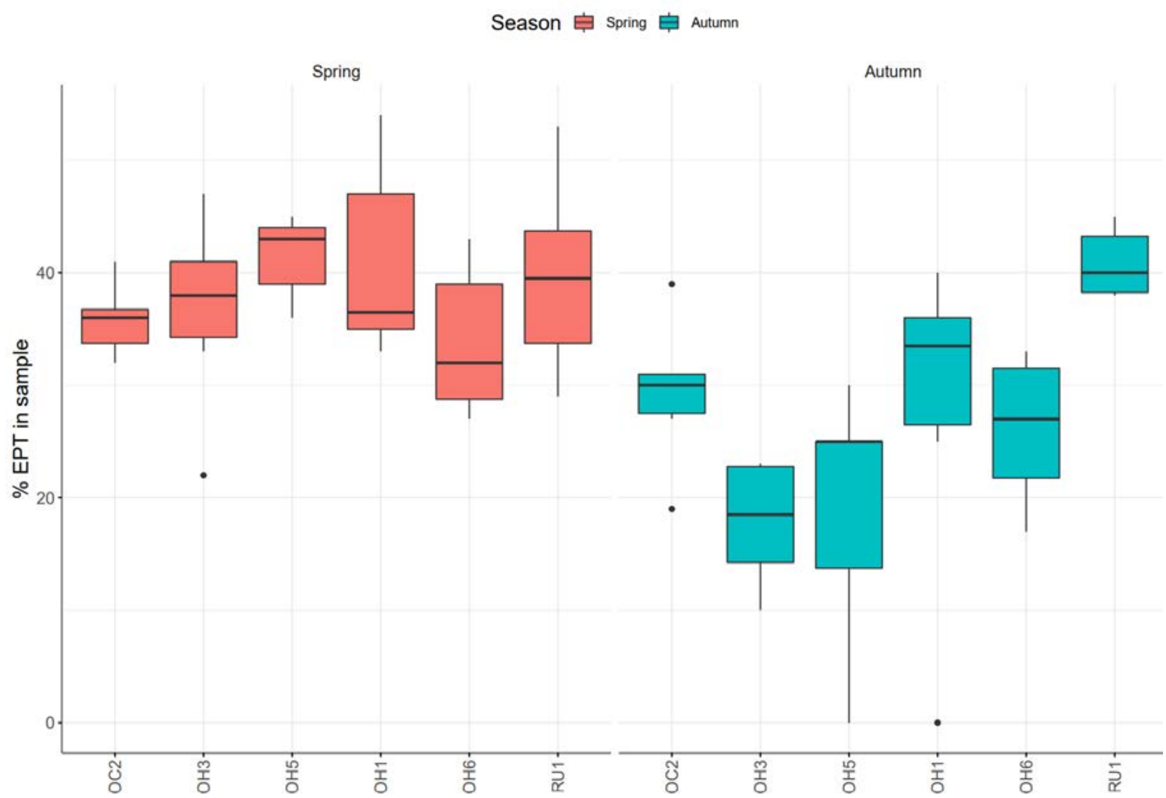


Figure 20 Abundance of EPT taxa as a percentage of total macroinvertebrate abundance in samples from sites on the Ohinemuri River and Ruahorehore Stream (RU1) collected during the December 2020 and March 2021 surveys.

9.5. Macroinvertebrate Community Indices

MCI scores for samples collected from the spring 2020 survey ranged from 77 (OC2) to 88 (OH1), and mean scores for sites OC2, OH3 and OH5 were borderline 'poor', while sites OH1, OH6, and RU1 were indicative of 'fair' water quality (based on the criteria of Stark & Maxted 2007) (Figure 21). A statistically significant difference was detected between the scores for the Ohinemuri sites (1-way ANOVA; $F_{4, 25}$=2.9, P=0.04), with the mean score for site OC2 lower than that for site OH1 for the spring survey (Figure 21; Tukey HSD tests). For the autumn 2020 survey, MCI scores ranged from 66 (OH6) to 80 (OH3), with all sites on the mainstem of the Ohinemuri indicative of 'poor' water quality. Site RU1 had a 'fair' water quality score. The MCI score for site OH6 was significantly lower than the scores for sites OC2 and OH3 (Figure 21; 1-way ANOVA, $F_{4, 25}$=3.3, $P < 0.03$).

All QMCI site scores for samples collected for the summer 2020 survey were close to the boundary between "poor" and "fair" water quality. For the autumn 2021 survey, QMCI scores ranged from 2.9 (OH6) to 4.02 (OH3). Site OH6 (furthest downstream) had a significantly lower (poorer) quality community compared to all other Ohinemuri sites (1-way ANOVA, $F_{4, 25}$=17.4, P<0.0001) (Figure 22).

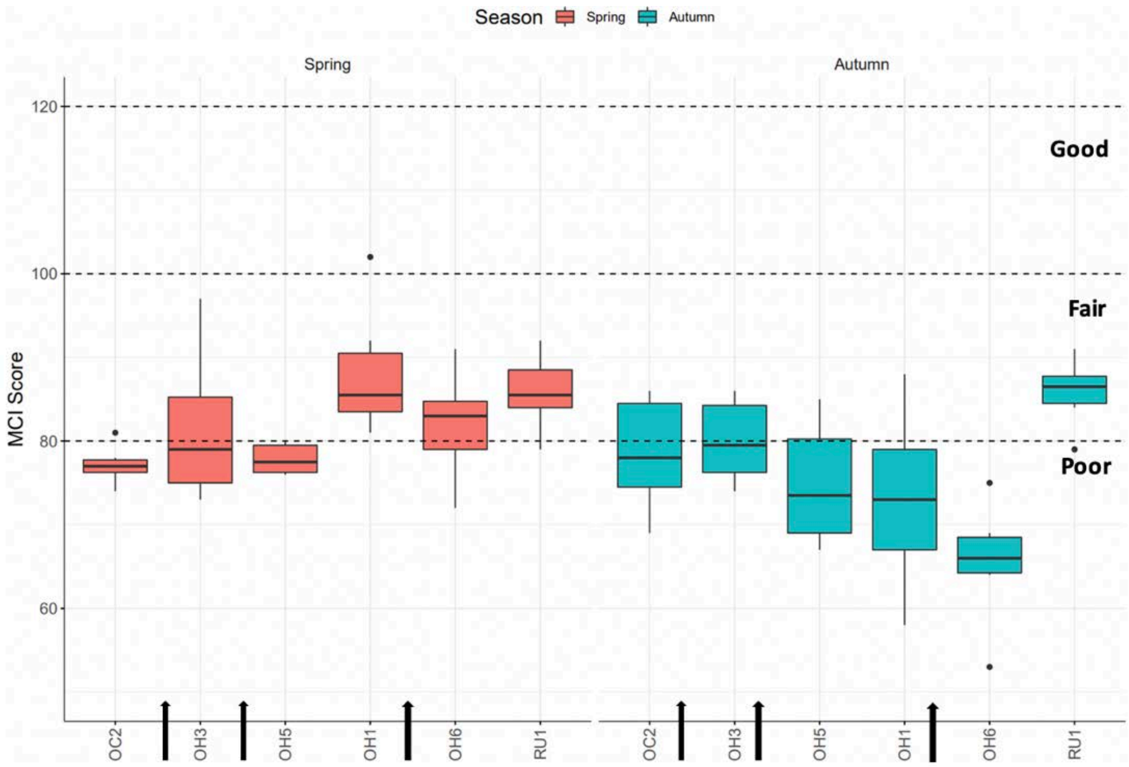


Figure 21 *Macroinvertebrate Community Index (MCI) scores for samples from sites on the Ohinemuri River and Ruahorehore Stream (RU1) collected during the December 2020 and March 2021 surveys. Discharge locations indicated by arrows.*

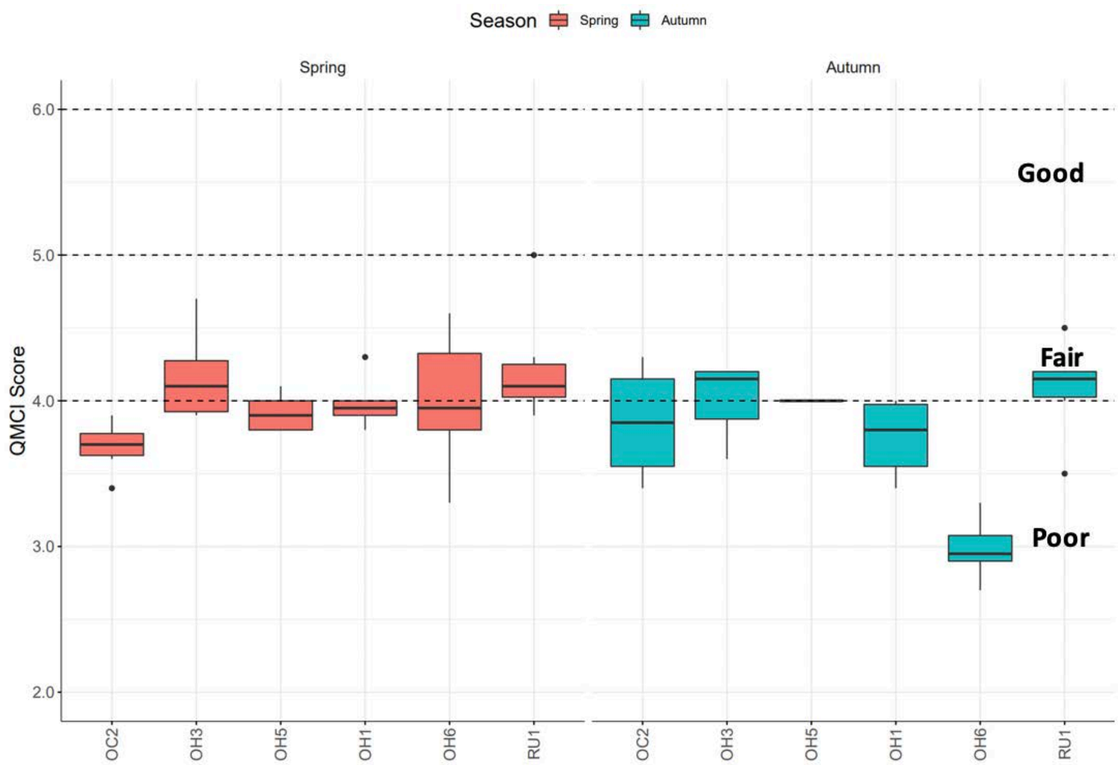


Figure 22 *Quantitative macroinvertebrate Community Index (QMCI) scores for samples from sites on the Ohinemuri River and Ruahorehore Stream (RU1) collected during the December 2020 and March 2021 surveys.*

10. Fish

Electric fishing was undertaken at sites OC2, OH5, OH1 and OH6 on the Ohinemuri River and sites on the Mataura Stream (M1), Ratarua Stream (R1), Ruahorehore Stream (RU1), and Waitete Stream (W1) between 25-26 March 2021, as required by Condition 16 of Discharge Permit 917318. These surveys allow for an assessment of the species present, fish densities and the size distribution of abundant species (typically common bully, Cran's bully, and shortfin eel). Discharge Permit 917318 also requires analysis of whole-body selenium concentration in bully (Condition 16). Full count and size data from electric fishing is contained in Appendix I.

10.1. Community composition and density

Five species of fish were caught during the March 2021 survey: common bully (*Gobiomorphus cotidianus*) (Not threatened), Cran's bully (*Gobiomorphus basalis*) (Not threatened), longfin eel (*Anguilla dieffenbachii*) (At Risk-Declining), shortfin eel (*Anguilla australis*) (Not threatened) and rainbow trout (*Oncorhynchus mykiss*) (Introduced and naturalised). In addition, koura or freshwater crayfish (*Paranephrops planifrons*) were caught at sites OC2, M1, and W1.

Fish populations at the Ohinemuri River and tributary sites were estimated using MicroFish 3.0 (van Deventer & Platts 1989). Results from this analysis are presented in Table 25. Of the mainstem sites, site OC2 had the highest overall density of fish (38 fish per 100 m^2), and, of the tributary sites, RU1 had the highest overall density (73 fish per 100 m^2). Overall, Cran's bully was estimated to be the most abundant species and were collected at all sites, except for R1, where no fish were caught. Estimates of Cran's bully density were greatest at RU1 (Ruahorehore Stream). Shortfin eel had the second highest estimated density overall and were found at sites OC2, OH1, OH6, RU1, and W1. The greatest density of shortfin eel were estimated to be present at OH1.

Additionally, common bully were collected from sites OC2, OH6, M1, and W1, longfin eel were collected from site M1, and rainbow trout from sites OH6, M1, and W1. Three unidentified bullies, 19 unidentified eels and 8 elvers were also collected (Table 25).

To consider long-term changes in fish density, annual estimates of density of abundant fish species for each year since 2006 were plotted and trend analysis carried out. Statistically significant ($p<0.05$) trends are presented in Table 26. Trends in the density of fish species present at sites OC2, W1 and R1 are not due to an effect from OGNZL's operations because they are either upstream of the discharges or are located in tributaries that feed into the Ohinemuri Stream and are thus located far from the mine footprint. A negative trend in the density of shortfin eels at OH6 (downstream of discharges E1 and E2) and OH1 (downstream of discharge E1) could reflect a number of factors, including the past regular removal of shortfin eels from these sites for selenium testing, possible changes in habitat available or sampled at this site, or an effect due to mine-related discharges. However, because this downward trend also occurs at the OC2 control site, an effect due to mine-related discharges seems unlikely.

Densities of individuals per m^2 for commonly caught fish species (Common bully, Cran's bully, longfin eel, shortfin eel, and rainbow trout) over the past 15 years have been presented in Figures 23-27.

Table 25 Estimated density of fish species collected in the Ohinemuri River (OC2, OH5, OH1, OH6) and tributary sites (RU1, M1, R1, W1) during the March 2021 survey. It should be noted that the densities presented here should be divided by 100 to compare to those presented in previous reports (which have been presented as fish per m^2).

Site	Cran's bully	Common bully	Unidentified bully	Longfin eel	Shortfin eel	Unidentified eel	Elver	Rainbow trout	TOTAL
OC2	20	7	1	0	6	4	0	0	**38**
OH5	6	0	0	0	0	1	3	0	**10**
OH1	10	0	0	0	11	0	1	0	**22**
OH6	7	2	0	0	6	1	4	1	**22**
RU1	60	0	0	0	8	5	0	0	**73**
M1	11	2	2	1	0	0	0	1	**17**
R1	0	0	0	0	0	0	0	0	**0**
W1	4	5	0	0	3	8	0	2	**21**

Table 26 Summary of statistically significant trends in the density of fish species at individual monitoring sites between 2006 and 2021.

Species	Site	$F_{1,16}$	R^2	P-value	Trend
Cran's bully	RU1	5.79	0.293	0.03	+ve
Cran's bully	R1	5.22	0.040	0.04	-ve
Cran's bully	W1	5.22	0.272	0.04	+ve
Longfin eel	R1	5.66	0.288	0.03	-ve
Shortfin eel	OC2	22.4	0.615	0.00	-ve
Shortfin eel	OH1	5.51	0.282	0.03	-ve
Shortfin eel	OH6	19.11	0.578	0.00	-ve

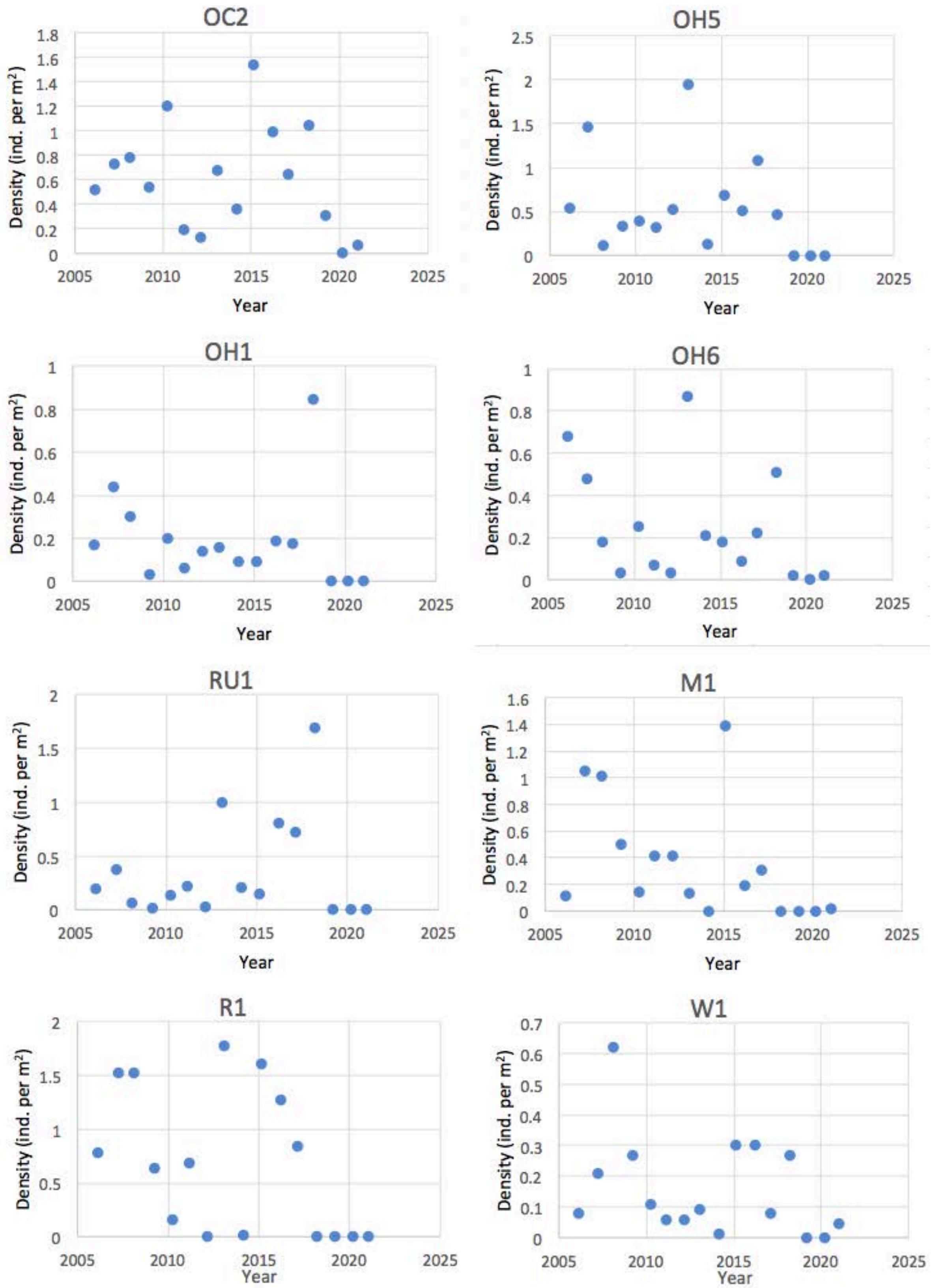


Figure 23 Density of common bullies at sites in the Ohinemuri River (OC2, OH5, OH1, OH6) and sites in tributaries (RU1, M1, R1, W1) between 2006 and 2021. Dotted lines are regression lines (with R^2 value), where a significant trend in fish density was detected (see Table 26).

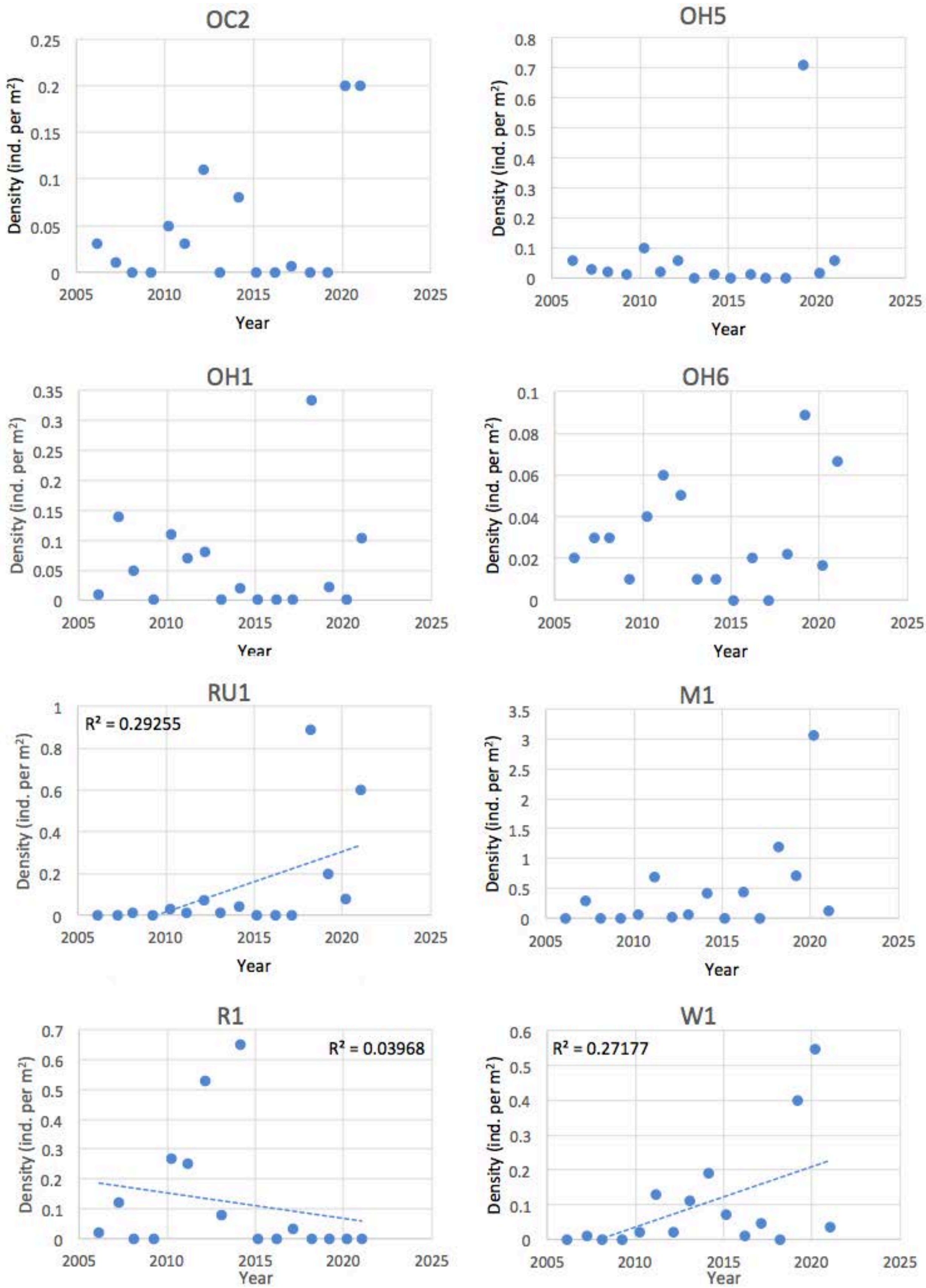


Figure 24 *Density of Cran's bullies at sites in the Ohinemuri River (OC2, OH5, OH1, OH6) and sites in tributaries (RU1, M1, R1, W1) between 2006 and 2021. Dotted lines are regression lines (with R^2 value), where a significant trend in fish density was detected (see Table 26).*

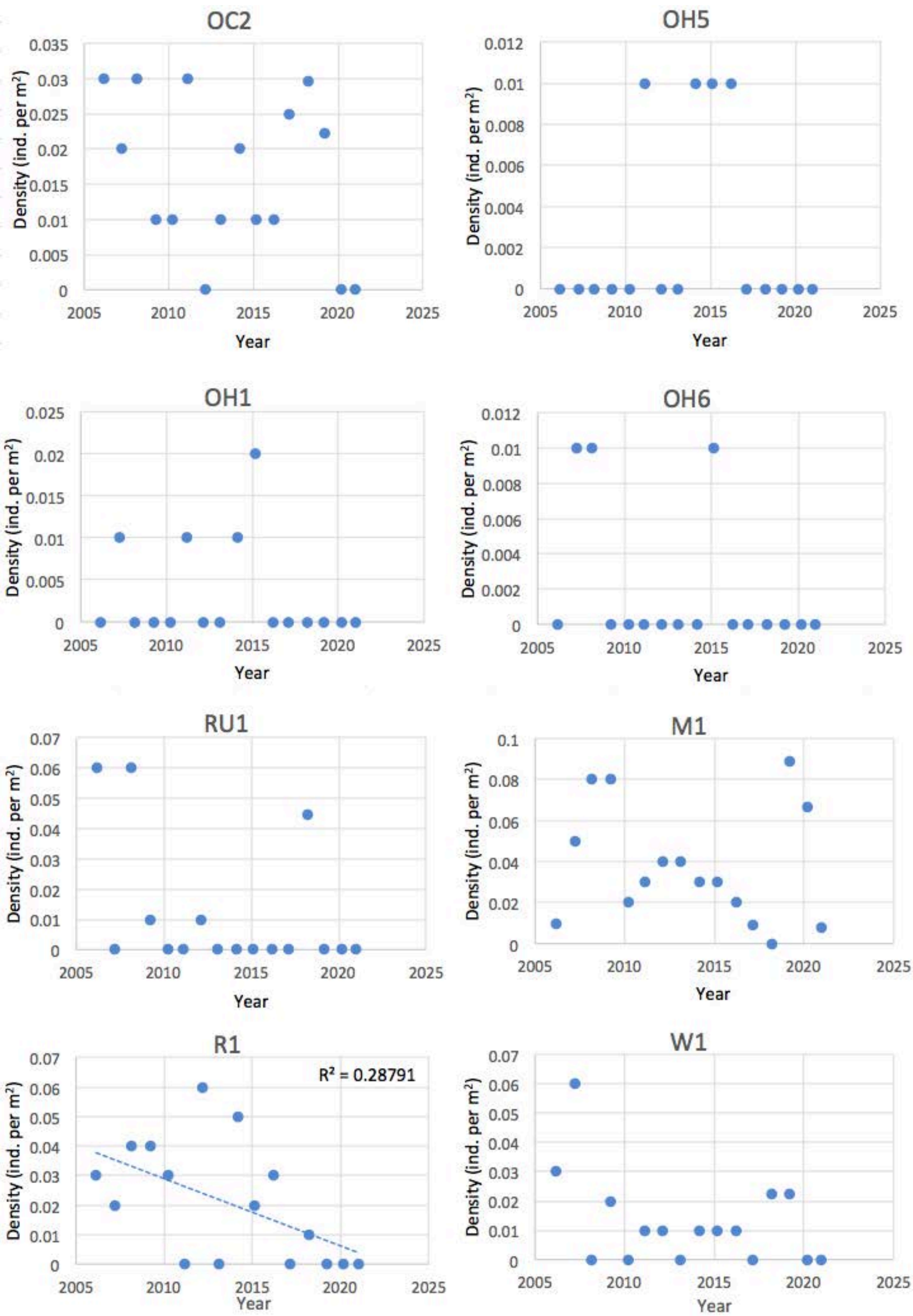


Figure 25 *Density of longfin eels at sites in the Ohinemuri River (OC2, OH5, OH1, OH6) and sites in tributaries (RU1, M1, R1, W1) between 2006 and 2021. Dotted lines are regression lines (with R^2 value), where a significant trend in fish density was detected (see Table 26).*

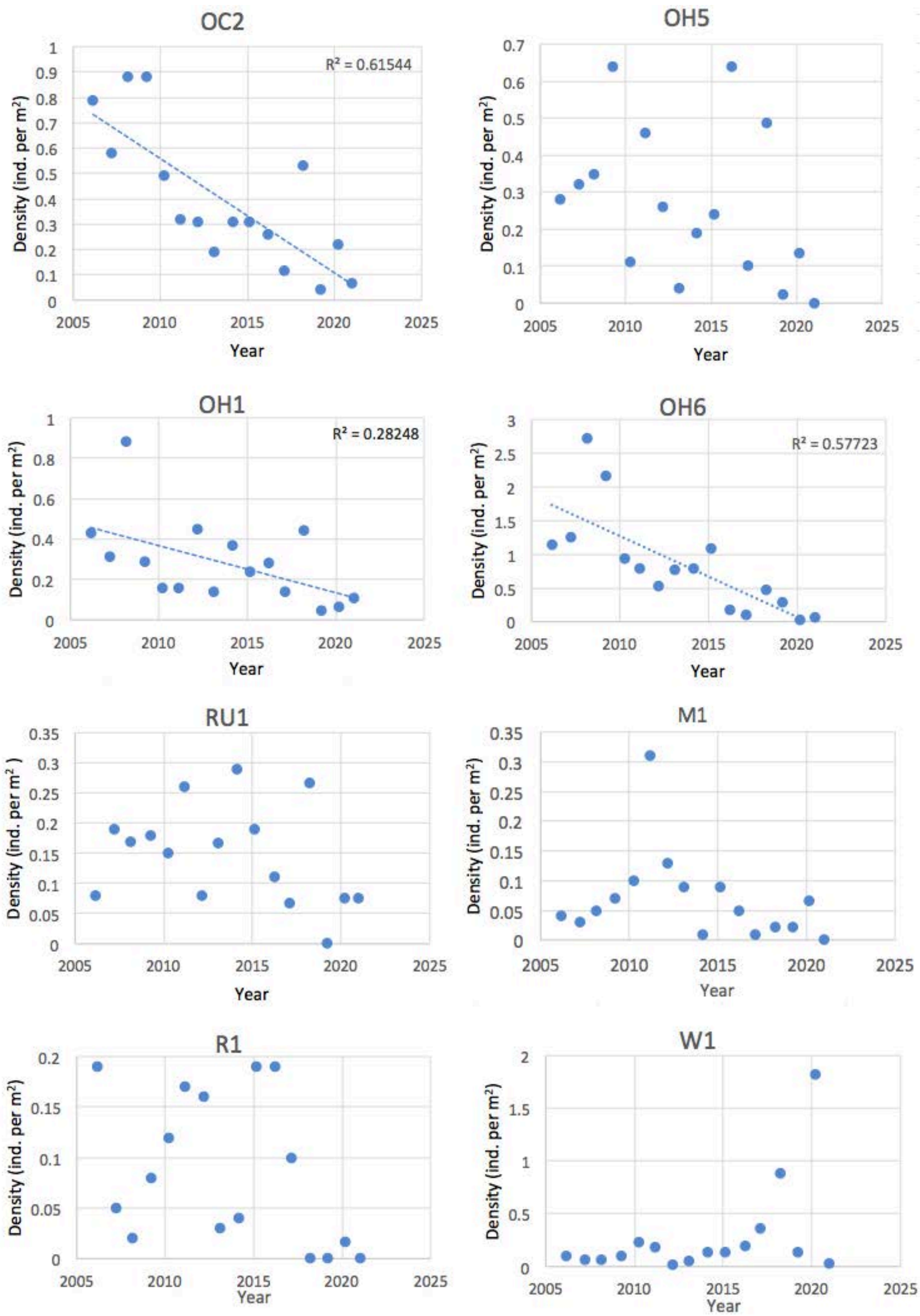


Figure 26 Density of shortfin eels at sites in the Ohinemuri River (OC2, OH5, OH1, OH6) and sites in tributaries (RU1, M1, R1, W1) between 2006 and 2021. Dotted lines are regression lines (with R^2 value), where a significant trend in fish density was detected (see Table 26).

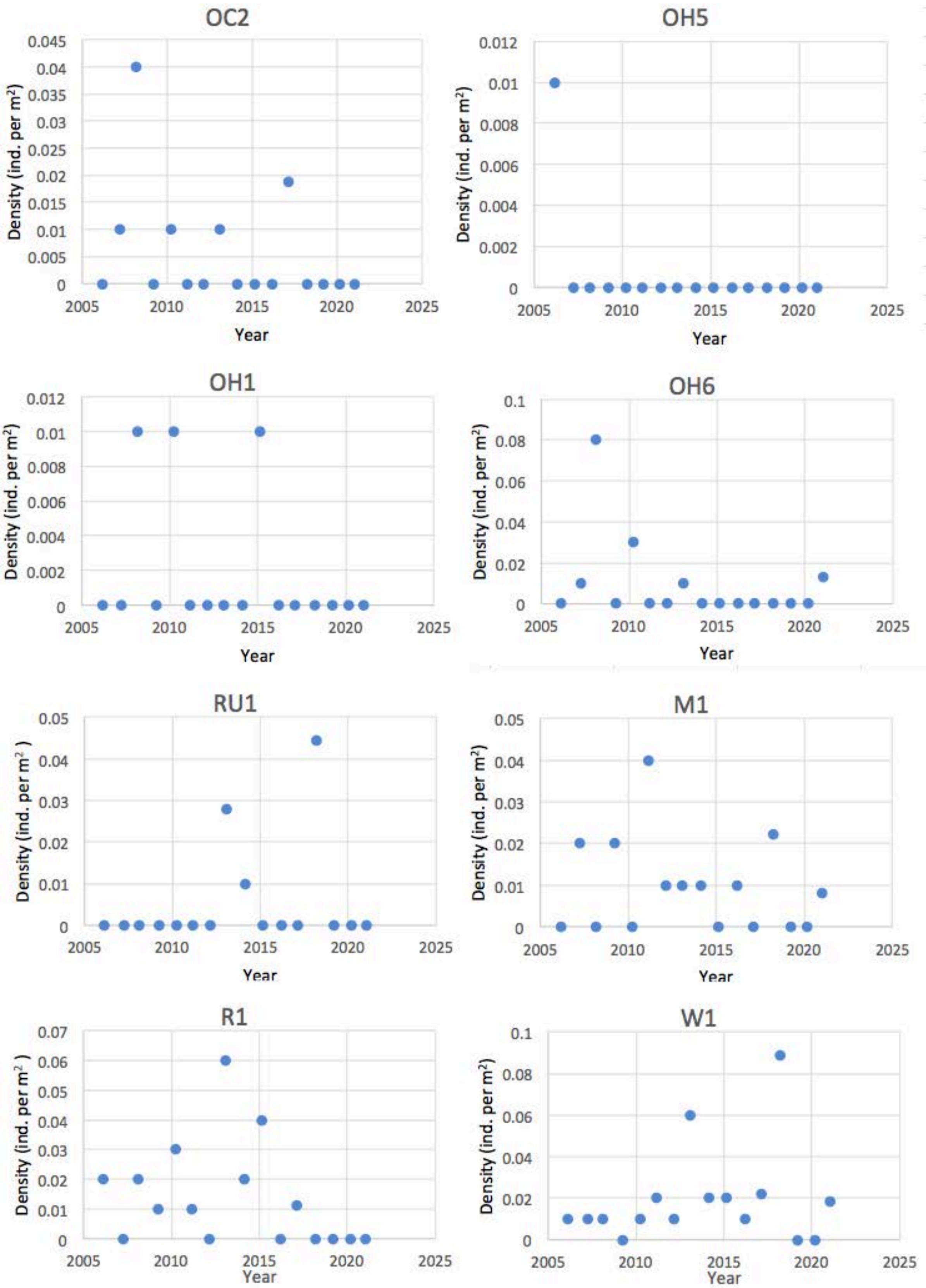


Figure 27 *Density of rainbow trout at sites in the Ohinemuri River (OC2, OH5, OH1, OH6) and sites in tributaries (RU1, M1, R1, W1) between 2006 and 2021. Dotted lines are regression lines (with R^2 value), where a significant trend in fish density was detected (see Table 26).*

10.2. Size distribution

The consistent abundance of shortfin eels and common bullies at survey sites over previous years has led to consideration of their size-frequency distributions in past reports. In addition, because numerous Cran's bully were caught, size-frequency distributions have been calculated for this species as well. Other fish species were not abundant enough to warrant plotting size-frequency information for each site, instead, size information for each is summarised below

10.2.1. Shortfin eels

Shortfin eel were collected from five of the eight sites surveyed; OC2, OH1, OH6, RU1 and W1. Elvers (<120 mm[6]) were present at four of the sites OH5, OH1, OH6 and M1, and juvenile eels (120-300 mm[7]) were present at the five sites where shortfin eels were collected. There were no adult (>300 mm) short fin eels caught at any of the sites (Figure 28) although adults were occasionally observed by the eye at some sites. The presence of juvenile eels at OC2, the most upstream mainstem site and M1 and R1 demonstrates that there is recruitment from the sea to the Ohinemuri River and upper tributaries.

10.2.2. Bullies

Common bullies were caught at sites OC2 (15-40 mm), OH6 (15-30 mm), M1 (30-45 mm), and W1 (20-65 mm) (Figure 29), in contrast to the 2020 survey when no common bullies were identified. Cran's bullies were caught at sites OC2 (15-60 mm), OH5 (35-50 mm), OH1 (30-65 mm), OH6 (20-65 mm), RU1 (15-70 mm), M1 (20-70 mm) and W1 (30-80 mm) (Figure 30). Common bully is the most widespread of the seven freshwater bully species. This species has a flexible life strategy wherein it can use the ocean or lakes to rear their young. Cran's bully is common at mid altitude sites and some distance inland, and dwells in stony rivers and streams. It is a non-diadromous species (does not make migrations to sea) and therefore has limited ability to re-colonize an area if its population is displaced.

10.2.3. Other fish species

Two longfin eels were caught at site M1 (350-550 mm) and eight rainbow trout were caught in total from sites OH6 (140-200 mm), M1 (100-150 mm), and W1 (100-220 mm). Seven bullies

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[6] Elvers up to 120 mm can climb vertical surfaces because surface tension can support their weight, whereas individuals larger than this cannot (McDowall 1990).

[7] Coordinated upstream migrations of eels cease when they reach approximately 300 mm, although individual eels may continue to move upstream until they are larger than this (McDowall 1990).

in total that were unable to be identified were observed at sites OC2 and M1. Twenty elvers that were unable to be identified were observed at sites OH5, OH1, OH6, RU1, and M1.

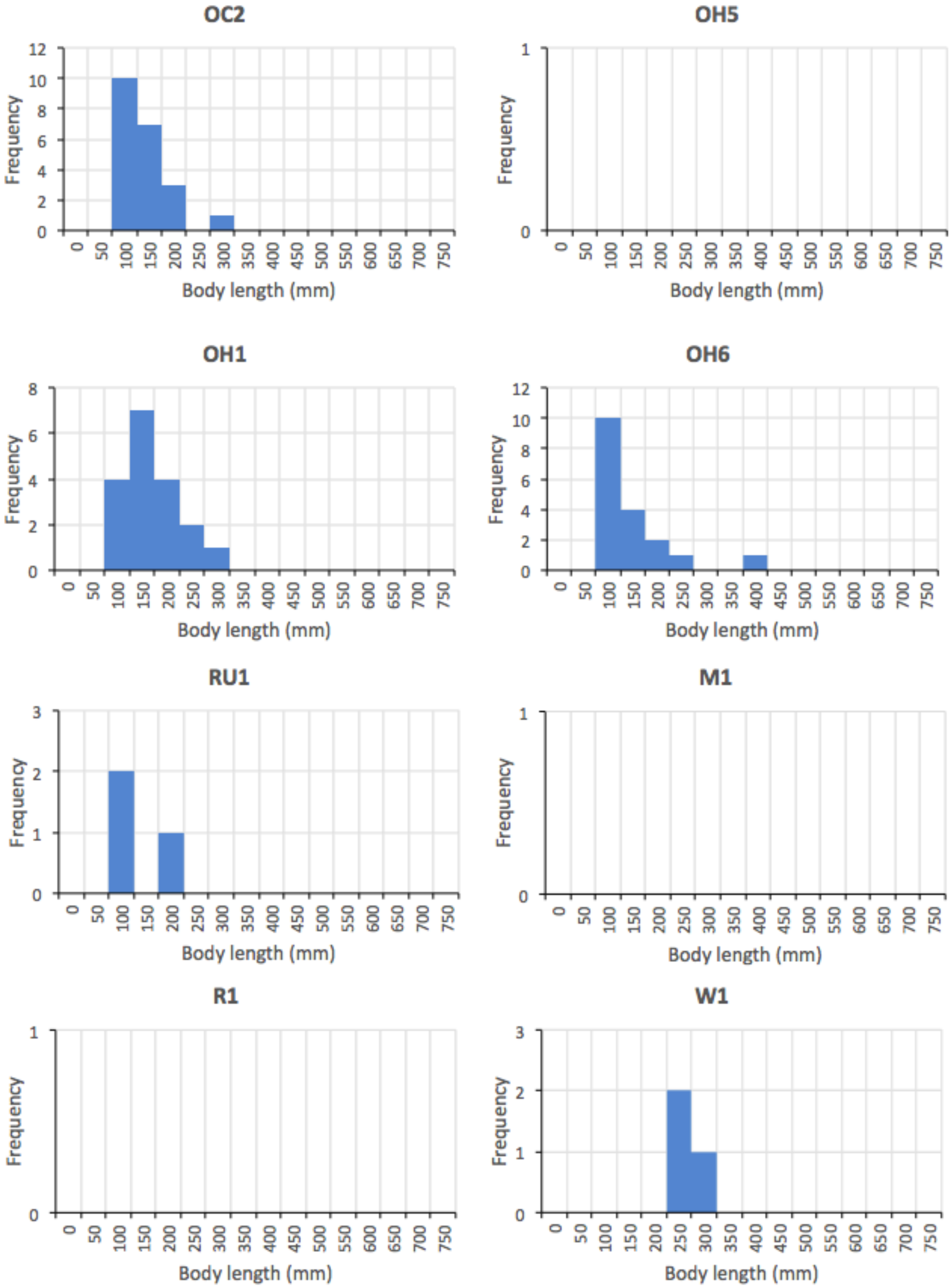

Figure 28 Size-frequency histograms for shortfin eel in the Ohinemuri River (OC2, OH5, OH1, OH6) and tributary sites (RU1, M1, R1, W1) during the autumn 2021 survey.

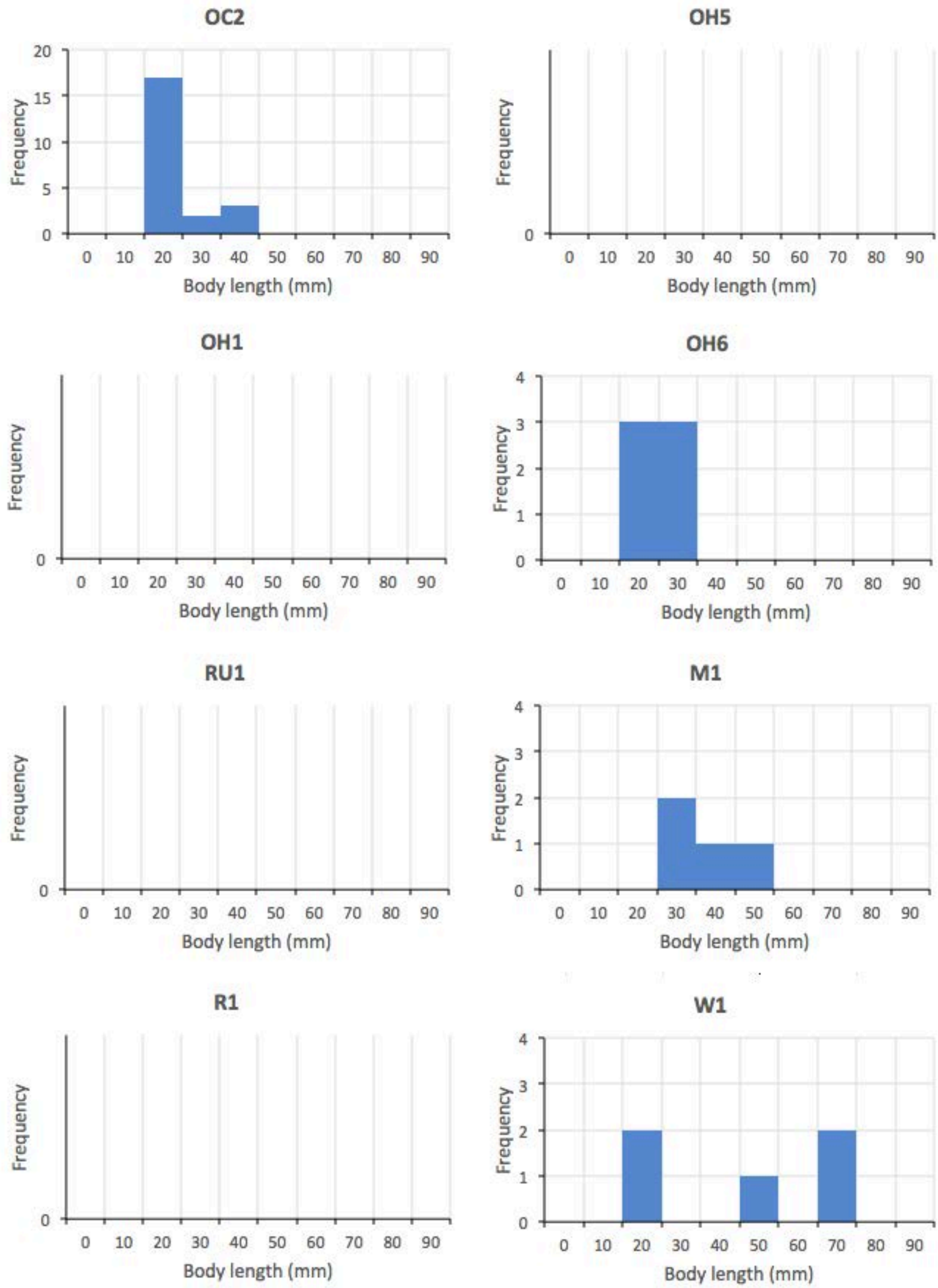

Figure 29 Size-frequency histograms for common bully in the Ohinemuri River (OC2, OH5, OH1, OH6) and tributary sites (RU1, M1, R1, W1) during the autumn 2021 survey.

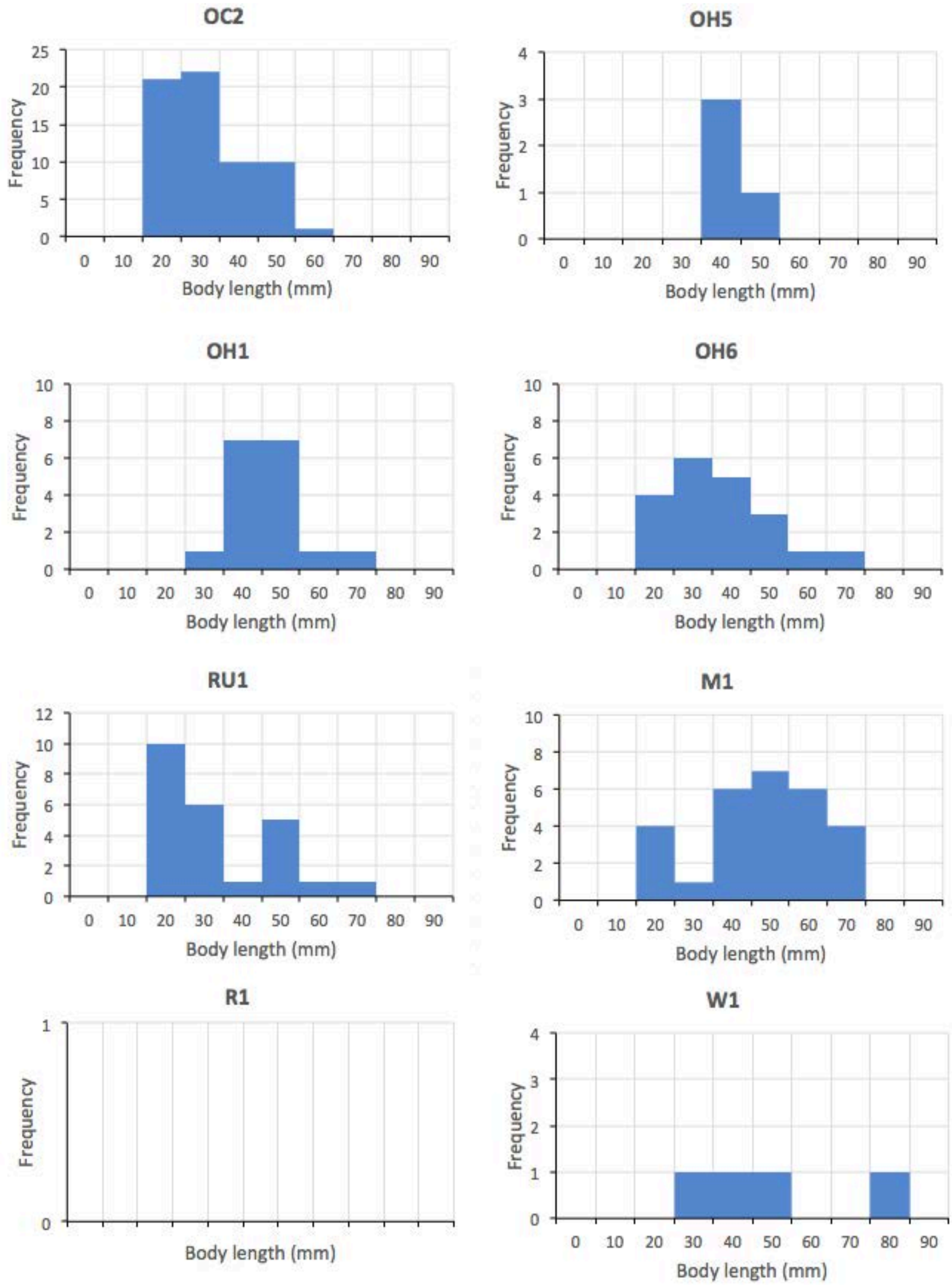

Figure 30 Size-frequency histograms for Cran's bully in the Ohinemuri River (OC2, OH5, OH1, OH6) and tributary sites (RU1, M1, R1, W1) during the autumn 2021 survey.

10.3. Selenium concentrations

The whole-body bully selenium concentrations were collected in March 2021 and are presented in Table 27 and Figure 31.

Condition 14a of the discharge permit (917318) identifies a trigger limit of 8.4 mg Se/kg (dry weight) and requires OGNZL to notify Waikato Regional Council when whole-body concentrations exceed this value and to implement an agreed monitoring programme to identify the cause and to identify steps taken to reduce selenium concentrations. Whole-body concentrations of selenium in autumn 2021 were below the compliance threshold at both OC2 and OH6 (Table 27 and Figure 30). The analysis reports are provided in Appendix G.

Table 16 Selenium concentrations (mg/kg dry weight) in bullies from sites OC2 and OH6 in the Ohinemuri River in 2021. Values in red exceed the guideline value (currently 8.4 mg Se/kg dry weight).

Fish species	Sampling occasion	OC2	OH6
Bully	March 2021	2.1	3.3
	Historical range	1.8-4.4	4.0-8.5

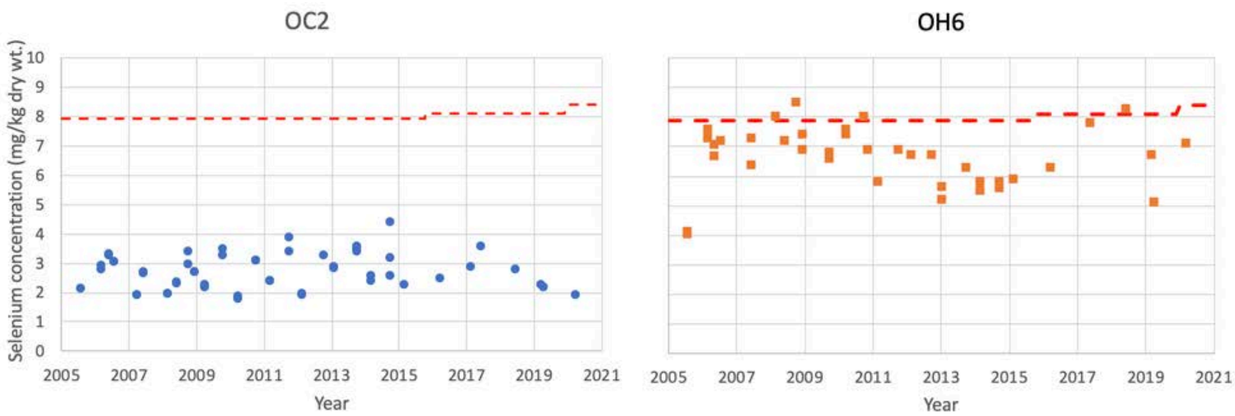

Figure 31 Selenium concentrations in the bullies collected from Sites OC2 and OH6. The red line denotes the trigger limit.

10.3.1. Compliance

OGNZL was within compliance for Condition 14a of the discharge permit (917318) for the 2020-2021 monitoring (Table 27, Figure 30), thus no additional actions were necessary.

10.4. Summary

OGNZL holds resource consents to discharge treated water to the Ohinemuri River from its wastewater treatment plant. These consents require OGNZL to monitor water, stream bed sediment and stream ecology, as well as to meet conditions designed to protect the downstream receiving environment. The data presented in this report were measured between 1 May 2020 and 30 April 2021 and are summarised below.

Treated water discharge

The daily volume of the upper discharge (E1) and the combined discharge (E1 + E2), and the maximum volume for the combined discharge of the treated water discharged to the Ohinemuri River exceeded the applicable limit several times between 1 May 2020 and 30 April 2021. OGNZL was fully compliant with Condition 14 of the discharge permit, with concentrations complying with the compliance values specified in Tables 1 to 3 of the discharge permit. Parameters that are measured daily from the discharge quality were not measured during June 7th-11th 2020 as no discharge was occurring at that time.

Receiving water

the lower pH compliance limit (6.5) was exceeded at OH6 on June 22nd 2020 (pH 6.4), at OC2 and RU1 on July 6th 2020 (pH 6.4), and at OH3 on February 15th 2021 (pH 6.4). These exceedances were mostly likely a result of heavy rainfall and unrelated to mine operations. Further, a downstream temperature of more than 3°C on 2 November 2020 (a change from 18°C to 22°C) was unlikely to be discharge-related as the treated water discharge temperature at the time was only 17°C. OGNZL complied with all other receiving water consent conditions between 1 May 2020 and 30 April 2021.

Sediments

Across all sites, the sand-size sediment fraction (63 µm-2 mm) was more abundant in fine sediment samples collected from the stream bed. For the autumn survey, the fine sediments at all sites were dominated by sands (>80%). The composition of fine sediments at all sites were within historical ranges.

> ***Arsenic*** - The concentration of As in the silt-size fraction (<63 µm) at site RU1 in spring and autumn 2020 exceeded the NOAA (1999) threshold effects level (TEL) (5.9 mg/kg) and the OME (1993) lowest effect level (LEL) of 6.0 mg/kg, however both values were below the historical range for this site. Elevated concentrations of As in silt were also found at sites OH5 and OH6 in autumn 2021, both of which exceed the NOAA (1999) threshold effects level (TEL) (5.9 mg/kg) and the OME (1993) lowest effect level (LEL) of 6.0 mg/kg. Furthermore, the As concentration at site OH6 in autumn 2021 was the highest ever observed since monitoring began in 2005. The historical range of As at site OC2 encompasses the concentrations of As found at sites RU1 and OH5, but the 11.8 mg/kg dry wt. observed in autumn 2021 at site OH6 is higher than the reference site range. This finding indicates the natural levels of arsenic at sites OH5 and RU1 approach or exceed the lower sediment guidelines for arsenic.

Cadmium - In the silt size fraction (<63 µm) in spring 2020, cadmium concentrations were above the NOAA TEL and OME LEL guidelines (both 0.6 mg/kg dry wt.) at sites OH3, OH6 and RU1. Sites OH3 and OH6 had cadmium concentrations that were also higher than historical concentrations. In autumn 2021, cadmium concentrations were elevated at site OC2 (reference site) and RU1 (both 0.72 mg/kg dry wt.), but both sites were within the higher end of their respective historical ranges.

Copper - Cu in the silt size fraction (<63 µm) at site OH6 in spring 2020 was just above the OME LEL guideline (16 mg/kg dry wt.). In autumn 2021, sites OH3, OH5, and OH6 were above the OME LEL guidelines but below the NOAA TEL guidelines (36 mg/kg dry wt.). Cu concentrations were within the historical range for sites OH5 and OH6, but Cu recorded at site OH3 was the highest recorded since monitoring began in 2005, and was higher than the reference site (OC2) historical range.

Iron - Iron concentrations were above guidelines in both the sand and silt fraction of sediment in spring 2020 and autumn 2021. Specifically, in the sand fraction (<2.0 mm) the upstream reference site OC2 exceeded the OME LEL guideline (2.0 % dry weight) in spring 2020 and autumn 2021, however the values were within the historical range. In the silt size fraction (<63 µm), the concentration of iron at the reference site OC2 and site OH3 also exceeded the OME LEL guideline in spring 2020 and autumn 2021. Sites OH5, OH1, and OH6 also exceeded the OME LEL guideline in autumn 2021; while sites OH5 and OH1 were within the historical range, site OH6 exceeded the historical range but was within the historical range of the reference site OC2.

Manganese - The concentration of Mn was elevated above the OME (1993) LEL (460 mg/kg) in the sand size fraction (63 µm - 2 mm) at reference site OC2 in autumn 2021, and was outside the historical. In the silt size fraction (<63 µm), in both spring 2020 and autumn 2021, Mn at sites OC2, RU1, OH1, and OH6 was elevated above the OME LEL guideline, but was within respective historical ranges (Table 15). In contrast, Mn concentrations at site OH3 in 2020 and 2021 were elevated above the OME guideline and both were the highest Mn values recorded at the site since monitoring began in 2005, but were within the historical range for the reference site OC2. As such, these levels of Mn are likely to be a result of catchment geology.

Mercury - The concentration of mercury was elevated above the NOAA (2008) TEL (0.17 mg/kg) and OME (1993) LEL (0.2 mg/kg) in the sand size fraction (63 µm - 2 mm) at all sites except OH1 and RU1, and at all sites in the silt size fraction (<63 µm) in the December 2020 survey. In the March 2021 survey, for the silt size fraction, all sites exceeded the OME and NOAA guidelines, however were within the historical range of each respective site and the reference site. Therefore, the Mercury concentrations found in sand and silt-size samples may be natural.

Zinc - In the silt size fraction (<63 µm), during the December 2020 survey, the concentration of zinc at sites OH6 and RU1 exceeded the NOAA (2008) TEL (123mg/kg)

OME (1993) LEL (120 mg/kg) guideline. Site RU1 zinc concentration was within its respective historical range. Site OH6 exceeded the historical range, but was within the reference site historical range. In the March 2021 survey, sites OC2 and RU1 were above the NOAA and OME guidelines, however were within their respective historical ranges.

Habitat

Aquatic and riparian habitat characteristics were recorded during the December 2020 survey. Survey sites were dominated by run and riffle habitat confined by steep banks. Most sites were generally open or only partly shaded. The Ruahorehore Stream monitoring site is narrower and is more shaded than the Ohinemuri River monitoring sites. The Ohinemuri River experienced high flows (>10 m3/s) within a month of both the December 2020 and March 2021 surveys. In December 2020, most Ohinemuri River sites were dominated by gravels with areas of cobbles and sand. Substrate character was similar in March 2021, with most sites dominated by coarse gravel and sand.

Periphyton

In spring 2020, the proportion of the bed covered by visible periphyton growths at Ohinemuri River sites ranged from 78% (OH3) to 100% (OH5). In autumn 2021, the percentage of bed covered by visible periphyton ranged from 66.5% at OH1 to 94.5% at sites OH5 and RU1. In spring, all sites exceeded the New Zealand periphyton guideline of a maximum cover of 30% cover (between the period 1 November to 30 April) whereas in autumn only sites OH5, OH1, OH6, and RU1 exceeded this guideline.

In spring, a range of cyanobacteria, diatoms and chlorophytes were present at all monitoring sites. Potentially toxic forms of cyanobacteria were present at all six monitoring sites. In autumn, cyanobacteria was common to dominant at most sites.

In spring, mean chlorophyll-*a* concentrations recorded at all sites were above the New Zealand periphyton guideline of 50 mg/m^2 for the protection of benthic biodiversity, the guideline of 120 mg/m^2 for long filamentous green algae for the protection of trout habitat and angling, and the guideline for diatoms/cyanobacteria (200 mg/m^2) (Biggs 2000) (Table 19). However, there were no significant differences detected between sites. Chlorophyll-*a* concentrations were at least three times lower in the autumn 2021 survey. Sites OC2, OH3, and OH6 were above the periphyton guideline of 50 mg/m^2 for the protection of benthic biodiversity (Table 19). Site OH6 was also above the New Zealand periphyton guideline of 120 mg/m^2 for long filamentous green algae for the protection of trout habitat and angling (Biggs 2000). In autumn 2021, the one-way ANOVA detected significant differences in chlorophyll-*a* concentrations at site OH6. Specifically, site OH6 had higher chlorophyll-*a* concentrations compared to upstream site OH1 and reference site OC2.

In spring, mean AFDW biomass of periphyton was well above the periphyton guideline of 35 g/m^2 for the protection of aesthetics/recreation and trout habitat and angling (Biggs 2000)

(Table 20, Figure 10). In autumn 2021, AFDW was at least twice as low as it was in the spring survey, and no sites exceeded the guideline (Table 20). In autumn, the one-way ANOVA detected a significantly greater AFDW biomass at site OH6 compared to sites OC2, OH3, and OH1 (Table 20).

The periphyton selenium concentration at OH6 (1.26 mg/kg dry weight) in 2021 was higher than that observed at OC2 (0.43mg/kg dry weight) on the same occasion (Figure 11). At Site OC2, the March 2021 selenium concentration was in the bottom 25% of the historic range, while the selenium concentration at Site OH6 in March 2021 was in the top 50% of the historic range.

Macrophytes

In spring, macrophyte cover was highest at Site OH6 (24%), which had no shading. Sites OC2, OH3, OH5 and OH1 had macrophyte cover between 1% and 4.4. In autumn, macrophyte cover was overall lower than in spring, however was highest at site OH3 (11%) and lowest at site OC2 (6%). No macrophytes were observed at sites OH5, OH1, OH6, and RU1. The selenium concentration in macrophytes at OH6 (0.7 mg/kg dry weight) was higher than that observed at Site OC2 (0.25 mg/kg dry weight) for the autumn 2021 survey. Both sites had very low selenium concentration compared to the historical range, and were in the 1st percentile of the historical range.

Benthic invertebrates

Community – In spring, macroinvertebrate communities were dominated by mollusca followed by trichoptera and diptera. Mollusca was also the dominant taxa found in the March 2021 survey, however trichopterans dominated at site OH6. NMDS plots suggest that in spring, sites on the Ohinemuri River were generally similar to one another in terms of macroinvertebrate community composition. Samples from each site on the Ohinemuri River were more similar to other samples collected from that site than to samples from other sites. Samples collected from site OH5 were more distinct from other sites, likely because of the high proportion of mollusca found in the samples. The autumn NMDS suggests that macroinvertebrate community composition between and among sites was more variable. A more pronounced grouping of sites OH1, OH6, and some replicates of site RU1 was evident. While sites OH1 and OH6 are close to the E2 discharge, RU1 was not affected by mine discharges and thus the group distinction is not likely due to mine discharges. Similarly, a pronounced grouping of OC2, OH3, and OH5 is evident, however OC2 is upstream of any discharge whereas OH3 and OH5 are not, thus the group distinction is not likely due to mine discharges.

Density – In spring, mean invertebrate density at the Ohinemuri River sites were similar. Invertebrate density was > 10,000 invertebrates per m^2 at sites OC2, OH3, OH5, and RU1, and sites OH1 and OH6 had densities of < 10,000 invertebrates per m^2. In autumn, mean invertebrate density was much lower than in spring at sites OC2, OH3, OH5, and RU1, but much higher at sites OH1 and OH6. OH1 invertebrate density was significantly higher those found at sites OH3, OH5, and OC2. Furthermore, significantly more invertebrates per m^2 was found at the furthest upstream reference site (OC2) and site OH6 which is downstream of all three mine discharge points.

Abundance and Richness – In spring 2020, the percentage change in abundance between sites located upstream (OH3) and downstream (OH5) of the upper discharge and between sites located upstream (OH1) and downstream (OH6) of the lower discharge were well inside the limit of ± 109 %. In Autumn 2021, the percent change in abundance between the upper discharge (OH3 and OH5) was 249%, and above the 109% threshold. This threshold was not exceeded in autumn 2020. Condition 18 states further monitoring is undertaken only when allowable limits are exceeded in two consecutive seasonal monitoring events (e.g., autumn to autumn), thus no further monitoring was required.

For the lower discharge, the percentage change in taxa richness between sites upstream and downstream of each discharge was within allowable limits at the time of both spring surveys considered (2019, 2020) and both autumn surveys (2020, 2021). In autumn 2020, the percentage change in taxa richness was outside of the allowable limit of 53%. Specifically, there was a 123% change in taxonomic richness between site OH3 and OH5 (Table 24). However, in autumn 2021, the percent change in richness was well within the 53% threshold and thus follow-up monitoring was not required.

Indices – The mean abundance of EPT taxa collected from sites on the mainstem of the Ohinemuri River was consistent across sites in spring 2020. No EPT taxa were found at site OH5 in spring 2020. The percentage of EPT taxa found in samples during autumn 2021 was significantly different between sites on the Ohinemuri River. Specifically, site OC2 has significantly higher EPT abundance as compared to sites OH3 and OH5. Percentage EPT taxa were similar across all sites in both spring 2020 and autumn 2021 (Figure 20).

MCI scores for samples collected during the spring 2020 survey, ranged from 77 (OC2) to 88 (OH1) and mean scores for sites OC2, OH3 and OH5 were borderline ‘poor’ and sites OH1, OH6, and RU1 were indicative of ‘fair’ water quality. A significant difference was detected between the scores for the mainstem sites, with the mean score for site OC2 lower than that for site OH1 during the spring survey. In the autumn 2020 survey, MCI scores ranged from 66 (OH6) to 80 (OH3), with all sites on the mainstem of the Ohinemuri indicative of ‘poor’ water quality; site RU1 had a ‘fair’ water quality score. Furthermore, site OH6 had a significantly lower score than site OC2 and site OH3.

QMCI scores for samples collected during the spring 2020 survey, ranged from 2.9 (OH6) to 4.02 (OH3), with the scores for most sites close to the boundary between ‘poor’ and ‘fair’ water quality. Most sites were indicative of ‘poor’ water; QMCI scores appear to deteriorate with downstream distance. Specifically, site OH6 (furthest downstream) had significantly lower (poorer) quality community as compared to all other mainstem Ohinemuri sites.

Fish

Five species of fish were collected during the March 2021 survey: common bully, Cran's bully, longfin eel, shortfin eel, and rainbow trout. Of the Ohinemuri River sites, site OC2, which is upstream of all mine-related discharges, had the highest density of fish (38 fish per 100 m^2). Of the tributary sites, RU1 which is immediately upstream of the confluence with the Ohinemuri River and adjacent to the mine, had the highest density of fish (73 fish per 100 m^2). Overall, Cran's bully was the most abundant fish species at all sites, with the exception of site OH1, where shortfin eel was the most abundant species.

Statistically significant negative population trends between 2006 and 2021 have been found at sites OC2 (shortfin eel), R1 (longfin eel), OH1 (shortfin eel) and OH6 (shortfin eel). A statistically significant decline in shortfin eel density at sites OH1 and OH6 could reflect a number of factors:

(a) the previous annual removal of shortfin eels from this site for selenium testing,

(b) possible changes in habitat available,

(c) the type of habitat at this site, or

(d) an effect of mine discharges.

However, because this downward trend also occurs at the OC2 control site, an effect due to mine-related discharges seems unlikely.

Whole-body selenium concentrations of bullies collected from sites OC2 and OH6 in autumn 2021 were below the compliance threshold, thus no additional actions were necessary.

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Appendix A. Resource Consent Conditions

Treated water discharges (Consent 971318)

Discharge Permit 971318 authorises the Waihi Gold Company (WGC) to discharge treated water from the WTP to the Ohinemuri River via two discharge points, E1 (upper discharge) and E2 (lower discharge). The relevant conditions of the discharge permit are listed below:

2. The maximum combined daily discharge from both discharge points shall be no greater than that shown in Table A.

3. The maximum combined rate of discharge from both discharge points shall be no greater than that shown in Table A.

4. The rate of discharge at point E1 shall not exceed the percentage of the instantaneous river flow above point E1 as shown in Table A.

5. For the combined discharge from points E1 and E2, the rate of discharge shall not exceed the percentage of the instantaneous river flow at discharge point E2, minus the discharge volume from point E1, (i.e. $E1+E2 \le (Q-E1) \times F$) as shown in Table A, where:

E1 = rate of discharge at point E1; E2 = rate of discharge at point E2; Q= river flow at E2.

Table A Discharge criteria for operating regimes

Criteria	Operating regime			
	A	B	C	D
Daily discharge (m^3/d)	20,000	26,000	5,200	26,000
Discharge rate (L/s)	235	301	60	301
Percentage of river flow (F) (%)	15	20	10	40

14. The treated water discharge shall at all times comply with the following limits specified in Tables 1, 2 and 3 of the consent (Tables 1 to 3 of the consent are reproduced in Tables 1 to 3 of this document).

14a. The consent holder shall manage the selenium concentration in the discharge to ensure that the following trigger limits are not exceeded as a result of the discharge:

	Whole body fish flesh trigger limits mg/kg (dry weight)
Bullies	8.4
Eels	8.5

Compliance with this condition shall be assessed by the monitoring regime described in condition 16, Table 5. In the event of an exceedance of the fish flesh trigger limit, the consent holder shall:

- advise Waikato Regional Council within 48 hours of receipt of the results, and
- reduce the selenium concentration in the discharge to 0.04g/m^3 for Regime A, 0.03g/m^3 for Regime B, 0.05g/m^3 for Regime C and 0.02g/m^3 for Regime D unless otherwise agreed with Waikato Regional Council in writing.

Within 10 working days of advising Waikato Regional Council of an exceedance of the fish flesh trigger limit, the consent holder shall submit a report to Waikato Regional Council that summarises:

- selenium concentrations in the treated water and receiving water and the results of any additional selenium monitoring required by this consent over the previous three months or as otherwise agreed with Waikato Regional Council,
- any operational events during the same period that might be related to the exceedance, and,
- any recommended actions as a result of the exceedance and the reported and assessed selenium concentrations.

The recommended actions shall be implemented following consultation with and the approval of Waikato Regional Council.

14b Except as provided for by Condition 16, Table 5 and Condition 20, the consent holder shall not sample and analyse eels unless otherwise agreed with Waikato Regional Council in writing.

15. Unless otherwise agreed in writing by Waikato Regional Council, the consent holder shall undertake the following programme of water monitoring (Table 4). (Table 4 of the consent is reproduced in Table 4 of this document).

16. Unless otherwise agreed with Waikato Regional Council the consent holder shall undertake the following monitoring throughout the period of wastewater discharge to the Ohinemuri River (Table 5 and Figure 1). (Table 5 of the consent is reproduced in Table 5 of this document).

Table 1 : WTP Discharge Compliance Limits

Parameter	Operating regime A		Operating regime B		Operating regime C		Operating regime D	
	Normal(1)	Maximum(1)	Normal(1)	Maximum(1)	Normal(1)	Maximum(1)	Normal(1)	Maximum(1)
pH range (unitless)	6.5-9.5		6.5-9.5		6.5-9.5		6.5-9.5	
Total suspended solids	10	50	8	40	5	10	8	40
Temperature (℃)	<3℃ rise	<3℃ rise	<3℃ rise	<3℃ rise	<3℃ rise	<3℃ rise	<3℃ rise	<3℃ rise
Cyanide (CNWAD)	0.25	0.71	0.2	0.56	0.36	1.02	0.11	0.32
Iron	1.0	6.7	0.8	5.0	0.1	0.3	0.5	3.1
Manganese	1.0	1.3	0.8	1.0	0.1	0.4	0.5	0.6
Copper	0.07(2)	0.13(2)	0.055(3)	0.10(3)	0.031(4)	0.054(4)	0.033(4a)	0.06(4a)
Nickel		1.2(2)		0.94(3)		0.64(4)		0.55(4a)
Zinc		0.8(2)		0.61(3)		0.38(4)		0.36(4a)
Ammonia	Refer Table 3		Refer Table 3		Refer Table 3		Refer Table 3	
Silver	0.02(2)	0.03(2)	0.017(3)	0.024(3)	0.005(4)	0.005(4)	0.01(4a)	0.014(4a)
Antimony		0.23	0.1(5)	0.18	0.07(5)	0.33	0.06(5)	0.10
Arsenic		1.45		1.14		0.02		0.66
Selenium	0.2	0.3	0.12(5)	0.2(5)	0.22(5)	0.38(5)	0.07(5)	0.12(5)
Mercury		0.0005(6)		0.0005(6)		0.0005(6)		0.0005(6)
Cadmium		0.008(2)		0.007(3)		0.004(4)		0.004(4a)
Chromium (VI)		0.08		0.06		0.05(6)		0.04
Lead		0.02(2)		0.018(3)		0.006(4)		0.011(4a)
Harness assumption	670		530		200(4)		315	

Table 1 Notes

(1) Normal compliance values to be met 97% of time based on all analyses taken during a quarterly period when the WTP is discharging. Maximum values are not to be exceeded in any analysis.

(2) Operating Regime A - For hardness related metals, the compliance values in Table 1 assume hardness in the WTP discharge of 670 g/m^3 as $CaCO_3$ prior to dilution in the Ohinemuri River. This equates to an in-river hardness of about 100 g/m3 as $CaCO_3$ following mixing. Refer Table 2 for compliance levels at differing hardness concentrations

(3) Operating Regime B - For hardness related metals, the compliance values in Table 1 assume hardness in the RO only discharge of zero and 530 g/m^3 as CaCO3 prior to dilution in the Ohinemuri River. This equates to an in-river hardness of about 100 g/m^3 as CaCO3 following mixing. Refer Table 2 for compliance levels at differing hardness concentrations.

(4) Operating Regime C - Prior to discharge of Reverse Osmosis (RO) plant permeate, hardness must be added to achieve a minimum hardness of 200 g/m^3 as CaCO3 to ensure in-river compliance for hardness related metals. Refer to Table 2 for compliance levels at differing hardness concentrations.

(4a) Operating Regime D – For hardness related metals, the compliance values in Table 1 assume a hardness in the WTP discharge of 315 g/m^3 as $CaCO_3$ prior to dilution in the Ohinemuri River This equates to an in-river hardness of about 100 g/m^3 as $CaCO_3$ following mixing. Refer to Table 2 for compliance levels at differing hardness concentrations.

(5) Values are trigger limits, not compliance limits. In the event that the trigger limits are exceeded, the consent holder shall inform the Waikato Regional Council as soon as practicable and prepare a report, to the satisfaction of the council, to demonstrate that continued discharges at concentrations exceeding the trigger limits will have no more than minor effects on the Ohinemuri River. This report shall be provided to the council within two months of the consent holder becoming aware of the trigger exceedance.

(6) Current analytical procedures for mercury have a practical quantification limit (PQL) of 0.0005

g/m3, and for chromium (VI) have a PQL of 0.05 g/m^3. The reporting limit for mercury and chromium concentrations shall be reviewed annually by the consent holder and shall be adjusted in line with improvements in analytical technology.

(7) Discharge limits for metals are for ‘acid-soluble’ concentration, determined on unfiltered samples.

The maximum allowable concentration (g/m±) for hardness related criteria:

$$= ((1 + Z) \times Y) - X) / Z$$

where: Y = (exp(m($ln\ H$) + b) x C x 10-3

H = (Z x WTP discharge hardness) + 14) / (1 + Z)

Z = 0.15 (Operating regime A); 0.2 (Operating regime B); 0.1 (Operating regime C); 0.4 (Operating regime D)

using the following constants:

Table 2 Calculation of compliance levels for hardness related criteria.

	Normal compliance		**Maximum[(1)]**		**X [(2)]**	**C**
Parameter	**M**	**b**	**m**	**b**		
Copper	0.8545[(3)]	-1.465[(3)]	0.9422	-1.464	0.001	0.85 [(4)] or 1.0
Nickel	N/A	N/A	0.846	1.1645	0.0006	1.0
Zinc	N/A	N/A	0.8473	0.7614	0.0047	1.0
Silver	1.51[(5)]	-9.72 [(5)]	1.72	-6.52	0.00005	45.2 [(6)] or 1.0
Cadmium	N/A	N/A	0.7852	-3.49	0.0001	1.0
Lead	N/A	N/A	1.273	-4.705	0.0002	1.0

Notes:

(1) From USEPA acute criteria (copper and silver) or chronic criteria (nickel, zinc, cadmium and lead) for aquatic biota.
(2) Mean receiving water quality as measured at Site OH3.
(3) From USEPA chronic criteria for aquatic biota.
(4) Constant to convert calculation for copper = 0.85 (compliance value) or = 1.0 (maximum value).
(5) From site specific criteria, calculated using USEPA (1985) methodology.
(6) Constant to convert calculation for silver = 10^3/22.1 (compliance value) or 1 = 1.0 (maximum value).

Table 3 Compliance Criteria For Total Ammonia

	Normal Compliance, (g/m³ as total ammonia)							Maximum, (g/m³ as total ammonia)						
Temperature, (⁰C)	**0**	**6**	**10**	**15**	**20**	**25**	**30**	**0**	**6**	**10**	**15**	**20**	**25**	**30**
pH	**Regime A**													
6.50	**23.00**	**21.46**	**20.70**	**19.17**	**19.17**	**19.17**	**18.40**	**268.31**	**252.98**	**237.65**	**229.98**	**222.31**	**222.31**	**222.31**
6.75	**23.00**	**21.46**	**20.70**	**19.93**	**19.17**	**19.17**	**19.17**	**245.31**	**229.98**	**214.65**	**206.98**	**206.98**	**199.32**	**199.32**
7.00	**23.00**	**21.46**	**20.70**	**19.93**	**19.17**	**19.17**	**19.17**	**214.65**	**199.32**	**191.65**	**183.98**	**176.32**	**176.32**	**176.32**
7.25	**23.00**	**21.46**	**20.70**	**19.93**	**19.17**	**19.17**	**19.17**	**133.39**	**168.65**	**153.32**	**151.02**	**147.19**	**145.65**	**145.65**
7.50	**23.00**	**21.46**	**20.70**	**19.93**	**19.17**	**19.17**	**19.17**	**133.39**	**124.96**	**118.82**	**114.22**	**111.92**	**111.16**	**111.16**
7.75	**21.46**	**19.93**	**19.17**	**18.40**	**17.63**	**17.63**	**18.40**	**93.53**	**87.39**	**83.56**	**80.49**	**78.96**	**78.19**	**78.96**
8.00	**13.95**	**13.03**	**12.42**	**12.04**	**12.65**	**11.88**	**12.19**	**61.33**	**57.50**	**54.43**	**52.90**	**52.13**	**52.13**	**53.66**
8.25	**7.90**	**7.44**	**7.13**	**6.90**	**6.90**	**6.98**	**7.21**	**34.50**	**32.20**	**31.43**	**30.66**	**29.90**	**30.66**	**31.43**
8.50	**4.45**	**4.22**	**4.06**	**4.06**	**4.06**	**4.22**	**4.45**	**19.93**	**18.40**	**17.63**	**17.63**	**17.63**	**18.40**	**19.93**
8.75	**2.61**	**2.45**	**2.38**	**2.38**	**2.45**	**2.68**	**2.91**	**11.27**	**10.73**	**10.50**	**10.58**	**10.89**	**11.65**	**12.65**
9.00	**1.49**	**1.45**	**1.45**	**1.49**	**1.61**	**1.76**	**2.07**	**6.59**	**6.36**	**6.36**	**6.59**	**6.98**	**7.74**	**8.89**
pH	**Regime B**													
6.50	**18.00**	**16.79**	**16.20**	**15.00**	**15.00**	**15.00**	**14.40**	**209.98**	**197.98**	**185.99**	**179.98**	**173.98**	**173.98**	**173.98**
6.75	**18.00**	**16.79**	**16.20**	**15.60**	**15.00**	**15.00**	**15.00**	**191.98**	**179.98**	**167.99**	**161.98**	**161.98**	**155.99**	**155.99**
7.00	**18.00**	**16.79**	**16.20**	**15.60**	**15.00**	**15.00**	**15.00**	**167.99**	**155.99**	**149.99**	**143.98**	**137.99**	**137.99**	**137.99**
7.25	**18.00**	**16.79**	**16.20**	**15.60**	**15.00**	**15.00**	**15.00**	**104.39**	**131.99**	**119.99**	**118.19**	**115.19**	**113.99**	**113.99**
7.50	**18.00**	**16.79**	**16.20**	**15.60**	**15.00**	**15.00**	**15.00**	**104.39**	**97.79**	**92.99**	**89.39**	**87.59**	**86.99**	**86.99**
7.75	**16.79**	**15.60**	**15.00**	**14.40**	**13.80**	**13.80**	**14.40**	**73.20**	**68.39**	**65.39**	**62.99**	**61.79**	**61.19**	**61.79**
8.00	**10.92**	**10.20**	**9.72**	**9.42**	**9.90**	**9.30**	**9.54**	**48.00**	**45.00**	**42.60**	**41.40**	**40.80**	**40.80**	**41.99**
8.25	**6.18**	**5.82**	**5.58**	**5.40**	**5.40**	**5.46**	**5.64**	**27.00**	**25.20**	**24.60**	**23.99**	**23.40**	**23.99**	**24.60**
8.50	**3.48**	**3.30**	**3.18**	**3.18**	**3.18**	**3.30**	**3.48**	**15.60**	**14.40**	**13.80**	**13.80**	**13.80**	**14.40**	**15.60**
8.75	**2.04**	**1.92**	**1.86**	**1.86**	**1.92**	**2.10**	**2.28**	**8.82**	**8.40**	**8.22**	**8.28**	**8.52**	**9.12**	**9.90**
9.00	**1.17**	**1.13**	**1.13**	**1.17**	**1.26**	**1.38**	**1.62**	**5.16**	**4.98**	**4.98**	**5.16**	**5.46**	**6.06**	**6.96**

Table 3 (Cont.) Compliance Criteria For Total Ammonia

	Normal Compliance, (g/m³ as total ammonia)							Maximum, (g/m³ as total ammonia)						
Temperature, (⁰C)	**0**	**6**	**10**	**15**	**20**	**25**	**30**	**0**	**6**	**10**	**15**	**20**	**25**	**30**
pH	**Regime C**													
6.50	**33.00**	**30.79**	**29.70**	**27.50**	**27.50**	**27.50**	**26.40**	**384.97**	**362.97**	**340.98**	**329.97**	**318.97**	**318.97**	**318.97**
6.75	**33.00**	**30.79**	**29.70**	**28.60**	**27.50**	**27.50**	**27.50**	**351.97**	**329.97**	**307.98**	**296.97**	**296.97**	**285.98**	**285.98**
7.00	**33.00**	**30.79**	**29.70**	**28.60**	**27.50**	**27.50**	**27.50**	**307.98**	**285.98**	**274.98**	**263.97**	**252.98**	**252.98**	**252.98**
7.25	**33.00**	**30.79**	**29.70**	**28.60**	**27.50**	**27.50**	**27.50**	**191.39**	**241.98**	**219.98**	**216.68**	**211.19**	**208.98**	**208.98**
7.50	**33.00**	**30.79**	**29.70**	**28.60**	**27.50**	**27.50**	**27.50**	**191.39**	**179.29**	**170.48**	**163.88**	**160.58**	**159.49**	**159.49**
7.75	**30.79**	**28.60**	**27.50**	**26.40**	**25.30**	**25.30**	**26.40**	**134.20**	**125.39**	**119.89**	**115.49**	**113.29**	**112.19**	**113.29**
8.00	**20.02**	**18.70**	**17.82**	**17.27**	**18.15**	**17.05**	**17.49**	**88.00**	**82.50**	**78.10**	**75.90**	**74.80**	**74.80**	**76.99**
8.25	**11.33**	**10.67**	**10.23**	**9.90**	**9.90**	**10.01**	**10.34**	**49.50**	**46.20**	**45.10**	**43.99**	**42.90**	**43.99**	**45.10**
8.50	**6.38**	**6.05**	**5.83**	**5.83**	**5.83**	**6.05**	**6.38**	**28.60**	**26.40**	**25.30**	**25.30**	**25.30**	**26.40**	**28.60**
8.75	**3.74**	**3.52**	**3.41**	**3.41**	**3.52**	**3.85**	**4.18**	**16.17**	**15.40**	**15.07**	**15.18**	**15.62**	**16.72**	**18.15**
9.00	**2.14**	**2.08**	**2.08**	**2.14**	**2.31**	**2.53**	**2.97**	**9.46**	**9.13**	**9.13**	**9.46**	**10.01**	**11.11**	**12.76**
pH	**Regime D**													
6.50	**10.50**	**9.80**	**9.45**	**8.75**	**8.75**	**8.75**	**8.40**	**122.49**	**115.49**	**108.49**	**104.99**	**101.49**	**101.49**	**101.49**
6.75	**10.50**	**9.80**	**9.45**	**9.10**	**8.75**	**8.75**	**8.75**	**111.99**	**104.99**	**97.99**	**94.49**	**94.49**	**90.99**	**90.99**
7.00	**10.50**	**9.80**	**9.45**	**9.10**	**8.75**	**8.75**	**8.75**	**97.99**	**90.99**	**87.49**	**83.99**	**80.49**	**80.49**	**80.49**
7.25	**10.50**	**9.80**	**9.45**	**9.10**	**8.75**	**8.75**	**8.75**	**60.90**	**76.99**	**69.99**	**68.94**	**67.20**	**66.49**	**66.49**
7.50	**10.50**	**9.80**	**9.45**	**9.10**	**8.75**	**8.75**	**8.75**	**60.90**	**57.05**	**54.24**	**52.14**	**51.09**	**50.75**	**50.75**
7.75	**9.80**	**9.10**	**8.75**	**8.40**	**8.05**	**8.05**	**8.40**	**42.70**	**39.90**	**38.15**	**36.75**	**36.05**	**35.70**	**36.05**
8.00	**6.37**	**5.95**	**5.67**	**5.50**	**5.78**	**5.42**	**5.57**	**28.00**	**26.25**	**24.85**	**24.15**	**23.80**	**23.80**	**24.50**
8.25	**3.61**	**3.40**	**3.26**	**3.15**	**3.15**	**3.19**	**3.29**	**15.75**	**14.70**	**14.35**	**14.00**	**13.65**	**14.00**	**14.35**
8.50	**2.03**	**1.93**	**1.85**	**1.85**	**1.85**	**1.93**	**2.03**	**9.10**	**8.40**	**8.05**	**8.05**	**8.05**	**8.40**	**9.10**
8.75	**1.19**	**1.12**	**1.09**	**1.09**	**1.12**	**1.22**	**1.33**	**5.15**	**4.90**	**4.79**	**4.83**	**4.97**	**5.32**	**5.78**
9.00	**0.68**	**0.66**	**0.66**	**0.68**	**0.74**	**0.80**	**0.95**	**3.01**	**2.90**	**2.90**	**3.01**	**3.19**	**3.53**	**4.06**

Table 4 WTP Discharge Monitoring

Frequency	**Site**	**Parameters**
Continuously	WTP Discharge Frendrups Torrens (Ruddocks)	Flow (at both discharge sites), turbidity, conductivity, pH temperature Flow, temperature
Daily	WTP Discharge	Cyanide, copper, iron, manganese, suspended solids, ammonia, silver
Weekly	WTP discharge Ohinemuri River (at location OH5 for discharges at point E1, and location OH6 for discharges at point E2)	Selenium, Antimony (28/06/07)
Monthly	WTP Discharge	Parameters listed in condition 14, Table 1.
Annual	WTP Discharge	Cobalt

Note: The WTP discharge monitoring programme for metals are for 'acid-soluble' concentrates determined on unfiltered samples. Monitoring of selenium and antimony in the Ohinemuri River shall be based on the soluble test method, defined as the concentration of dissolved metal measured in that fraction which passes through a 0.45 µm filter

17. Unless otherwise agreed by Waikato Regional Council in writing the results of the interim monitoring shall be reported to Council within two months of spring sampling. A full report detailing the results of all monitoring specified in condition 16, Table 6 shall be submitted to Waikato Regional Council by 30 July each year following the autumn sampling. This report shall include a comparison of the sediment data with the National Oceanic and Atmospheric Administration and Ontario Ministry of Environment sediment quality guidelines.

    Should a more appropriate set of standards or guidelines be developed, then those could be substituted as the comparison guidelines by mutual agreement between Waikato Regional Council and the consent holder.

18. At any time following the completion of two seasonal monitoring events (e.g. spring to spring), if a significant difference is deemed to have occurred between sites on both occasions then the consent holder shall undertake immediate further monitoring. Should a significant difference be recorded during this contingency monitoring the consent holder shall inform Council and shall determine any mitigation measures that need to be implemented to ensure that significant effects are remedied or mitigated. 'Significant' is defined as follows:

    - a significant difference in macroinvertebrate biota will be deemed to have occurred following a statistically significant change at test sites B and DPD of 30% above the natural variation recorded at the control sites A and UPD;

    - a significant difference in total macroinvertebrate abundance will be deemed to have occurred following a statistically significant change at test sites B and DPD of 50% above the natural variation recorded at the control sites A and UPD.

22 All biological monitoring sampling and analysis shall have regard to :

(i) consistent quantitative estimates of the aquatic biota
(ii) consistent laboratory and sorting/counting protocols
(iii) consistent taxonomic resolution of aquatic biota

and shall be undertaken to the satisfaction of the Council.

23 All water quality and sediment sampling and analysis shall be undertaken using Standard Methods for the Examination of Water and Wastewater (19th Edition 1995, or updates), APHA, AWWA and WEF, unless otherwise agreed in writing by Waikato Regional Council. All other measuring, testing, recording and analytical methods as may be required from time to time pursuant to the requirements of this consent shall be to the satisfaction of Council.

Table 5 Biological, Sediment and River Water Quality Monitoring

Aquatic biota	Frequency	Sites	Methods	Parameters
Fish	Late summer (Feb-Mar)	OC2, OH5, RU1, OH1, OH6, a site on Mataura, (M1) Ratarua (R1) and Waitete (W1) Streams	Electric fishing	Species numbers Species abundance Fish lengths
Macro-Invertebrates	Spring (Oct-Dec) Autumn (Mar-May)	OH3, OH5 RU1, OH1, OH6	Surber sampling	Taxa richness Total abundance Key taxa abundance
Periphyton	Spring (Oct-Dec) Autumn (Mar-May)	OH3, OH5 RU1, OH1, OH6	Rock scrape sampling	Chl*a*, AFDW, taxa richness
Water Quality	Spring (Oct-Dec) Autumn (Mar-May)	OH3, OH5 RU1, OH1, OH6	Spot Sampling	All parameters listed in condition 14, Table 1, and NO_3
Sediment	Spring (Oct- Dec) Autumn (Mar- May)	OH3, OH5 RU1, OH1, OH6	Sediment Coring	Metals listed in condition 14, Table 1
Fish (bullys)	Once during summer (January to March)	OC2, OH6	Analysed in accordance with appropriate USEPA procedures as agreed with Waikato Regional Council	Composite whole body selenium concentration (dry weight)
Periphyton and macrophyte	Autumn (Mar-May)	OC2, OH6	Analysed in accordance with appropriate USEPA procedures as agreed with Waikato Regional Council	Total Selenium (both wet weight and dry weight)

Note: The results of sampling undertaken to determine selenium concentration in fish, periphyton, macrophyte and macroinvertebrate shall be submitted to the Waikato Regional Council within one month of the sampling event.

Receiving Water (Consent 97318)

Condition 6 of Discharge Permit 97318 requires OGNZL to establish and maintain river gauging facilities, for the purpose of determining the river flow at the points of discharge, while Condition 16 of this consent specifies the collection of water samples from sites within the Ohinemuri River and Ruahorehore Stream in spring and autumn each year. These samples are to be analysed for nitrate and for the parameters listed in Table 1. In addition, OGNZL is required to monitor the temperature of the Ohinemuri River (Frendrups) and Ruahorehore Stream (Torrens) continuously, while selenium and antimony concentrations are to be assessed at Sites OH5 and OH6 on a weekly basis.

The results of all analyses are to be reported to the Waikato Regional Council as specified in Condition 17 of this consent. Discharge Permits 971303, 971304, 971305, 971306, 971311, 971312, 971315 and 971323 provide receiving water quality standards; these criteria are summarised in Table 6.

Table 6 Receiving Water Quality Standards

Parameter	Receiving Water Concentration (2)	
(g/m^3 unless otherwise stated)	**Hardness 20 g/m^3 $CaCO_3$**	**Hardness 100 g/m^3 $CaCO_3$**
Temperature	less than 3°C increase	less than 3°C increase
pH	6.5 to 9.0	6.5 to 9.0
Suspended Solids	For upstream concentrations of less than or equal to 100g/m^3 the increase shall be no greater than 10g/m^3. For upstream concentrations of greater than 100g/m^3 the increase shall be no greater than 10%	For upstream concentrations of less than or equal to 100g/m^3 the increase shall be no greater than 10g/m^3. For upstream concentrations of greater than 100g/m^3 the increase shall be no greater than 10%
Cyanide (CN_{WAD})(1)	0.093	0.093
Iron	1.0	1.0
Manganese	2.0	2.0
Copper	0.003	0.011
Nickel	0.040	0.160
Zinc	0.027	0.100
Silver[1]	0.00025	0.00284 09/04/10
Total Ammonia	Refer Table 2	Refer Table 2
Antimony	0.030	0.030
Arsenic	0.190	0.190
Selenium	~~0.005~~ Refer Note (4)	~~0.005~~ Refer Note (4)
Mercury	0.000012	0.000012
Cadmium	0.0003	0.001
Chromium (VI)	0.010	0.010
Lead	0.0004	0.0025

Table 6 Notes:

(1) Monitoring of metals/metalloids shall be based on the soluble test method, defined as the concentration of dissolved metals/metalloids measured in that fraction which passes through a 0.45 µm filter except for mercury (Hg), which shall be based on acid soluble concentrations determined on unfiltered samples.

(2) In the event of silt pond discharges authorised by RC 971311, either separately or in combination with other discharges: TSS shall increase by no more than 10 % compared with upstream concentrations for rainfall events greater than the design storm. In the event of collection pond discharges authorised by RC 971312, and tailings pond discharges authorised by RC 971323: for upstream concentrations of less than or equal to 100 g/m^3 the increase in TSS downstream shall be no greater than 10 g/m^3. For upstream concentrations of greater than 100 g/m^3 the increase shall be no greater than 10%.

(3) The temperature increase resulting from the tailings pond discharges authorised by RC 971323, in combination with all other discharges authorised for this site, shall be less than 3 °C.

(4) Site specific derived criteria using USEPA (1985) methodology.

(5) Current analytical procedures for mercury have a practical quantification limit (PQL) of 0.0005 ppm. This PQL is acceptable for the purposes of reporting mercury concentrations.

The reporting 'limit' for mercury concentrations shall be reviewed annually by the consent holder and shall be adjusted in line with improvements in analytical technology.

(6) The selenium concentration in the receiving water shall remain below the trigger limits of 0.02 g/m^3 97 % of the time on an annual basis, and 0.035 g/m^3 in any single analysis, based on monitoring undertaken pursuant to Condition 16 of consent 971318. In the event that these limits are exceeded, the consent holder shall inform the Waikato Regional Council as soon as practicable and prepare a report, to the satisfaction of the Council, to demonstrate that continued discharges at concentrations exceeding the trigger limits will have no more than minor effects on the Ohinemuri River. This report shall be provided to the Council within two months of the consent holder becoming aware of the trigger exceedance.

Table 7 Total ammonia criteria for receiving waters

Chronic Criterion - g/m³ as Ammonia							
Temp °C / pH	**0**	**5**	**10**	**15**	**20**	**25**	**30**
6.50	3.0	2.8	2.7	2.5	2.5	2.5	2.4
6.75	3.0	2.8	2.7	2.6	2.5	2.5	2.5
7.00	3.0	2.8	2.7	2.6	2.5	2.5	2.5
7.25	3.0	2.8	2.7	2.6	2.5	2.5	2.5
7.50	3.0	2.8	2.7	2.6	2.5	2.5	2.5
7.75	2.8	2.6	2.5	2.4	2.3	2.3	2.4
8.00	1.82	1.70	1.62	1.57	1.55	1.55	1.59
8.25	1.03	0.97	0.93	0.90	0.90	0.91	0.94
8.50	0.58	0.55	0.53	0.53	0.53	0.55	0.58
8.75	0.34	0.32	0.31	0.31	0.32	0.35	0.38
9.00	0.195	0.189	0.189	0.195	0.21	0.23	0.27

Note: To convert these values to mg/l as nitrogen, multiply by 0.822

APPENDIX B: Treated Water Volume and River Flow Data

Table B1 Discharge volumes and river flows between 1 May 2020 and 31 March 2021.

Date	Regime	E1 (m³/d)	E2 (m³/d)	TSF2	Ohinemuri Flows (m³/d)		Collection Pond Discharges (m³/d)		
					Frendrups	Ruddocks	S3	S4	S5
1-May-20	4	2,216	2,450	0	16692	3171	0	0	0
2-May-20	4	2,200	1,570	0	16205	3200	0	0	0
3-May-20	4	2,228	2,448	0	20110	3513	0	0	0
4-May-20	4	2,192	2,020	0	35495	4796	0	0	0
5-May-20	4	2,172	1,638	0	21888	3823	0	0	0
6-May-20	4	2,176	1,506	0	19469	3566	0	0	0
7-May-20	4	2,152	1,426	0	17672	3439	0	0	0
8-May-20	4	2,164	1,484	0	17068	3318	0	0	0
9-May-20	4	2,176	1,350	0	17257	3297	0	0	0
10-May-20	4	2,188	1,540	0	16829	3375	0	0	0
11-May-20	4	2,188	1,414	0	17082	3416	0	0	0
12-May-20	4	2,188	1,564	0	17290	3501	0	0	0
13-May-20	4	2,168	2,026	0	19393	3540	0	0	0
14-May-20	4	2,176	1,272	0	20049	3382	0	0	0
15-May-20	4	2,200	1,516	0	17527	3340	0	0	0
16-May-20	4	2,220	1,420	0	18492	3361	0	0	0
17-May-20	4	2,202	1,348	0	17348	3358	0	0	0
18-May-20	4	2,202	1,386	0	16711	3295	0	0	0
19-May-20	4	864	514	0	16331	3310	0	0	0
20-May-20	4	0	0	0	16239	3299	0	0	0
21-May-20	4	708	1,208	0	16342	3314	0	0	0
22-May-20	4	1,956	1,648	0	15589	3334	0	0	0
23-May-20	4	1,944	2,408	0	16120	3363	0	0	0
24-May-20	4	1,932	3,740	0	16401	3543	0	0	0
25-May-20	4	1,900	4,324	0	28227	4522	2	0	0
26-May-20	4	1,916	3,636	0	24887	4060	0	0	0
27-May-20	4	1,916	4,036	0	26989	4466	0	0	0
28-May-20	4	1,928	4,300	0	22105	3924	0	0	0
29-May-20	4	2,516	5,256	0	19274	3672	0	0	0
30-May-20	4	8,468	3,708	0	67871	6324	248	0	0
31-May-20	4	14,168	4,640	0	122399	12488	1041	11	0
1-Jun-20	4	16,008	6,586	0	759867	137365	3041	3712	1366
2-Jun-20	4	14,856	7,110	0	405244	94436	5334	2596	1593
3-Jun-20	4	16,968	7,156	0	188358	29636	299	2542	0
4-Jun-20	4	17,744	7,136	0	160127	32351	0	3360	0
5-Jun-20	4	16,052	7,016	0	116119	23811	0	2641	0
6-Jun-20	4	13,616	4,952	0	91176	20239	1068	871	131
7-Jun-20	4	3,240	0	0	73024	16708	1000	0	309
8-Jun-20	4	0	0	0	62989	14127	0	0	1077
9-Jun-20	4	0	0	0	54925	12516	0	0	1080
10-Jun-20	4	0	0	0	48566	11953	0	0	1080
11-Jun-20	4	8	0	0	44477	9027	3	0	245
12-Jun-20	4	6,728	0	0	42193	7562	0	0	0
13-Jun-20	4	12,960	88	0	39309	6931	0	0	0
14-Jun-20	4	13,208	0	0	37039	6720	0	0	0
15-Jun-20	4	13,200	0	0	35702	6353	0	0	0
16-Jun-20	4	12,740	440	0	34666	6001	0	0	0
17-Jun-20	4	12,172	0	0	33723	5721	0	0	0
18-Jun-20	4	11,788	96	0	40540	6586	18	0	140

Date	Regime	E1 (m³/d)	E2 (m³/d)	TSF2	Ohinemuri Flows (m³/d)		Collection Pond Discharges (m³/d)		
					Frendrups	Ruddocks	S3	S4	S5
19-Jun-20	4	15,004	1,332	0	72832	12544	0	0	1330
20-Jun-20	4	14,796	1,626	0	186449	74139	102	206	723
21-Jun-20	4	15,212	4,750	0	186449	74139	589	1593	3330
22-Jun-20	4	15,012	1,968	0	186449	74139	1204	660	1379
23-Jun-20	4	11,632	0	0	186449	74139	307	0	0
24-Jun-20	4	11,780	106	0	186449	74139	284	0	0
25-Jun-20	4	18,136	6,746	0	186449	74139	4087	7128	6165
26-Jun-20	4	17,588	5,400	0	186449	74139	7559	7526	7560
27-Jun-20	4	14,492	2,782	0	186449	74139	6809	5037	6766
28-Jun-20	4	11,204	206	0	186449	74139	7285	2757	7560
29-Jun-20	4	11,408	0	0	186449	74139	6528	496	2121
30-Jun-20	4	13,884	0	0	186449	74139	7546	172	585
1-Jul-20	4	13,112	264	0	300067	135734	2622	399	334
2-Jul-20	4	12,564	0	0	244080	96595	125	1	0
3-Jul-20	4	12,164	142	0	200275	77501	0	62	165
4-Jul-20	4	12,336	72	0	171850	68688	109	150	0
5-Jul-20	4	12,320	704	0	160099	66442	326	0	0
6-Jul-20	4	16,340	2,458	0	291168	155434	4547	3828	5622
7-Jul-20	4	15,748	2,470	0	301190	174787	6061	1894	2578
8-Jul-20	4	14,408	72	0	300413	170035	2455	549	303
9-Jul-20	4	11,372	0	0	259546	130723	432	0	448
10-Jul-20	4	11,928	0	0	217987	100397	0	0	0
11-Jul-20	4	12,284	0	0	191635	87523	49	0	0
12-Jul-20	4	12,504	0	0	170035	79488	690	968	0
13-Jul-20	4	12,500	0	0	151459	69466	0	0	0
14-Jul-20	4	10,576	0	0	135475	63245	0	0	420
15-Jul-20	4	12,264	666	0	156125	78970	525	1361	1635
16-Jul-20	4	18,184	7,076	0	1231373	604800	7015	7197	7460
17-Jul-20	4	18,748	5,540	0	1552608	666835	7472	7559	7561
18-Jul-20	4	17,200	2,588	0	865555	440122	7360	6937	7558
19-Jul-20	4	15,972	1,112	0	582941	324864	6935	753	7394
20-Jul-20	4	14,900	2,708	0	542419	299894	7496	2606	5048
21-Jul-20	4	16,116	1,784	0	633053	304992	7755	1639	1852
22-Jul-20	4	16,192	916	0	531792	270000	7365	1433	1715
23-Jul-20	4	13,944	0	2153	432259	214790	5747	203	201
24-Jul-20	4	12,256	0	4730	358733	159322	230	0	0
25-Jul-20	4	12,360	0	4563	298080	127008	543	639	0
26-Jul-20	4	12,544	0	4718	258941	106963	0	0	0
27-Jul-20	4	12,584	0	4694	227318	93053	0	0	0
28-Jul-20	4	12,388	0	4585	202262	82166	0	0	0
29-Jul-20	4	12,340	0	4770	178157	73526	366	0	804
30-Jul-20	4	12,168	0	3038	161136	64886	0	0	0
31-Jul-20	4	12,204	206	0	146534	60480	305	43	0
1-Aug-20	4	11,948	0	0	137738	49959	0	341	129
2-Aug-20	4	11,976	0	0	129810	49767	200	0	0
3-Aug-20	4	11,908	0	0	128326	47303	0	0	0
4-Aug-20	4	11,912	0	74	122515	44485	0	0	0
5-Aug-20	4	11,848	0	29	107558	40645	109	0	0
6-Aug-20	4	11,812	0	0	97531	38860	576	0	0
7-Aug-20	4	14,404	184	0	188024	62948	1277	868	1377
8-Aug-20	4	14,472	0	0	164034	69372	3151	1107	2390

Date	Regime	E1 (m^3/d)	E2 (m^3/d)	TSF2	Ohinemuri Flows (m^3/d)		Collection Pond Discharges (m^3/d)		
					Frendrups	Ruddocks	S3	S4	S5
9-Aug-20	4	12,752	0	13	145214	54815	307	0	396
10-Aug-20	4	12,120	0	0	133509	51444	0	972	0
11-Aug-20	4	12,948	1,282	0	171300	81282	2243	2256	1139
12-Aug-20	4	11,936	0	0	192634	97045	2780	333	2973
13-Aug-20	4	8,004	0	0	174240	81553	0	0	0
14-Aug-20	4	7,864	0	0	158559	74030	0	0	0
15-Aug-20	4	13,256	0	0	141759	64595	0	0	0
16-Aug-20	4	13,264	140	0	128403	60494	0	0	0
17-Aug-20	4	13,220	0	0	119377	58657	1265	981	0
18-Aug-20	4	9,172	0	0	112571	53369	0	0	0
19-Aug-20	4	15,548	3,624	0	372059	218861	2901	3987	3819
20-Aug-20	4	17,244	3,488	0	393739	269954	7519	3414	7461
21-Aug-20	2	14,904	88	0	314755	199335	4595	0	262
22-Aug-20	2	13,044	0	0	255005	144357	961	918	401
23-Aug-20	2	13,840	550	0	264896	157516	1146	1534	2168
24-Aug-20	2	14,528	500	1445	305755	214262	5978	1966	2145
25-Aug-20	2	14,744	0	4763	343133	192641	2148	736	1613
26-Aug-20	2	11,432	0	4755	333046	163554	653	655	0
27-Aug-20	2	11,296	0	4811	297460	143383	0	0	0
28-Aug-20	2	11,820	142	1743	256350	132381	820	688	802
29-Aug-20	2	12,136	0	0	221390	99367	0	0	0
30-Aug-20	2	9,860	0	0	200138	81299	0	0	0
31-Aug-20	2	8,992	0	0	182611	73780	0	0	0
1-Sep-20	2	9,084	0	0	178305	72671	0	0	0
2-Sep-20	2	9,736	0	0	161417	67694	0	0	0
3-Sep-20	2	9,020	0	0	142462	60036	0	0	0
4-Sep-20	2	8,420	0	0	126123	52392	0	0	0
5-Sep-20	2	10,516	0	0	115383	48967	0	0	0
6-Sep-20	2	9,624	0	0	108078	45995	0	0	0
7-Sep-20	2	9,000	0	0	106648	45167	0	0	0
8-Sep-20	2	7,568	0	0	93227	41029	0	0	0
9-Sep-20	2	9,024	0	0	86178	36174	0	0	0
10-Sep-20	4	9,040	0	0	83754	35008	29	0	0
11-Sep-20	4	9,056	0	0	83063	33567	75	0	0
12-Sep-20	4	8,752	0	0	73949	30361	0	0	0
13-Sep-20	4	8,280	0	0	69313	28789	0	0	0
14-Sep-20	4	7,376	0	0	67139	26813	0	0	0
15-Sep-20	4	6,804	0	0	65044	26205	0	0	0
16-Sep-20	4	7,548	0	0	64226	26653	0	0	0
17-Sep-20	4	6,676	0	0	63078	27182	0	0	0
18-Sep-20	4	8,944	0	0	61930	27715	0	0	0
19-Sep-20	4	8,152	0	0	60783	28332	0	0	0
20-Sep-20	4	9,688	0	0	59635	29029	0	0	0
21-Sep-20	4	9,912	0	0	58555	29726	0	0	0
22-Sep-20	4	11,120	0	0	57552	30423	0	0	0
23-Sep-20	4	10,920	0	0	56560	31120	0	0	0
24-Sep-20	4	10,968	0	0	55568	31817	0	0	0
25-Sep-20	4	8,492	0	0	54576	32515	0	0	0
26-Sep-20	4	8,232	0	0	53584	33212	0	0	0
27-Sep-20	4	8,596	0	0	52592	33909	0	0	0
28-Sep-20	4	7,840	0	0	51600	34606	0	0	0

Date	Regime	E1 (m³/d)	E2 (m³/d)	TSF2	Ohinemuri Flows (m³/d)		Collection Pond Discharges (m³/d)		
					Frendrups	Ruddocks	S3	S4	S5
29-Sep-20	4	8,964	0	1	50608	32480	0	0	0
30-Sep-20	4	8,512	0	0	47698	23533	0	0	0
1-Oct-20	4	8,860	0	0	45999	23401	0	813	0
2-Oct-20	4	11,572	0	0	43057	21929	0	0	0
3-Oct-20	4	12,212	0	0	41306	21273	0	0	0
4-Oct-20	4	9,600	0	0	39581	20615	67	315	0
5-Oct-20	4	8,236	0	0	37854	19958	0	0	0
6-Oct-20	4	6,196	0	0	35866	19202	0	0	588
7-Oct-20	4	3,436	12	0	33656	18285	0	0	81
8-Oct-20	4	5,596	0	0	33034	17827	0	0	0
9-Oct-20	4	5,224	0	0	33871	17842	0	0	0
10-Oct-20	4	5,752	0	0	30062	16745	0	0	0
11-Oct-20	4	5,168	0	0	29151	16172	0	0	0
12-Oct-20	4	5,296	0	0	33084	16474	0	0	0
13-Oct-20	4	6,012	0	0	44363	19225	0	0	0
14-Oct-20	4	5,980	0	0	46178	19948	0	0	0
15-Oct-20	4	5,748	0	0	34303	17582	0	0	0
16-Oct-20	4	9,652	10	0	34534	17014	0	0	4
17-Oct-20	4	9,516	0	0	31405	16363	0	0	0
18-Oct-20	4	10,244	0	0	29880	15943	0	0	0
19-Oct-20	4	10,188	0	0	29297	15907	0	0	0
20-Oct-20	4	9,644	0	0	28272	15879	0	0	0
21-Oct-20	4	10,188	0	0	29562	16444	0	0	0
22-Oct-20	4	9,812	0	0	28221	16108	0	0	0
23-Oct-20	4	9,612	0	0	26322	14950	0	0	0
24-Oct-20	4	9,604	0	0	25607	14652	0	0	0
25-Oct-20	4	9,632	0	0	25163	14649	0	0	0
26-Oct-20	4	9,728	0	0	24780	14428	0	0	0
27-Oct-20	4	9,480	0	0	24462	13938	0	0	0
28-Oct-20	4	9,584	0	0	23560	13376	0	0	0
29-Oct-20	4	8,840	0	0	24682	12982	0	0	0
30-Oct-20	4	9,816	0	0	25053	13608	0	0	0
31-Oct-20	4	9,388	0	0	25955	13940	3	0	0
1-Nov-20	4	7,776	0	0	24974	13438	0	0	0
2-Nov-20	4	6,104	0	0	22156	12964	0	0	0
3-Nov-20	4	9,056	0	0	23761	13150	0	0	0
4-Nov-20	4	9,020	0	0	25714	12629	0	0	0
5-Nov-20	4	10,808	702	0	147571	59889	33	315	899
6-Nov-20	4	11,692	1,146	0	159586	58015	2222	0	279
7-Nov-20	4	14,300	2,574	0	80125	32248	2942	184	0
8-Nov-20	4	16,292	7,364	0	125478	43420	4081	0	0
9-Nov-20	4	14,960	7,364	0	157842	58412	5233	0	68
10-Nov-20	4	15,644	7,362	0	236345	129314	6054	1703	2843
11-Nov-20	4	13,804	3,498	0	307618	265615	6424	2056	7560
12-Nov-20	4	13,228	2,308	1	217473	149483	1095	0	4228
13-Nov-20	4	12,128	2,156	0	164650	88811	0	0	0
14-Nov-20	4	10,416	68	0	134492	72284	0	0	0
15-Nov-20	4	7,624	2,032	0	114257	67094	0	0	0
16-Nov-20	4	8,748	516	0	100340	62868	0	0	0
17-Nov-20	4	9,004	184	1	88639	58168	0	0	0
18-Nov-20	4	9,144	284	1	79405	44048	0	0	0

Date	Regime	E1 (m³/d)	E2 (m³/d)	TSF2	Ohinemuri Flows (m³/d)		Collection Pond Discharges (m³/d)		
					Frendrups	Ruddocks	S3	S4	S5
19-Nov-20	4	8,844	0	0	70854	35082	0	0	0
20-Nov-20	4	9,012	0	0	61879	31112	0	0	0
21-Nov-20	4	9,760	0	1	56667	28708	0	0	0
22-Nov-20	4	9,508	0	0	56055	26871	0	0	0
23-Nov-20	4	9,552	0	0	51104	24935	0	0	1
24-Nov-20	4	9,612	0	0	55068	26919	316	158	0
25-Nov-20	4	14,456	800	0	141928	64707	2723	875	0
26-Nov-20	4	12,384	300	0	78200	34471	0	0	0
27-Nov-20	4	11,044	512	1	67352	30107	0	0	8
28-Nov-20	4	7,120	0	1	55801	27322	0	0	0
29-Nov-20	4	9,724	134	0	53579	26639	0	0	0
30-Nov-20	4	13,056	898	0	53476	26461	0	0	0
1-Dec-20	4	11,776	406	0	71991	29218	0	0	0
2-Dec-20	4	16,440	2,488	42	56378	24403	0	0	0
3-Dec-20	4	15,492	2,494	0	52202	23752	0	0	0
4-Dec-20	4	12,456	72	0	47757	23059	0	0	0
5-Dec-20	4	11,624	72	0	44515	22415	0	0	0
6-Dec-20	4	10,476	0	0	43724	21919	0	0	0
7-Dec-20	4	10,364	0	0	41061	20463	0	0	0
8-Dec-20	4	10,900	0	0	39798	20284	0	0	0
9-Dec-20	4	11,460	0	0	38888	19973	0	0	0
10-Dec-20	4	12,272	0	0	53535	22659	0	0	0
11-Dec-20	4	10,368	0	0	39953	20335	0	0	0
12-Dec-20	4	11,124	0	1	36390	17885	0	0	0
13-Dec-20	4	11,760	0	0	34467	16157	0	0	0
14-Dec-20	4	11,732	0	0	33715	16613	0	0	0
15-Dec-20	4	10,160	0	0	32581	15738	0	0	0
16-Dec-20	4	5,268	86	0	31448	14207	0	0	0
17-Dec-20	4	6,908	0	1	31119	14268	0	0	0
18-Dec-20	4	8,160	0	0	30132	14937	0	0	0
19-Dec-20	4	9,064	0	0	30680	15479	0	0	0
20-Dec-20	4	7,192	0	0	30496	15877	0	0	0
21-Dec-20	4	6,992	0	0	28998	12485	0	0	0
22-Dec-20	4	7,436	0	0	29320	10388	0	0	0
23-Dec-20	4	7,884	0	0	30122	10466	0	0	0
24-Dec-20	4	7,788	0	0	33860	11755	0	0	0
25-Dec-20	4	10,624	0	0	30702	10900	0	0	0
26-Dec-20	4	10,408	0	0	27478	9819	0	0	0
27-Dec-20	4	8,608	436	0	32089	11434	0	0	0
28-Dec-20	4	11,160	0	0	35243	13801	0	0	0
29-Dec-20	4	10,580	0	0	27466	11669	0	0	0
30-Dec-20	4	10,368	124	0	26461	10898	0	0	0
31-Dec-20	4	10,000	318	5	24595	10533	0	0	0
1-Jan-21	4	10,060	214	28	24050	10257	0	0	0
2-Jan-21	4	10,344	0	0	30106	10733	0	0	0
3-Jan-21	4	11,696	0	0	58752	14400	0	0	0
4-Jan-21	4	11,640	0	1	33113	14816	0	0	0
5-Jan-21	4	10,588	444	4	29946	12327	0	0	0
6-Jan-21	4	11,000	1,112	0	26521	9068	0	0	0
7-Jan-21	4	10,184	2,124	0	25768	8798	0	0	0
8-Jan-21	4	11,424	1,412	0	35179	10767	0	0	0

Date	Regime	E1 (m^3/d)	E2 (m^3/d)	TSF2	Ohinemuri Flows (m^3/d)		Collection Pond Discharges (m^3/d)		
					Frendrups	Ruddocks	S3	S4	S5
9-Jan-21	4	12,100	752	0	29453	12116	0	0	0
10-Jan-21	4	8,944	3,404	0	26509	9887	0	0	0
11-Jan-21	4	8,036	2,214	0	27710	9040	0	0	0
12-Jan-21	4	8,152	2,382	0	25795	8497	0	0	0
13-Jan-21	4	8,552	3,738	0	24160	7542	0	0	0
14-Jan-21	4	8,488	3,882	0	23689	7554	0	0	0
15-Jan-21	4	8,076	4,026	0	23083	7448	0	0	0
16-Jan-21	4	7,980	4,068	0	21587	7266	0	0	0
17-Jan-21	4	8,084	4,174	0	20958	7146	0	0	0
18-Jan-21	4	8,236	3,418	0	20586	7054	0	0	0
19-Jan-21	4	8,300	3,828	0	21630	7937	0	0	0
20-Jan-21	4	8,904	4,092	0	30681	9771	0	0	7
21-Jan-21	4	8,712	3,548	0	22847	9317	0	0	0
22-Jan-21	4	8,908	3,120	0	21782	8812	0	0	0
23-Jan-21	4	8,892	3,172	0	20339	8480	0	0	0
24-Jan-21	4	8,752	3,350	0	19975	8123	0	0	0
25-Jan-21	4	8,256	2,870	0	19397	8096	0	0	0
26-Jan-21	4	5,248	1,798	0	18577	7558	0	0	0
27-Jan-21	4	5,616	1,194	0	18206	7445	0	0	0
28-Jan-21	4	8,672	2,882	0	19297	7176	0	0	0
29-Jan-21	4	8,340	2,634	0	17874	6846	0	0	0
30-Jan-21	4	7,040	2,402	0	16259	6512	0	0	0
31-Jan-21	4	7,768	2,190	0	16482	5998	0	0	0
1-Feb-21	4	7,712	2,088	0	15899	5819	0	0	0
2-Feb-21	4	7,652	1,758	0	15959	5442	0	0	0
3-Feb-21	4	7,648	2,156	0	16360	4728	0	0	0
4-Feb-21	4	7,868	968	0	16023	4168	0	0	0
5-Feb-21	4	7,476	540	0	15341	3845	0	0	0
6-Feb-21	4	7,104	2,014	0	14460	3237	0	0	0
7-Feb-21	4	6,760	1,676	0	14551	3171	0	0	0
8-Feb-21	4	4,632	0	0	14650	2964	0	0	0
9-Feb-21	4	6,024	0	0	16179	2747	0	0	0
10-Feb-21	4	7,404	598	0	19485	3365	0	0	0
11-Feb-21	4	8,712	1,306	0	23871	4227	0	0	0
12-Feb-21	4	8,224	1,524	0	19996	3744	0	0	0
13-Feb-21	4	7,244	3,120	0	16095	2869	0	0	0
14-Feb-21	4	6,008	2,724	0	16233	2279	0	0	0
15-Feb-21	4	10,836	4,548	0	778881	433845	401	3363	3701
16-Feb-21	4	13,400	6,192	0	482137	269011	5945	7105	7543
17-Feb-21	4	13,632	6,738	0	230208	101745	5885	2240	5606
18-Feb-21	4	13,208	4,340	0	139425	48212	3891	0	2877
19-Feb-21	4	12,584	6,124	0	100410	34435	5414	0	0
20-Feb-21	4	12,844	6,738	0	79381	27779	3912	0	0
21-Feb-21	4	12,804	4,788	0	67078	19652	2865	0	0
22-Feb-21	4	12,752	134	0	60055	15964	2036	0	0
23-Feb-21	4	12,256	0	0	53452	14551	1949	0	0
24-Feb-21	4	12,464	0	0	50513	13524	2020	0	0
25-Feb-21	4	12,412	0	0	48460	14344	2366	0	0
26-Feb-21	4	12,224	0	0	46009	13549	1016	0	0
27-Feb-21	4	12,232	1,216	0	43873	14654	0	0	0
28-Feb-21	4	12,292	6,386	0	43058	14611	0	0	0

Date	Regime	E1 (m³/d)	E2 (m³/d)	TSF2	Ohinemuri Flows (m³/d)		Collection Pond Discharges (m³/d)		
					Frendrups	Ruddocks	S3	S4	S5
1-Mar-21	4	8,088	2,242	0	40315	14444	0	0	0
2-Mar-21	4	6,644	1,422	0	39106	14261	0	0	0
3-Mar-21	4	12,304	5,430	0	51161	18772	0	0	0
4-Mar-21	4	14,188	5,268	0	53166	21181	0	0	0
5-Mar-21	4	13,464	5,358	0	43318	21676	0	0	0
6-Mar-21	4	13,408	5,178	0	38905	25541	0	0	0
7-Mar-21	4	13,704	4,884	0	36663	27181	0	0	0
8-Mar-21	4	9,508	3,178	0	33612	26461	0	0	0
9-Mar-21	4	8,812	2,558	0	34054	28915	0	0	0
10-Mar-21	4	10,816	4,050	0	35749	27488	48	0	0
11-Mar-21	4	10,156	4,348	0	36524	38809	128	0	92
12-Mar-21	4	10,376	4,800	0	31989	39300	78	0	0
13-Mar-21	4	9,416	4,872	0	29719	26335	0	0	0
14-Mar-21	4	9,124	3,132	0	28715	13746	0	0	0
15-Mar-21	4	10,092	3,684	0	30439	16345	0	0	87
16-Mar-21	4	9,996	2,724	0	29150	17953	0	0	0
17-Mar-21	4	10,008	4,192	0	28015	11855	0	0	0
18-Mar-21	4	9,708	4,654	0	26784	13050	0	0	0
19-Mar-21	4	8,432	4,532	0	24759	12884	0	0	0
20-Mar-21	4	8,380	4,536	0	24967	13295	0	0	0
21-Mar-21	4	8,620	4,656	0	24401	13353	0	0	0
22-Mar-21	4	8,460	3,814	0	23615	13394	0	0	0
23-Mar-21	4	8,016	4,758	0	23833	13379	0	0	0
24-Mar-21	4	2,460	920	0	23423	13693	0	0	0
25-Mar-21	4	584	0	0	23513	13723	0	0	0
26-Mar-21	4	680	0	0	22298	13384	0	0	0
27-Mar-21	4	6,780	2,850	0	22572	12769	0	0	0
28-Mar-21	4	7,204	4,194	0	22190	12219	0	0	0
29-Mar-21	4	9,312	4,580	0	26740	12980	0	0	0
30-Mar-21	4	9,364	4,694	0	26573	13036	0	0	0
31-Mar-21	4	8,440	4,442	0	26426	13394	0	0	0

APPENDIX C: Treated Water Quality Data

Table C1 Treated water discharge quality (daily data) between 1 May 2020 and 30 April 2021

Date	Regime	pH	SS (mg/L)	NH3 (mg/L)	CNWAD (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Silver (mg/L)
1/05/2020	4	8.8	2	2.5	0.007	0.0036	0.021	0.020	0.0004
2/05/2020	4	8.8	2	2.3	0.007	0.0034	0.022	0.019	0.0004
3/05/2020	4	8.8	2	1.5	0.007	0.0027	0.023	0.019	0.0004
4/05/2020	4	8.7	2	1.0	0.007	0.0018	0.020	0.052	0.0004
5/05/2020	4	8.7	2	0.5	0.007	0.0013	0.019	0.045	0.0004
6/05/2020	4	8.8	2	0.5	0.007	0.0010	0.015	0.030	0.0004
7/05/2020	4	8.8	2	0.4	0.007	0.0010	0.015	0.020	0.0004
8/05/2020	4	8.8	2	0.3	0.007	0.0010	0.021	0.014	0.0004
9/05/2020	4	8.8	2	0.3	0.007	0.0010	0.020	0.010	0.0004
10/05/2020	4	8.8	2	0.3	0.007	0.0010	0.022	0.010	0.0004
11/05/2020	4	8.8	2	0.5	0.007	0.0010	0.017	0.009	0.0004
12/05/2020	4	8.8	2	0.5	0.007	0.0010	0.020	0.007	0.0004
13/05/2020	4	8.8	2	0.4	0.007	0.0010	0.020	0.007	0.0004
14/05/2020	4	8.8	2	0.5	0.007	0.0010	0.018	0.007	0.0004
15/05/2020	4	8.8	2	0.5	0.007	0.0010	0.011	0.009	0.0004
16/05/2020	4	8.8	2	0.3	0.007	0.0010	0.019	0.008	0.0004
17/05/2020	4	8.8	2	0.3	0.007	0.0010	0.019	0.007	0.0004
18/05/2020	4	8.8	2	0.3	0.007	0.0010	0.014	0.007	0.0004
19/05/2020	4	8.9	2	0.3	0.007	0.0010	0.016	0.007	0.0004
20/05/2020	4	8.7	2	0.3	0.007	0.0010	0.027	0.007	0.0004
21/05/2020	4	8.6	2	0.4	0.007	0.0010	0.023	0.006	0.0004
22/05/2020	4	8.7	2	0.3	0.007	0.0016	0.030	0.007	0.0004
23/05/2020	4	8.7	2	1.2	0.007	0.0023	0.022	0.008	0.0004
24/05/2020	4	8.8	2	1.7	0.007	0.0041	0.027	0.009	0.0004
25/05/2020	4	8.8	2	1.7	0.007	0.0035	0.025	0.010	0.0004
26/05/2020	4	8.8	2	1.8	0.007	0.0043	0.028	0.009	0.0004
27/05/2020	4	8.8	2	2.2	0.007	0.0065	0.037	0.011	0.0004
28/05/2020	4	8.8	2	1.8	0.007	0.0062	0.033	0.009	0.0004
29/05/2020	4	8.8	2	2.0	0.007	0.0085	0.041	0.009	0.0004
30/05/2020	4	8.9	2	1.9	0.008	0.0092	0.039	0.009	0.0004
31/05/2020	4	8.7	2	1.3	0.007	0.0045	0.041	0.022	0.0004
1/06/2020	4	8.7	2	1.2	0.007	0.0039	0.045	0.018	0.0004
2/06/2020	4	8.7	2	1.0	0.007	0.0014	0.039	0.018	0.0004
3/06/2020	4	8.8	2	1.5	0.023	0.0054	0.050	0.017	0.0004
4/06/2020	4	8.7	2	1.1	0.009	0.0088	0.064	0.022	0.0004
5/06/2020	4	8.7	2	0.9	0.011	0.0088	0.048	0.016	0.0004
6/06/2020	4	8.8	2	0.7	0.007	0.0094	0.058	0.017	0.0004
7/06/2020	4								
8/06/2020	4								
9/06/2020	4								
10/06/2020	4								
11/06/2020	4								
12/06/2020	4	8.8	3	1.1	0.007	0.0028	0.037	0.013	0.0004
13/06/2020	4	8.8	2	1.0	0.007	0.0023	0.067	0.020	0.0004

Date	Regime	pH	SS (mg/L)	NH3 (mg/L)	CNWAD (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Silver (mg/L)
14/06/2020	4	8.9	2	1.2	0.007	0.0014	0.069	0.022	0.0004
15/06/2020	4	8.9	2	1.0	0.007	0.0010	0.074	0.022	0.0004
16/06/2020	4	8.7	2	1.1	0.008	0.0011	0.087	0.025	0.0004
17/06/2020	4	8.9	2	1.1	0.007	0.0011	0.077	0.022	0.0004
18/06/2020	4	8.9	2	1.4	0.007	0.0011	0.084	0.022	0.0004
19/06/2020	4	8.8	4	1.0	0.007	0.0010	0.061	0.016	0.0004
20/06/2020	4	8.8	2	1.0	0.007	0.0010	0.057	0.012	0.0004
21/06/2020	4	8.7	2	0.9	0.007	0.0010	0.044	0.016	0.0004
22/06/2020	4	8.7	2	1.2	0.007	0.0010	0.041	0.016	0.0004
23/06/2020	4	8.9	2	1.2	0.007	0.0014	0.031	0.011	0.0004
24/06/2020	4	8.9	2	1.1	0.007	0.0013	0.052	0.011	0.0004
25/06/2020	4	8.9	2	0.9	0.007	0.0010	0.051	0.014	0.0004
26/06/2020	4	8.6	2	2.3	0.007	0.0010	0.044	0.021	0.0004
27/06/2020	4	8.8	2	2.5	0.007	0.0010	0.044	0.014	0.0004
28/06/2020	4	9.0	2	1.8	0.008	0.0010	0.037	0.013	0.0004
29/06/2020	4	8.9	2	2.0	0.007	0.0010	0.029	0.016	0.0004
30/06/2020	4	8.9	2	1.2	0.007	0.0025	0.045	0.013	0.0004
1/07/2020	4	8.8	2	0.8	0.007	0.0010	0.053	0.013	0.0004
2/07/2020	4	8.8	2	0.6	0.007	0.0010	0.071	0.016	0.0004
3/07/2020	4	8.9	2	1.1	0.007	0.0010	0.065	0.016	0.0004
4/07/2020	4	8.9	2	1.0	0.007	0.0010	0.063	0.015	0.0004
5/07/2020	4	8.9	2	0.7	0.007	0.0010	0.071	0.015	0.0004
6/07/2020	4	8.9	2	0.7	0.007	0.0010	0.065	0.014	0.0004
7/07/2020	4	8.9	2	1.7	0.007	0.0010	0.058	0.013	0.0004
8/07/2020	4	8.9	2	2.0	0.007	0.0013	0.058	0.014	0.0004
9/07/2020	4	9.0	2	1.4	0.007	0.0010	0.088	0.015	0.0004
10/07/2020	4	8.8	2	1.0	0.007	0.0010	0.064	0.014	0.0004
11/07/2020	4	8.9	2	1.1	0.007	0.0010	0.058	0.017	0.0004
12/07/2020	4	9.0	2	1.0	0.007	0.0010	0.052	0.014	0.0004
13/07/2020	4	8.9	2	0.8	0.007	0.0010	0.055	0.015	0.0004
14/07/2020	4	8.9	2	0.7	0.007	0.0010	0.055	0.015	0.0004
15/07/2020	4	8.8	2	0.5	0.007	0.0010	0.046	0.013	0.0004
16/07/2020	4	8.8	2	1.2	0.007	0.0010	0.052	0.020	0.0004
17/07/2020	4	8.7	2	2.9	0.007	0.0010	0.050	0.025	0.0004
18/07/2020	4	8.9	2	3.7	0.007	0.0010	0.040	0.023	0.0004
19/07/2020	4	8.8	2	2.3	0.007	0.0010	0.047	0.019	0.0004
20/07/2020	4	8.9	2	1.5	0.007	0.0010	0.036	0.012	0.0004
21/07/2020	4	8.9	2	1.4	0.007	0.0010	0.040	0.014	0.0004
22/07/2020	4	8.9	2	1.4	0.007	0.0010	0.042	0.017	0.0004
23/07/2020	4	8.8	2	1.2	0.007	0.0010	0.037	0.014	0.0004
24/07/2020	4	8.9	2	0.8	0.007	0.0010	0.038	0.012	0.0004
25/07/2020	4	8.8	2	0.7	0.007	0.0010	0.037	0.012	0.0004
26/07/2020	4	8.8	2	0.5	0.007	0.0010	0.031	0.011	0.0004
27/07/2020	4	8.8	2	0.4	0.007	0.0010	0.030	0.012	0.0004
28/07/2020	4	8.9	2	0.4	0.007	0.0010	0.038	0.011	0.0004
29/07/2020	4	8.9	2	0.4	0.007	0.0010	0.027	0.010	0.0004

Date	Regime	pH	SS (mg/L)	NH3 (mg/L)	CNWAD (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Silver (mg/L)
30/07/2020	4	8.8	2	0.5	0.007	0.0010	0.033	0.011	0.0004
31/07/2020	4	8.8	2	0.6	0.007	0.0010	0.028	0.008	0.0004
1/08/2020	4	8.8	2	0.5	0.007	0.0010	0.019	0.007	0.0004
2/08/2020	4	8.8	2	0.6	0.007	0.0010	0.031	0.009	0.0004
3/08/2020	4	8.8	2	0.5	0.007	0.0010	0.030	0.008	0.0004
4/08/2020	4	8.9	2	0.5	0.007	0.0010	0.032	0.008	0.0004
5/08/2020	4	8.9	2	0.4	0.007	0.0010	0.029	0.007	0.0004
6/08/2020	4	8.8	2	0.9	0.007	0.0010	0.035	0.010	0.0004
7/08/2020	4	8.8	2	0.7	0.007	0.0010	0.032	0.010	0.0004
8/08/2020	4	8.8	2	0.9	0.007	0.0010	0.044	0.014	0.0004
9/08/2020	4	8.8	2	1.1	0.007	0.0010	0.044	0.011	0.0004
10/08/2020	4	8.8	2	1.0	0.007	0.0010	0.035	0.011	0.0004
11/08/2020	4	8.8	2	0.6	0.007	0.0010	0.042	0.012	0.0004
12/08/2020	4	8.7	2	0.6	0.007	0.0010	0.040	0.011	0.0004
13/08/2020	4	8.9	2	1.1	0.007	0.0010	0.031	0.010	0.0004
14/08/2020	4	8.8	2	0.8	0.007	0.0010	0.022	0.008	0.0004
15/08/2020	4	8.8	2	0.5	0.007	0.0010	0.030	0.007	0.0004
16/08/2020	4	8.9	2	0.7	0.008	0.0012	0.045	0.009	0.0004
17/08/2020	4	8.8	2	0.6	0.007	0.0013	0.056	0.009	0.0004
18/08/2020	4	8.7	2	0.3	0.007	0.0011	0.054	0.012	0.0004
19/08/2020	4	8.7	2	0.2	0.007	0.0016	0.076	0.015	0.0004
20/08/2020	4	8.6	2	0.9	0.070	0.0049	0.059	0.021	0.0007
21/08/2020	2	8.8	2	0.9	0.023	0.0037	0.047	0.017	0.0004
22/08/2020	2	8.9	2	1.2	0.010	0.0027	0.037	0.012	0.0004
23/08/2020	2	8.8	2	1.3	0.008	0.0018	0.029	0.009	0.0004
24/08/2020	2	8.7	2	0.6	0.008	0.0019	0.035	0.014	0.0004
25/08/2020	2	8.6	2	0.5	0.011	0.0026	0.043	0.015	0.0004
26/08/2020	2	8.6	2	0.7	0.007	0.0028	0.056	0.015	0.0004
27/08/2020	2	8.6	2	1.0	0.007	0.0026	0.045	0.014	0.0004
28/08/2020	2	8.7	2	0.6	0.007	0.0021	0.033	0.014	0.0004
29/08/2020	2	8.6	2	0.3	0.007	0.0026	0.040	0.015	0.0004
30/08/2020	2	8.8	2	0.6	0.007	0.0021	0.031	0.012	0.0004
31/08/2020	2	8.7	2	0.9	0.007	0.0022	0.029	0.011	0.0004
1/09/2020	2	8.6	2	0.47	0.007	0.0023	0.026	0.011	0.0004
2/09/2020	2	8.6	2	0.32	0.007	0.0018	0.034	0.010	0.0004
3/09/2020	2	8.5	2	0.3	0.007	0.0021	0.033	0.009	0.0004
4/09/2020	2	8.6	2	0.18	0.007	0.0024	0.022	0.009	0.0004
5/09/2020	2	8.7	2	0.17	0.007	0.0020	0.025	0.009	0.0004
6/09/2020	2	8.7	2	0.85	0.007	0.0020	0.021	0.008	0.0004
7/09/2020	2	8.7	2	0.58	0.007	0.0020	0.012	0.009	0.0004
8/09/2020	2	8.8	2	0.56	0.007	0.0013	0.034	0.008	0.0004
9/09/2020	2	8.6	2	0.45	0.007	0.0013	0.027	0.010	0.0004
10/09/2020	4	8.6	2	0.25	0.007	0.0015	0.024	0.010	0.0004
11/09/2020	4	8.7	2	0.25	0.007	0.0010	0.017	0.009	0.0004
12/09/2020	4	8.7	2	0.24	0.007	0.0010	0.010	0.008	0.0004
13/09/2020	4	8.7	2	0.32	0.007	0.0010	0.014	0.009	0.0004

Date	Regime	pH	SS (mg/L)	NH3 (mg/L)	CNWAD (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Silver (mg/L)
14/09/2020	4	8.6	2	0.4	0.007	0.0010	0.015	0.009	0.0004
15/09/2020	4	8.7	2	0.86	0.007	0.0010	0.028	0.010	0.0004
16/09/2020	4	8.6	4	0.71	0.007	0.0010	0.033	0.011	0.0004
17/09/2020	4	8.6	2	0.64	0.007	0.0010	0.020	0.010	0.0004
18/09/2020	4	8.5	2	0.46	0.007	0.0010	0.020	0.010	0.0004
19/09/2020	4	8.5	2	0.43	0.007	0.0010	0.030	0.011	0.0004
20/09/2020	4	8.7	2	0.36	0.007	0.0010	0.025	0.013	0.0004
21/09/2020	4	8.6	2	0.41	0.007	0.0010	0.021	0.013	0.0004
22/09/2020	4	8.6	2	0.45	0.007	0.0022	0.033	0.012	0.0004
23/09/2020	4	8.6	2	0.46	0.007	0.0021	0.016	0.013	0.0004
24/09/2020	4	8.6	2	0.57	0.007	0.0025	0.018	0.012	0.0004
25/09/2020	4	8.5	2	0.56	0.007	0.0023	0.019	0.011	0.0004
26/09/2020	4	8.6	2	0.49	0.007	0.0016	0.016	0.012	0.0004
27/09/2020	4	8.7	2	0.5	0.007	0.0011	0.023	0.013	0.0004
28/09/2020	4	8.6	2	0.61	0.007	0.0010	0.017	0.012	0.0004
29/09/2020	4	8.6	2	0.78	0.007	0.0010	0.020	0.010	0.0004
30/09/2020	4	8.2	2	0.68	0.007	0.0010	0.021	0.014	0.0004
1/10/2020	4	8.6	2	0.5	0.007	0.0010	0.025	0.016	0.0004
2/10/2020	4	8.5	2	0.5	0.007	0.0025	0.034	0.016	0.0004
3/10/2020	4	8.7	2	0.3	0.007	0.0025	0.017	0.015	0.0004
4/10/2020	4	8.7	2	0.4	0.007	0.0025	0.019	0.012	0.0004
5/10/2020	4	8.4	2	0.3	0.007	0.0022	0.018	0.010	0.0004
6/10/2020	4	8.6	2	0.4	0.007	0.0016	0.016	0.008	0.0004
7/10/2020	4	8.3	2	0.7	0.007	0.0013	0.020	0.009	0.0004
8/10/2020	4	8.5	2	1.1	0.007	0.0016	0.036	0.010	0.0004
9/10/2020	4	8.6	2	1.4	0.007	0.0010	0.020	0.009	0.0004
10/10/2020	4	8.7	2	1.4	0.007	0.0083	0.020	0.008	0.0004
11/10/2020	4	8.8	2	1.4	0.007	0.0010	0.024	0.007	0.0004
12/10/2020	4	8.8	2	1.3	0.007	0.0010	0.021	0.005	0.0004
13/10/2020	4	8.7	2	1.1	0.007	0.0010	0.020	0.007	0.0004
14/10/2020	4	8.7	2	1.3	0.007	0.0019	0.016	0.008	0.0004
15/10/2020	4	8.8	2	1.1	0.007	0.0011	0.028	0.008	0.0004
16/10/2020	4	8.8	2	0.7	0.007	0.0010	0.021	0.010	0.0004
17/10/2020	4	8.8	2	0.6	0.007	0.0010	0.008	0.008	0.0004
18/10/2020	4	8.7	2	0.5	0.007	0.0010	0.018	0.011	0.0004
19/10/2020	4	8.6	2	0.6	0.007	0.0010	0.022	0.012	0.0004
20/10/2020	4	8.8	2	1.1	0.007	0.0010	0.020	0.013	0.0004
21/10/2020	4	8.8	2	0.7	0.007	0.0010	0.012	0.012	0.0004
22/10/2020	4	8.8	2	0.4	0.007	0.0012	0.037	0.015	0.0004
23/10/2020	4	8.7	2	0.9	0.007	0.0010	0.010	0.012	0.0004
24/10/2020	4	8.7	4	0.8	0.007	0.0010	0.010	0.014	0.0004
25/10/2020	4	8.7	2	0.6	0.007	0.0010	0.008	0.014	0.0004
26/10/2020	4	8.7	2	0.4	0.007	0.0010	0.008	0.014	0.0004
27/10/2020	4	8.7	2	0.4	0.007	0.0010	0.017	0.013	0.0004
28/10/2020	4	8.7	2	0.4	0.007	0.0010	0.016	0.014	0.0004
29/10/2020	4	8.7	2	0.4	0.007	0.0010	0.015	0.015	0.0004

Date	Regime	pH	SS (mg/L)	NH3 (mg/L)	CNWAD (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Silver (mg/L)
30/10/2020	4	8.6	2	0.4	0.007	0.0010	0.013	0.014	0.0004
31/10/2020	4	8.6	2	0.5	0.007	0.0010	0.012	0.014	0.0004
1/11/2020	4	8.7	2	0.4	0.007	0.0010	0.013	0.014	0.0004
2/11/2020	4	8.8	2	0.3	0.007	0.0010	0.017	0.013	0.0004
3/11/2020	4	8.8	2	0.5	0.007	0.0010	0.009	0.012	0.0004
4/11/2020	4	8.7	2	0.5	0.007	0.0010	0.015	0.012	0.0004
5/11/2020	4	8.8	2	0.6	0.007	0.0010	0.018	0.011	0.0004
6/11/2020	4	8.7	3	0.9	0.007	0.0010	0.016	0.010	0.0004
7/11/2020	4	8.7	2	1.5	0.007	0.0033	0.039	0.012	0.0004
8/11/2020	4	8.7	2	0.9	0.007	0.0027	0.027	0.015	0.0004
9/11/2020	4	8.8	2	1.0	0.007	0.0029	0.009	0.012	0.0004
10/11/2020	4	8.8	2	0.9	0.007	0.0029	0.028	0.014	0.0004
11/11/2020	4	8.7	2	1.2	0.007	0.0024	0.020	0.015	0.0004
12/11/2020	4	8.9	2	1.1	0.007	0.0026	0.022	0.010	0.0004
13/11/2020	4	8.9	2	1.0	0.007	0.0031	0.022	0.011	0.0004
14/11/2020	4	8.7	2	1.1	0.007	0.0030	0.016	0.007	0.0004
15/11/2020	4	8.7	2	1.0	0.008	0.0018	0.017	0.007	0.0004
16/11/2020	4	8.8	2	0.7	0.007	0.0010	0.011	0.008	0.0004
17/11/2020	4	8.8	2	0.7	0.007	0.0010	0.014	0.008	0.0004
18/11/2020	4	8.8	2	0.5	0.007	0.0010	0.017	0.010	0.0004
19/11/2020	4	8.8	2	0.4	0.007	0.0010	0.014	0.009	0.0004
20/11/2020	4	8.8	2	0.5	0.007	0.0010	0.012	0.009	0.0004
21/11/2020	4	8.8	2	0.4	0.007	0.0010	0.014	0.010	0.0004
22/11/2020	4	8.8	2	0.4	0.007	0.0010	0.023	0.011	0.0004
23/11/2020	4	8.7	2	0.4	0.007	0.0010	0.014	0.011	0.0004
24/11/2020	4	8.7	2	0.4	0.007	0.0010	0.019	0.010	0.0004
25/11/2020	4	8.7	2	0.4	0.007	0.0010	0.022	0.012	0.0004
26/11/2020	4	8.7	2	1.1	0.007	0.0038	0.033	0.011	0.0004
27/11/2020	4	8.7	2	1.5	0.007	0.0036	0.024	0.012	0.0004
28/11/2020	4	8.7	2	1.0	0.008	0.0018	0.023	0.010	0.0004
29/11/2020	4	8.7	2	0.8	0.007	0.0017	0.017	0.010	0.0004
30/11/2020	4	8.8	2	1.7	0.019	0.0024	0.028	0.011	0.0004
1/12/2020	4	8.8	2	2.1	0.025	0.0042	0.028	0.016	0.0004
2/12/2020	4	8.7	2	1.5	0.013	0.0028	0.024	0.017	0.0004
3/12/2020	4	8.8	2	1.3	0.021	0.0024	0.028	0.017	0.0005
4/12/2020	4	8.6	2	0.9	0.008	0.0012	0.021	0.013	0.0004
5/12/2020	4	8.8	2	0.5	0.007	0.0014	0.013	0.013	0.0004
6/12/2020	4	8.7	2	0.4	0.007	0.0010	0.008	0.014	0.0004
7/12/2020	4	8.8	2	0.5	0.007	0.0010	0.021	0.014	0.0004
8/12/2020	4	8.7	2	0.6	0.007	0.0010	0.025	0.014	0.0004
9/12/2020	4	8.7	2	0.7	0.007	0.0010	0.030	0.015	0.0004
10/12/2020	4	8.8	2	1.1	0.007	0.0010	0.021	0.013	0.0004
11/12/2020	4	8.7	4	0.9	0.007	0.0010	0.032	0.012	0.0004
12/12/2020	4	8.8	3	0.8	0.007	0.0010	0.027	0.015	0.0004
13/12/2020	4	8.7	2	0.9	0.007	0.0010	0.022	0.014	0.0004
14/12/2020	4	8.7	2	0.9	0.007	0.0010	0.031	0.019	0.0004

Date	Regime	pH	SS (mg/L)	NH3 (mg/L)	CNWAD (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Silver (mg/L)
15/12/2020	4	8.7	2	0.8	0.007	0.0010	0.023	0.016	0.0004
16/12/2020	4	8.6	2	0.8	0.007	0.0010	0.022	0.014	0.0004
17/12/2020	4	8.6	2	0.9	0.007	0.0010	0.033	0.019	0.0004
18/12/2020	4	8.6	2	0.9	0.007	0.0010	0.028	0.016	0.0004
19/12/2020	4	8.7	2	0.7	0.007	0.0010	0.013	0.013	0.0004
20/12/2020	4	8.5	2	0.5	0.007	0.0010	0.024	0.014	0.0004
21/12/2020	4	8.4	2	0.4	0.007	0.0010	0.028	0.014	0.0004
22/12/2020	4	8.7	2	0.5	0.007	0.0010	0.028	0.015	0.0004
23/12/2020	4	8.6	2	0.6	0.007	0.0010	0.028	0.013	0.0004
24/12/2020	4	8.5	2	0.7	0.007	0.0010	0.038	0.014	0.0004
25/12/2020	4	8.7	2	0.6	0.007	0.0010	0.020	0.012	0.0004
26/12/2020	4	8.8	2	0.5	0.007	0.0010	0.019	0.011	0.0004
27/12/2020	4	8.7	2	0.4	0.007	0.0010	0.029	0.012	0.0004
28/12/2020	4	8.7	2	0.4	0.007	0.0017	0.033	0.013	0.0004
29/12/2020	4	8.8	2	0.4	0.007	0.0010	0.028	0.013	0.0004
30/12/2020	4	8.9	2	0.4	0.007	0.0010	0.028	0.013	0.0004
31/12/2020	4	8.9	2	0.6	0.007	0.0010	0.008	0.011	0.0004
1/01/2021	4	8.7	2	0.5	0.007	0.0010	0.028	0.013	0.0004
2/01/2021	4	8.8	2	0.5	0.007	0.0010	0.017	0.001	0.0004
3/01/2021	4	8.7	2	0.5	0.007	0.0010	0.021	0.002	0.0004
4/01/2021	4	8.8	2	1.1	0.007	0.0010	0.026	0.014	0.0004
5/01/2021	4	8.8	2	1.4	0.007	0.0010	0.027	0.010	0.0004
6/01/2021	4	8.9	2	0.8	0.007	0.0010	0.027	0.012	0.0004
7/01/2021	4	8.9	2	0.4	0.007	0.0010	0.025	0.010	0.0004
8/01/2021	4	8.9	2	0.4	0.007	0.0010	0.026	0.013	0.0004
9/01/2021	4	8.8	2	0.6	0.007	0.0010	0.027	0.017	0.0004
10/01/2021	4	8.8	2	0.8	0.007	0.0010	0.017	0.016	0.0004
11/01/2021	4	8.8	2	0.6	0.007	0.0010	0.024	0.015	0.0004
12/01/2021	4	8.8	2	0.7	0.007	0.0010	0.063	0.015	0.0004
13/01/2021	4	8.7	2	0.7	0.007	0.0010	0.018	0.013	0.0004
14/01/2021	4	8.9	2	0.6	0.007	0.0010	0.025	0.013	0.0004
15/01/2021	4	8.9	2	0.5	0.007	0.0010	0.012	0.011	0.0004
16/01/2021	4	8.9	2	0.7	0.007	0.0010	0.022	0.012	0.0004
17/01/2021	4	8.9	2	0.9	0.007	0.0010	0.022	0.013	0.0004
18/01/2021	4	8.9	2	0.8	0.007	0.0010	0.024	0.014	0.0004
19/01/2021	4	8.9	2	0.7	0.007	0.0010	0.019	0.015	0.0004
20/01/2021	4	8.8	2	0.7	0.007	0.0010	0.018	0.016	0.0004
21/01/2021	4	8.8	2	0.5	0.007	0.0010	0.018	0.016	0.0004
22/01/2021	4	8.8	2	0.5	0.007	0.0010	0.014	0.016	0.0004
23/01/2021	4	7.7	2	0.5	0.007	0.0010	0.011	0.017	0.0004
24/01/2021	4	9.0	2	0.5	0.007	0.0010	0.010	0.017	0.0004
25/01/2021	4	8.9	2	0.6	0.007	0.0010	0.008	0.014	0.0004
26/01/2021	4	8.8	2	0.5	0.007	0.0014	0.008	0.010	0.0004
27/01/2021	4	8.8	2	0.6	0.007	0.0010	0.008	0.014	0.0004
28/01/2021	4	8.8	2	1.3	0.007	0.0010	0.022	0.014	0.0004
29/01/2021	4	8.9	2	0.6	0.007	0.0010	0.013	0.016	0.0004

Date	Regime	pH	SS	NH3	CNWAD	Copper	Iron	Manganese	Silver
			(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
30/01/2021	4	9.0	2	0.5	0.007	0.0010	0.008	0.011	0.0004
31/01/2021	4	9.0	2	1.5	0.007	0.0010	0.009	0.011	0.0004
1/02/2021	4	8.9	2	0.8	0.007	0.0010	0.008	0.011	0.0004
2/02/2021	4	8.8	2	0.7	0.007	0.0010	0.008	0.012	0.0004
3/02/2021	4	8.9	2	0.4	0.007	0.0010	0.013	0.013	0.0004
4/02/2021	4	8.7	2	0.5	0.007	0.0010	0.008	0.012	0.0004
5/02/2021	4	8.8	2	0.4	0.007	0.0010	0.012	0.015	0.0004
6/02/2021	4	8.7	3	0.9	0.007	0.0010	0.008	0.014	0.0004
7/02/2021	4	8.8	2	0.6	0.007	0.0010	0.008	0.015	0.0004
8/02/2021	4	8.8	2	2.6	0.007	0.0010	0.011	0.014	0.0004
9/02/2021	4	8.8	2	1.6	0.007	0.0010	0.014	0.013	0.0004
10/02/2021	4	8.7	2	1.0	0.007	0.0010	0.008	0.011	0.0004
11/02/2021	4	8.8	4	1.3	0.007	0.0010	0.016	0.014	0.0004
12/02/2021	4	8.7	3	0.5	0.007	0.0010	0.011	0.012	0.0004
13/02/2021	4	8.7	2	0.2	0.007	0.0010	0.008	0.013	0.0004
14/02/2021	4	8.7	6	0.9	0.007	0.0010	0.009	0.016	0.0004
15/02/2021	4	8.7	3	1.0	0.007	0.0010	0.010	0.015	0.0004
16/02/2021	4	8.6	6	1.6	0.007	0.0010	0.048	0.019	0.0004
17/02/2021	4	8.6	2	0.7	0.007	0.0010	0.027	0.023	0.0004
18/02/2021	4	8.8	2	0.4	0.007	0.0012	0.011	0.016	0.0004
19/02/2021	4	8.8	2	0.5	0.007	0.0012	0.018	0.014	0.0004
20/02/2021	4	8.9	2	0.4	0.007	0.0010	0.013	0.017	0.0004
21/02/2021	4	8.8	2	0.3	0.007	0.0010	0.024	0.015	0.0004
22/02/2021	4	8.9	2	0.4	0.007	0.0010	0.009	0.015	0.0004
23/02/2021	4	8.9	4	0.5	0.007	0.0010	0.015	0.020	0.0004
24/02/2021	4	8.8	7	0.2	0.007	0.0010	0.008	0.021	0.0004
25/02/2021	4	8.8	2	0.3	0.007	0.0010	0.015	0.022	0.0004
26/02/2021	4	8.7	2	0.2	0.007	0.0010	0.024	0.020	0.0004
27/02/2021	4	8.8	2	0.9	0.007	0.0010	0.013	0.015	0.0004
28/02/2021	4	8.8	6	1.1	0.007	0.0019	0.060	0.019	0.0004
1/03/2021	4	8.7	2	1.0	0.007	0.0020	0.022	0.016	0.0004
2/03/2021	4	8.5	2	0.8	0.007	0.0016	0.020	0.015	0.0004
3/03/2021	4	8.8	2	0.8	0.007	0.0014	0.015	0.015	0.0004
4/03/2021	4	8.7	2	0.9	0.007	0.0022	0.012	0.014	0.0004
5/03/2021	4	8.9	2	0.9	0.007	0.0024	0.017	0.020	0.0004
6/03/2021	4	8.9	2	1.0	0.007	0.0028	0.016	0.017	0.0004
7/03/2021	4	8.8	2	1.2	0.007	0.0033	0.022	0.015	0.0004
8/03/2021	4	8.8	2	1.6	0.007	0.0043	0.028	0.015	0.0004
9/03/2021	4	8.7	2	1.0	0.007	0.0023	0.019	0.015	0.0004
10/03/2021	4	8.9	2	1.2	0.007	0.0020	0.021	0.014	0.0004
11/03/2021	4	8.9	2	1.2	0.007	0.0017	0.019	0.014	0.0004
12/03/2021	4	8.8	2	1.3	0.007	0.0021	0.021	0.019	0.0004
13/03/2021	4	8.8	2	0.9	0.007	0.0015	0.012	0.015	0.0004
14/03/2021	4	8.7	2	0.7	0.007	0.0012	0.013	0.015	0.0004
15/03/2021	4	8.8	2	0.9	0.007	0.0010	0.010	0.017	0.0004
16/03/2021	4	8.8	2	0.7	0.007	0.0010	0.013	0.023	0.0004

Date	Regime	pH	SS (mg/L)	NH3 (mg/L)	CNWAD (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Silver (mg/L)
17/03/2021	4	8.8	2	0.6	0.007	0.0010	0.014	0.016	0.0004
18/03/2021	4	8.9	2	0.7	0.007	0.0012	0.008	0.014	0.0004
19/03/2021	4	8.8	2	0.7	0.007	0.0013	0.012	0.014	0.0004
20/03/2021	4	8.8	2	1.2	0.007	0.0010	0.010	0.015	0.0004
21/03/2021	4	8.8	2	1.4	0.007	0.0012	0.013	0.017	0.0004
22/03/2021	4	8.7	2	1.3	0.007	0.0010	0.010	0.017	0.0004
23/03/2021	4	8.7	2	1.6	0.007	0.0024	0.023	0.017	0.0004
24/03/2021	4	8.8	2	1.1	0.007	0.0015	0.016	0.015	0.0004
25/03/2021	4	8.7	2	1.0	0.007	0.0015	0.018	0.014	0.0004
26/03/2021	4	8.6	2	1.0	0.007	0.0015	0.021	0.016	0.0004
27/03/2021	4	8.7	2	1.6	0.007	0.0025	0.019	0.015	0.0004
28/03/2021	4	8.7	2	3.4	0.010	0.0043	0.026	0.013	0.0004
29/03/2021	4	8.7	2	2.7	0.007	0.0036	0.027	0.015	0.0004
30/03/2021	4	8.7	2	3.0	0.007	0.0120	0.026	0.014	0.0004
31/03/2021	4								
1/04/2021	4	8.8	2	2.7	0.017	0.0240	0.034	0.018	0.0004
2/04/2021	4	8.8	2	3.2	0.011	0.0070	0.032	0.017	0.0004
3/04/2021	4	8.8	2	3.0	0.008	0.0044	0.024	0.015	0.0004
4/04/2021	4	8.8	2	1.7	0.007	0.0014	0.017	0.015	0.0004
5/04/2021	4	8.8	2	1.4	0.007	0.0014	0.012	0.016	0.0004
6/04/2021	4	8.7	2	1.4	0.007	0.0012	0.021	0.015	0.0004
7/04/2021	4	8.7	2	1.2	0.007	0.0010	0.009	0.015	0.0004
8/04/2021	4	8.8	2	2.4	0.007	0.0010	0.010	0.016	0.0004
9/04/2021	4	8.8	2	2.1	0.007	0.0010	0.009	0.015	0.0004
10/04/2021	4	8.6	2	1.2	0.007	0.0010	0.013	0.018	0.0004
11/04/2021	4	8.6	2	2.4	0.012	0.0028	0.025	0.015	0.0004
12/04/2021	4	8.7	2	3.3	0.010	0.0042	0.032	0.016	0.0004
13/04/2021	4	8.8	2	2.4	0.007	0.0026	0.012	0.014	0.0004
14/04/2021	4	8.8	2	1.7	0.007	0.0019	0.011	0.013	0.0004
15/04/2021	4	8.9	2	1.7	0.007	0.0026	0.020	0.016	0.0004
16/04/2021	4	8.8	2	2.7	0.007	0.0068	0.022	0.015	0.0004
17/04/2021	4	8.7	2	1.5	0.007	0.0028	0.013	0.015	0.0004
18/04/2021	4	8.7	2	1.6	0.007	0.0017	0.016	0.015	0.0004
19/04/2021	4	8.6	2	1.2	0.007	0.0012	0.008	0.014	0.0004
20/04/2021	4	8.7	2	0.9	0.007	0.0010	0.008	0.014	0.0004
21/04/2021	4	8.8	2	1.8	0.007	0.0052	0.043	0.019	0.0004
22/04/2021	4	8.7	2	1.9	0.007	0.0075	0.054	0.017	0.0004
23/04/2021	4	8.8	2	2.7	0.009	0.0051	0.051	0.019	0.0004
24/04/2021	4	8.9	2	2.8	0.007	0.0036	0.023	0.014	0.0004
25/04/2021	4	8.8	2	4.0	0.007	0.0057	0.032	0.010	0.0004
26/04/2021	4	8.7	2	4.7	0.007	0.0067	0.041	0.010	0.0004
27/04/2021	4	8.8	2	4.2	0.007	0.0072	0.045	0.009	0.0004
28/04/2021	4	8.7	2	2.7	0.007	0.0043	0.027	0.010	0.0004
29/04/2021	4	8.9	4	2.5	0.007	0.0017	0.013	0.011	0.0004
30/04/2021	4	8.9	2	1.5	0.007	0.0012	0.008	0.009	0.0004

Table C2 Treated water discharge quality (non-daily data) between 4 May 2020 and 27 April 2021

Date	Regime	Antimony- Acid Soluble (g/m3)	Antimony- Dissolved (g/m3)	Arsenic - Acid Soluble (g/m3)	Arsenic- Dissolved (g/m3)	Cadmium - Acid Soluble (g/m3)	Cadmium- Dissolved (g/m3)	Calcium- Dissolved (g/m3)	Chromium- Hexavalent (g/m3)	Cobalt- Dissolved (g/m3)
4/05/20	4	0.0066		0.002		0.0001		500	0.01	
10/05/20	4	0.006	0.0065							
17/05/20	4	0.0065	0.0064							
24/05/20	4	0.006	0.0061							
1/06/20	4	0.0015		0.001		5.00E-05		230	0.01	
14/06/20	4	0.0035	0.0039							
22/06/20	4	0.0026	0.0027							
2/07/20	4	0.0035	0.0036							
6/07/20	4	0.0032		0.0011		5.00E-05		290	0.01	
12/07/20	4	0.0032	0.0032							
19/07/20	4	0.0024	0.0023							
26/07/20	4	0.0036	0.0039							
3/08/20	4	0.0042		0.001		5.00E-05		340	0.01	
9/08/20	4	0.0042	0.0048							
11/08/20	4									
18/08/20	4	0.0033	0.0033							
23/08/20	4	0.0033	0.0042							
30/08/20	4	0.0041	0.0042							
7/09/20	4	0.0036		0.002		0.0001		450	0.01	
14/09/20	4	0.0024	0.0028							
20/09/20	4	0.0027	0.003							
27/09/20	4	0.0029	0.003							
5/10/20	4	0.0031		0.002		0.0001		490	0.01	
12/10/20	4	0.0041	0.0042							
20/10/20	4	0.0024	0.0023							
27/10/20	4	0.0022	0.0024							
2/11/20	4	0.002		0.002		0.0001		560	0.01	
9/11/20	4	0.0037	0.0039							
16/11/20	4	0.0032	0.0032							
23/11/20	2	0.0023	0.0024							
3/12/20	4	0.008		0.002		0.0001		530	0.01	
6/12/20	4	0.002	0.002							
15/12/20	4	0.0017	0.0016							
21/12/20	4	0.0016	0.0015							
28/12/20	4	0.0014	0.0014							
4/01/21	4	0.0013		0.002		0.0001		640	0.01	
11/01/21	4	0.001	0.001							
18/01/21	4	0.001	0.001							
24/01/21	4	0.0006	0.0006							
1/02/21	4	0.0008	0.001	0.002	0.002	0.0001	0.0001	560	0.01	0.0013
2/02/21	4	0.0006	0.0007							
14/02/21	2	0.0007	0.0008							
21/02/21	4	0.0005	0.0006							
1/03/21	4	0.0037		0.002		0.0001		520	0.01	
7/03/21	4	0.0062	0.0056							
15/03/21	4	0.0012	0.0013							
22/03/21	4	0.0029	0.0031							
28/03/21	4	0.0084	0.0088							
6/04/21	4	0.0019		0.001		5.00E-05		560	0.01	
11/04/21	2	0.0091	0.0095							
18/04/21	4	0.0029	0.0031							
27/04/21	4	0.0119	0.0127							

Table C2 (cont.) *Treated water discharge quality (non-daily data) between 4 May 2020 and 27 April 2021.*

Date	Regime	Copper-Acid Soluble (g/m3)	Copper-Dissolved (g/m3)	Cyanide-Total (g/m3)	Electrical Conductivity (EC) (mS/m)	FLS pH	FLS Temp	Free Ammonia (g/m3 at 10°C)	Hardness-Total (g/m3 as CaCO3)	Iron-Acid Soluble (g/m3)
4/05/20	4	0.0014			246	8.68	22	0.107	1460	0.04
10/05/20	4					8.32	18.1			
17/05/20	4					8.44	25			
24/05/20	4					8.97	19.9			
1/06/20	4	0.0008			126.8	8.78	16.9	0.049	680	0.04
14/06/20	4					9.14	16.6			
22/06/20	4					9.11	16.3			
2/07/20	4									
6/07/20	4	0.0005			160.7	9.02	16.6	0.0142	850	0.06
12/07/20	4					9.01	17.4			
19/07/20	4					8.95	16.5			
26/07/20	4					9.1	18.3			
3/08/20	4	0.0005			180.7	9.01	19.1	0.043	1010	0.03
9/08/20	4					9.18	18.1			
11/08/20	4				179.4				970	
18/08/20	4					8.67	16.6			
23/08/20	4					8.81	19.3			
30/08/20	4					8.74	20.1			
7/09/20	4	0.0013			224	8.55	21.9	0.064	1280	0.04
14/09/20	4					8.7	19.1			
20/09/20	4					8.81	22.2			
27/09/20	4					8.88	22.6			
5/10/20	4	0.0024			228	8.71	22.3	0.003	1440	0.04
12/10/20	4					8.83	22.1			
20/10/20	4					8.85	24.2			
27/10/20	4						25.9			
2/11/20	4	0.001			268	8.73	25.1	0.069	1610	0.04
9/11/20	4					8.78	20.6			
16/11/20	4					8.95	25			
23/11/20	2					8.83	24.8			
3/12/20	4	0.0022			252	8.89	23.3	0.062	1560	0.04
6/12/20	4					8.89	25.2			
15/12/20	4					8.37	24.5			
21/12/20	4			0.002		8.3	26.3			
28/12/20	4					8.56	21.6			
4/01/21	4	0.001			279	8.84	26.5	0.136	1830	0.04
11/01/21	4					8.84	25.8			
18/01/21	4					8.9	26			
24/01/21	4					8.96	24.2			
1/02/21	4	0.001	0.001		293	8.56	22.5	0.22	1760	0.04
2/02/21	4					8.97	25.6			
14/02/21	2					8.67	22.6			
21/02/21	4					9.01	25.9			
1/03/21	4	0.0018			275	8.15	22.7	0.05	1580	0.04
7/03/21	4					8.89	23.2			
15/03/21	4					8.99	25.9			
22/03/21	4					8.9	24.9			
28/03/21	4					8.77	21.8			
6/04/21	4	0.0005			290	8.91	23.6	0.061	1780	0.02
11/04/21	2					8.7	23.9			
18/04/21	4					8.94	23.9			
27/04/21	4					7.93	18.7			

Table C2 (cont.) *Treated water discharge quality (non-daily data) between 4 May 2020 and 27 April 2021.*

Date	Regime	Iron-Dissolved (g/m3)	Lead - Acid Soluble (g/m3)	Lead-Dissolved (g/m3)	Magnesium-Dissolved (g/m3)	Manganese-Acid Soluble (g/m3)	Manganese-Dissolved (g/m3)	Mercury-Acid Soluble (g/m3)	Mercury-Dissolved (g/m3)	Nickel-Acid Soluble (g/m3)	Nickel-Dissolved (g/m3)
4/05/20	4		0.0002		51	0.051		8.00E-05		0.001	
10/05/20	4										
17/05/20	4										
24/05/20	4										
1/06/20	4		0.0001		23	0.0178		8.00E-05		0.0007	
14/06/20	4										
22/06/20	4										
2/07/20	4										
6/07/20	4		0.00018		33	0.0134		8.00E-05		0.0006	
12/07/20	4										
19/07/20	4										
26/07/20	4										
3/08/20	4		0.0001		38	0.0082		8.00E-05		0.0005	
9/08/20	4										
11/08/20	4										
18/08/20	4										
23/08/20	4										
30/08/20	4										
7/09/20	4		0.0002		39	0.0082		8.00E-05		0.001	
14/09/20	4										
20/09/20	4										
27/09/20	4										
5/10/20	4		0.0002		54	0.0091		8.00E-05		0.001	
12/10/20	4										
20/10/20	4										
27/10/20	4										
2/11/20	4		0.0002		52	0.0132		8.00E-05		0.001	
9/11/20	4										
16/11/20	4										
23/11/20	2										
3/12/20	4		0.0002		57	0.0157		8.00E-05		0.001	
6/12/20	4										
15/12/20	4										
21/12/20	4										
28/12/20	4										
4/01/21	4		0.0002		56	0.0095		8.00E-05		0.001	
11/01/21	4										
18/01/21	4										
24/01/21	4										
1/02/21	4	0.04	0.0002	0.0002	85	0.0122	0.0088	8.00E-05	8.00E-05	0.001	0.001
2/02/21	4										
14/02/21	2										
21/02/21	4										
1/03/21	4		0.0002		67	0.0158		8.00E-05		0.001	
7/03/21	4										
15/03/21	4										
22/03/21	4										
28/03/21	4										
6/04/21	4		0.0001		91	0.0149		8.00E-05		0.0007	
11/04/21	2										
18/04/21	4										
27/04/21	4										

Table C2 (cont.) *Treated water discharge quality (non-daily data) between 4 May 2020 and 27 April 2021.*

Date	Regime	Nitrate-N (g/m3)	Nitrate-N + Nitrite-N (g/m3)	Nitrite-N (g/m3)	Nitrogen-Total Ammoniacal (g/m3)	pH (pH unit)	Phosphorus-Total (g/m3)	Potassium-Dissolved (g/m3)	Reactive Phosphorus-Dissolved (g/m3)	Selenium-Acid Soluble (g/m3)	Selenium-Dissolved (g/m3)
4/05/20	4				0.97	8.7	0.006		0.004	0.0012	
10/05/20	4					8.5				0.002	0.002
17/05/20	4					8.7				0.002	0.002
24/05/20	4					8.4				0.002	0.002
1/06/20	4				0.97	8.4	0.004		0.004	0.0015	
14/06/20	4					8.7				0.0014	0.0014
22/06/20	4					8.5				0.0013	0.0013
2/07/20	4					7.9				0.0013	0.0014
6/07/20	4				0.67	8	0.007		0.004	0.0008	
12/07/20	4					8.5				0.001	0.001
19/07/20	4					8.7				0.0011	0.001
26/07/20	4					8.6				0.001	0.001
3/08/20	4				0.54	8.6	0.013		0.005	0.0005	
9/08/20	4					8.3				0.001	0.001
11/08/20	4	4.7				8.6					
18/08/20	4					8.3				0.001	0.001
23/08/20	4					8.3				0.001	0.001
30/08/20	4					8.4				0.001	0.001
7/09/20	4				0.59	8.7	0.004		0.004	0.0004	
14/09/20	4					8.6				0.002	0.002
20/09/20	4					8.7				0.002	0.002
27/09/20	4					8.3				0.002	0.002
5/10/20	4				0.35	7.6	0.004		0.004	0.0004	
12/10/20	4					8.7				0.002	0.002
20/10/20	4					8.8				0.002	0.002
27/10/20	4					8.7				0.002	0.002
2/11/20	4				0.57	8.8	0.011		0.04	0.0004	
9/11/20	4					8.8				0.0037	0.0037
16/11/20	4					8.8				0.002	0.002
23/11/20	2					8.6				0.002	0.002
3/12/20	4				1.53	8.3	0.007		0.004	0.0063	
6/12/20	4					8.8				0.002	0.002
15/12/20	4					8.7				0.002	0.002
21/12/20	4					8.7				0.002	0.002
28/12/20	4					8.8				0.002	0.002
4/01/21	4		8.2		1.22	8.7	0.002		0.004	0.0005	
11/01/21	4					8.4				0.002	0.002
18/01/21	4					8.9				0.002	0.002
24/01/21	4					8.9				0.002	0.002
1/02/21	4	2	2.1	0.1	1.46	8.9	0.002	10.9	0.004	0.0004	0.0004
2/02/21	4					8.9				0.002	0.002
14/02/21	2					8.7				0.002	0.002
21/02/21	4					8.6				0.002	0.002
1/03/21	4		6.8		0.75	8.5	0.004		0.004	0.0023	
7/03/21	4					8.7				0.004	0.004
15/03/21	4					8.8				0.002	0.002
22/03/21	4					8.2				0.002	0.002
28/03/21	4					8.6				0.005	0.005
6/04/21	4				0.95	8.5	0.002		0.004	0.0009	
11/04/21	2					8.6				0.006	0.006
18/04/21	4					8.6				0.002	0.002
27/04/21	4					8.1				0.0075	0.0077

Table C2 (cont.) *Treated water discharge quality (non-daily data) between 1 May 2019 and 30 April 2020*

Date	Regime	Silica-Reactive (g/m3 as SiO2)	Silver-Acid Soluble (g/m3)	Silver-Dissolved (g/m3)	Sodium-Dissolved (g/m3)	Sulphate (g/m3)	Total Kjeldahl Nitrogen (TKN) (g/m3)	Total Suspended Solids (g/m3)	Acid Dissociable (WAD) Cyanide (g/m3)	Zinc-Acid Soluble (g/m3)	Zinc-Dissolved (g/m3)
4/05/20	4		0.0002			1500		3	0.02	0.002	
10/05/20	4							3			
17/05/20	4							3			
24/05/20	4							3			
1/06/20	4		0.0001			550		3	0.02	0.0015	
14/06/20	4							3			
22/06/20	4							3			
2/07/20	4							3			
6/07/20	4		0.0001			900		3	0.02	0.001	
12/07/20	4							3			
19/07/20	4							3			
26/07/20	4							3			
3/08/20	4		0.0001			1010		3	0.02	0.001	
9/08/20	4							3			
11/08/20	4					960					
18/08/20	4							3			
23/08/20	4							3			
30/08/20	4							3			
7/09/20	4		0.0002			1320		3	0.02	0.002	
14/09/20	4							3			
20/09/20	4							3			
27/09/20	4							3			
5/10/20	4		0.0002			1430		3	0.02	0.002	
12/10/20	4							3			
20/10/20	4							3			
27/10/20	4							3			
2/11/20	4		0.0002			1800		3	0.02	0.002	
9/11/20	4							3			
16/11/20	4							3			
23/11/20	2							3			
3/12/20	4		0.0002			1510		3	0.02	0.002	
6/12/20	4							3			
15/12/20	4							3			
21/12/20	4							3			
28/12/20	4							3			
4/01/21	4		0.0002			1810		3	0.02	0.002	
11/01/21	4							3			
18/01/21	4							3			
24/01/21	4							3			
1/02/21	4	7.1	0.0002	0.0002	41	2000	1.55	3	0.002	0.002	0.002
2/02/21	4							3			
14/02/21	2							3			
21/02/21	4							3			
1/03/21	4		0.0002			1730		3	0.02	0.002	
7/03/21	4							3			
15/03/21	4							3			
22/03/21	4							3			
28/03/21	4							3			
6/04/21	4		0.0001			1950		3	0.02	0.001	
11/04/21	2							3			
18/04/21	4							3			
27/04/21	4							6			

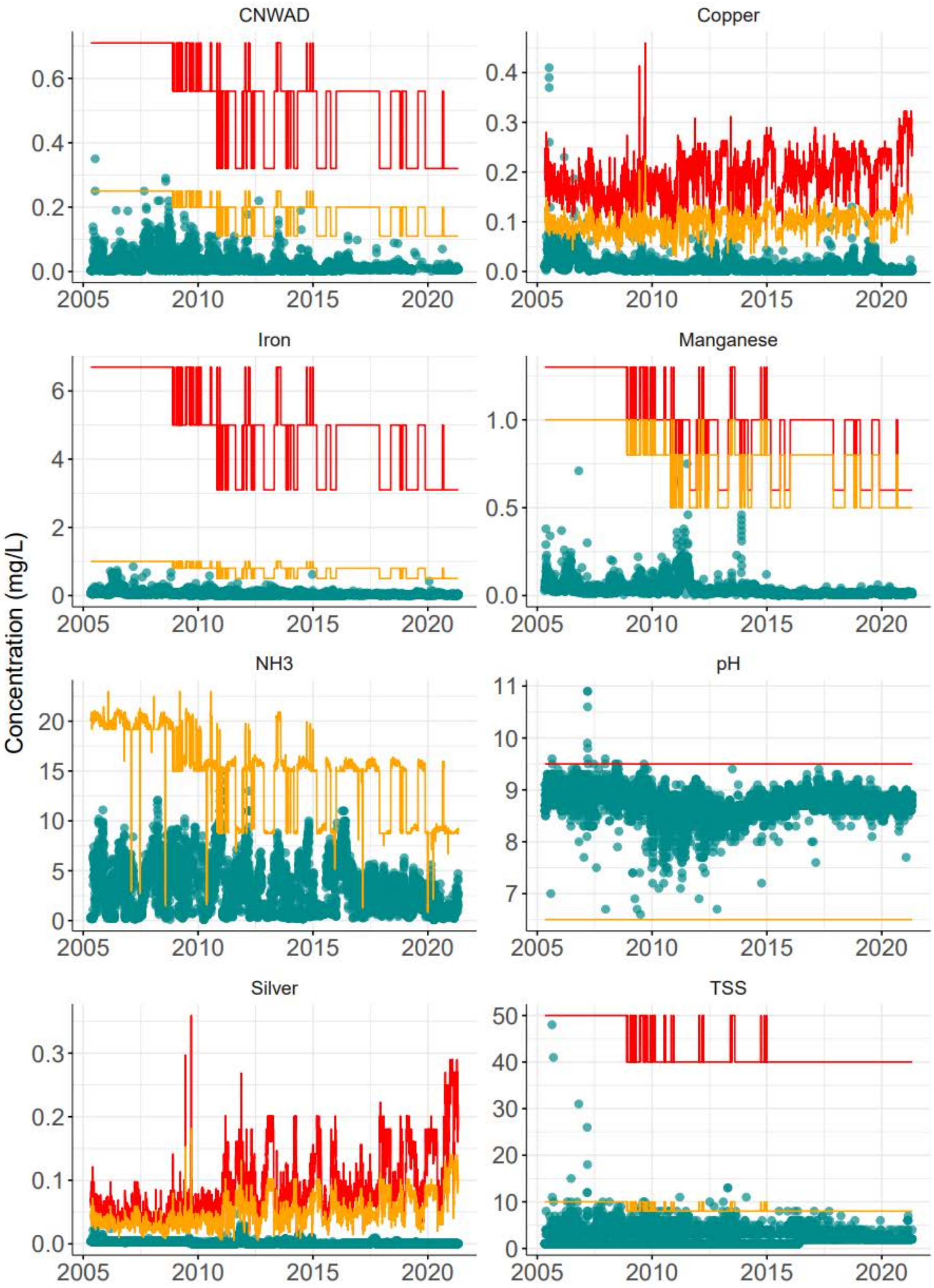

Figure C1 *Daily pH, total suspended solids, ammonia, weak acid dissociable cyanide (CNWAD), copper, iron, manganese and silver concentrations in treated water between 2005 and 2021 with maximum (red) and normal (orange) compliance values.*

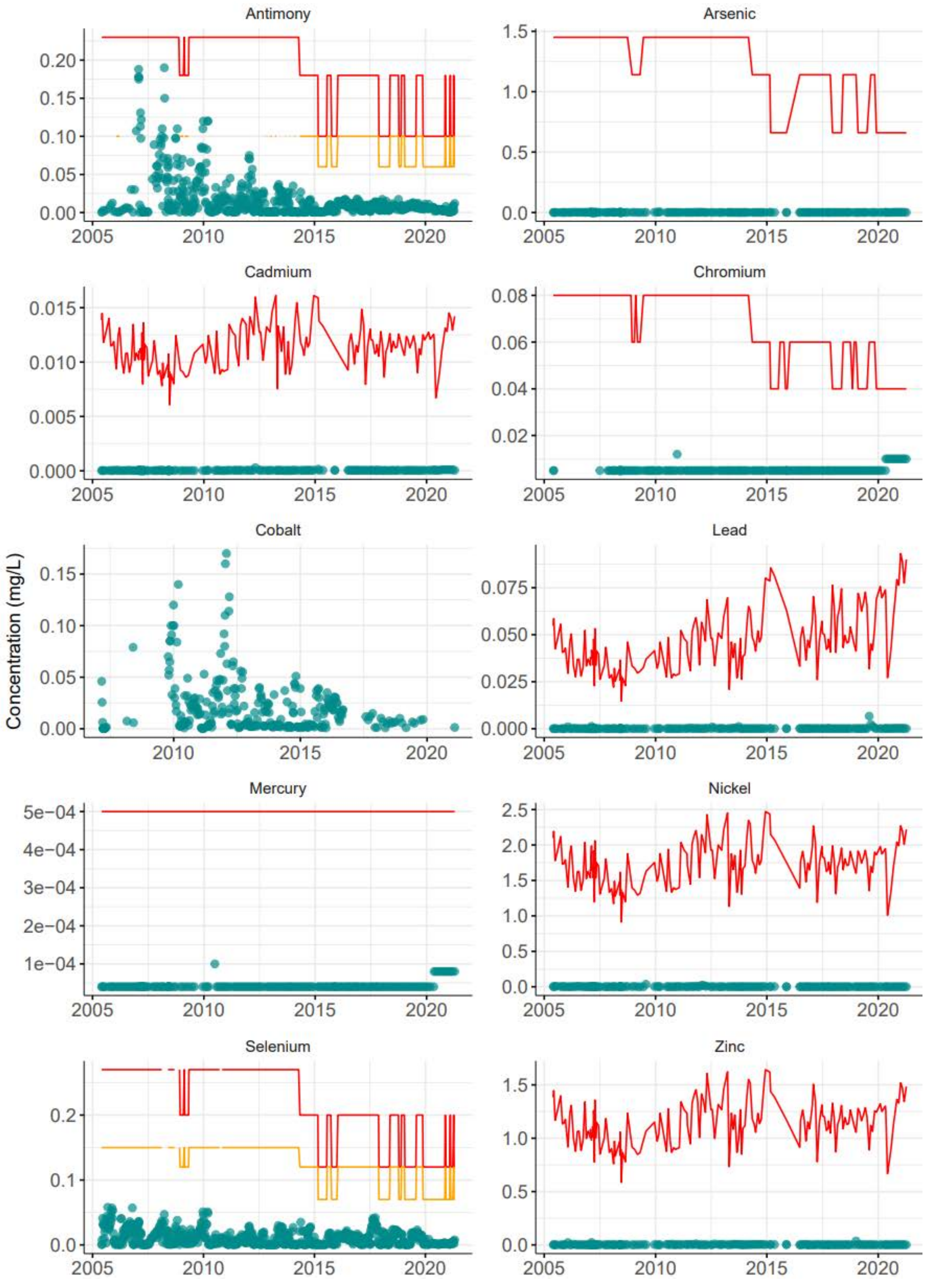

Figure C2 Acid-soluble concentrations of metals and metalloids in treated water between 2005 and 2021 with maximum (red) and normal (orange) compliance values.

APPENDIX D: Receiving Water Quality Data

Table D1 Receiving physiochemical water quality between 1 May 2020 and 30 April 2021.

Date	Site	FLS EC (mS/m)	pH (lab)	FLS Temp	Total Suspended Solids (g/m3)	pH (pH unit)	Electrical Conductivity (EC) (mS/m)
3/05/2020	OC2	13.6	7	15.3	3	6.61	9.9
10/05/2020	OC2	14.2	7.6	15.7	3		
17/05/2020	OC2	15	7.1	14.1	3	7.26	
24/05/2020	OC2	24.7	7.2	13.9	3	7.04	
2/06/2020	OC2	8.1	6.9	14.2	5	6.88	10.1
7/06/2020	OC2	7.4	7	10.9	3	6.85	
15/06/2020	OC2	8.4	7.3	12.1	3	7.28	
22/06/2020	OC2	6.8	7.5	12.9	3	7.09	
2/07/2020	OC2		6.7		3	7.54	
6/07/2020	OC2	8.06	6.4	12.7	16	6.23	8.5
13/07/2020	OC2	7.8	6.5	12.4	3	6.71	
20/07/2020	OC2	7.5	7.3	14.4	6	6.74	
26/07/2020	OC2	7.6	7.5	10.9	3	6.82	
3/08/2020	OC2	7.3	6.8	11.5	3	8.06	7.8
9/08/2020	OC2	8.4	7.5	11.1	3	7.05	
18/08/2020	OC2	8.6	7.5	13.5	3	6.7	
24/08/2020	OC2	8.1	7.1	13	4	7.74	
30/08/2020	OC2	8.3	6.9	12.3	3	7.37	
8/09/2020	OC2	8.4	7	11.3	3		8
14/09/2020	OC2	8.4	7.4	12.4	3	8.83	
21/09/2020	OC2	8.6	7.1	13.2	3	6.58	
27/09/2020	OC2	8.2	7	15.7	3	6.98	
5/10/2020	OC2	8.4	7	14.3	3	7.45	8.2
12/10/2020	OC2	8.4	7.4	15	3	7.98	
20/10/2020	OC2	8.453	7.4	16.4	3	6.84	
27/10/2020	OC2		7.2	17.5	3	7.38	
2/11/2020	OC2	8.7	7.5	20.2	3	7.81	8.2
9/11/2020	OC2	8	7	16	5	7.22	
16/11/2020	OC2	8.1	7.2	17	3	7.84	
23/11/2020	OC2	7.3	7.4	16.3	3	6.78	
3/12/2020	OC2	8.3	7.2	17.6	3	6.86	8.1
6/12/2020	OC2	8.4	7.4	17.6	3	7.25	
15/12/2020	OC2	11.7	7.3	16.8	3	7.16	
21/12/2020	OC2	14.6	7.6	20.2	3	6.97	
29/12/2020	OC2	23.6	7.2	19.4	3	6.53	
5/01/2021	OC2	8.2	7.3	22.8	3	6.85	8.2
11/01/2021	OC2	8.6	7.1	19.6	3	6.63	
18/01/2021	OC2	8.6	7.4	20.8	3	6.8	
25/01/2021	OC2	9.07	7.4	18.9	3	7.37	
2/02/2021	OC2	9.11	7.5	19.1	3	7.8	
9/02/2021	OC2	10.5	7.2	20.5	3	7.68	8.6
15/02/2021	OC2	9.53	7.1	20.6	3	6.98	
22/02/2021	OC2	8.9	7.1	18.7	3	7.2	
2/03/2021	OC2	24.9	6.8	22.6	3	6.97	8.4
8/03/2021	OC2	9.5	7.2	16.4	3	7.75	
15/03/2021	OC2	9.3	7.2	18	3	7.29	
22/03/2021	OC2	10	8.1	17.2	3	6.16	
29/03/2021	OC2	8.2	7.1	18.6	3	7	
7/04/2021	OC2	8.5	7.6	16.5	3	7.27	9.1
12/04/2021	OC2	8.2	7.4	19.4	3	6.96	
19/04/2021	OC2	8.3	7	14.5	3	7.08	

Date	Site	FLS EC (mS/m)	pH (lab)	FLS Temp	Total Suspended Solids (g/m3)	pH (pH unit)	Electrical Conductivity (EC) (mS/m)
27/04/2021	OC2	8.4	7.4	14.6	3	5.59	
3/05/2020	OH3	11.2	7.2	15.3	3	7.8	10.3
2/06/2020	OH3	8.2	7.1	14.2	5	7.7	10.3
6/07/2020	OH3	8.27	6.8	12.7	17	6.95	8.2
3/08/2020	OH3	7.7	6.7	11.1	3	6.01	7.8
8/09/2020	OH3	8.4	7	11.6	3	6.64	8.3
5/10/2020	OH3	8.4	7	14.4	3	7.04	8.4
2/11/2020	OH3	10.3	8.7	18	3	7.23	8.2
3/12/2020	OH3	8.4	7.2	17.4	3	7.13	8.1
5/01/2021	OH3	13.6	7.3	23	3	7.38	13.7
9/02/2021	OH3	14.5	7.2	20.4	3	7.43	8.6
15/02/2021	OH3	7.89	6.4	14.8	300	6.58	5.4
2/03/2021	OH3	11.7	6.9	22.4	3	6.59	8.4
7/04/2021	OH3	8.6	7.4	16.7	3	7.21	9.1
3/05/2020	OH5	24.6	7	15.7	3	6.53	27.4
10/05/2020	OH5	58.1	7.3	16.2	3		
17/05/2020	OH5	47.6	7.4	14.3	3	7.04	
24/05/2020	OH5	18.7	7.2	14	3	7.21	
2/06/2020	OH5	12.7	6.9	14.5	3	6.93	15.7
7/06/2020	OH5	7.7	6.9	11.1	3	7.07	
15/06/2020	OH5	37.6	6.8	13	3	7.22	
22/06/2020	OH5	29.8	7.8	13.1	3	7.06	
2/07/2020	OH5		6.5		3	7.81	
6/07/2020	OH5	20.5	7.6	12.3	14	6.66	20.6
13/07/2020	OH5	22.7	6.5	12.7	3	6.94	
20/07/2020	OH5	12	6.8	14.6	4	6.82	
26/07/2020	OH5	18.6	7.3	11.3	3	6.6	
3/08/2020	OH5	24.9	6.9	12.9	3	7.59	26
9/08/2020	OH5	24.5	7.1	11.5	3	7.2	
18/08/2020	OH5	31.4	6.8	13.5	3	7.07	
24/08/2020	OH5	16.6	6.8	14.8	4	8.16	
30/08/2020	OH5	21.4	6.7	12.8	3	9.07	
8/09/2020	OH5	26.9	7.1	12.5	3		26
14/09/2020	OH5	43.3	7	13.5	3	9.02	
21/09/2020	OH5	49	7.2	14.8	3	6.85	
27/09/2020	OH5	50.4	6.6	15.9	3	6.82	
5/10/2020	OH5	46.6	7.1	15.2	3	8.69	46.5
12/10/2020	OH5	49	6.6	16	3	8.45	
20/10/2020	OH5	76.22	8.8	18.9	3	7.97	
27/10/2020	OH5		8.2	20.1	3	7.04	
2/11/2020	OH5	68.9	8.5	22	3	7.15	67.5
9/11/2020	OH5	31.1	7.1	16.4	5	8.03	
16/11/2020	OH5	29.1	8.4	18.1	3	7.73	
23/11/2020	OH5	52	8.6	17.9	3	7.55	
3/12/2020	OH5	80.5	7.4	18.9	3	7.74	80.4
6/12/2020	OH5	67.5	7.9	19.5	3	7.19	
15/12/2020	OH5	6.1	7.2	20.4	3	7.85	
21/12/2020	OH5	57.4	7.5	23.5	3	8.18	
29/12/2020	OH5	67.2	7.7	20.7	3	6.54	
5/01/2021	OH5	90.1	7.5	24.7	3	6.23	92.9
11/01/2021	OH5	59.7	7.1	21.6	3	7.04	
18/01/2021	OH5	111.3	7.3	22.5	3	6.66	
25/01/2021	OH5	122.8	7.3	19.9	3	7.79	

Date	Site	FLS EC (mS/m)	pH (lab)	FLS Temp	Total Suspended Solids (g/m3)	pH (pH unit)	Electrical Conductivity (EC) (mS/m)
2/02/2021	OH5	134	7.6	21.5	3	7.23	
9/02/2021	OH5	105.4	7.8	22.6	3	9.13	109.7
15/02/2021	OH5	22	7.3	20.6	8	8.56	
15/02/2021	OH5	9.21	6.5	14.7	270	7.26	7
22/02/2021	OH5	59.7	6.9	20.4	3	7.86	
2/03/2021	OH5	79.8	7.1	22.9	3	7.96	82.8
8/03/2021	OH5	107	7.1	18.8	3	7.29	
15/03/2021	OH5	103.1	7.4	20.2	4	7.31	
22/03/2021	OH5	86.7	8.8	20	3	7.21	
29/03/2021	OH5	92.5	8	19.8	3	7.24	
7/04/2021	OH5	91	7.3	17	3	7.79	9.6
12/04/2021	OH5	88.8	7.7	20.8	3	5.99	
19/04/2021	OH5	91.1	7.4	17.2	3	6.61	
27/04/2021	OH5	76.8	7.4	14.4	3	7.28	
3/05/2020	OH6	56.7	7	16.1	3	6.62	59.5
10/05/2020	OH6	58.9	7	16	3		
17/05/2020	OH6	42.8	7.7	14.5	3	6.97	
24/05/2020	OH6	54.1	7.1	14.4	3	7.09	
2/06/2020	OH6	13.9	6.6	14.4	5	6.95	17.3
7/06/2020	OH6	9.4	6.6	11.4	3	6.94	
15/06/2020	OH6	42.9	7.1	13	3	7.3	
22/06/2020	OH6	15.5	6.4	13.1	3	7.07	
2/07/2020	OH6		6.5		3	6.86	
6/07/2020	OH6	19.4	6.6	12.8	15	6.46	19.6
13/07/2020	OH6	21.6	6.6	12.9	3	6.8	
20/07/2020	OH6	12.3	6.6	14.5	4	6.97	
26/07/2020	OH6	16.5	6.6	11.3	3	6.74	
3/08/2020	OH6	12.5	6.6	12.5	3	7.56	23.3
9/08/2020	OH6	23.2	6.8	11.7	3	7.26	
18/08/2020	OH6	24	6.7	13.7	3	7.21	
24/08/2020	OH6	16.7	6.8	13.7	5	7.78	
30/08/2020	OH6	18.8	6.6	12.9	3	8	
8/09/2020	OH6	24.7	7	13.3	3		24.3
14/09/2020	OH6	35.4	7.3	12.9	3	7.36	
21/09/2020	OH6	40.5	7.1	15	3	6.84	
27/09/2020	OH6	40	6.7	15.4	3	8.58	
5/10/2020	OH6	59.1	6.6	16.1	3	7.73	59.1
12/10/2020	OH6	44.1	7.2	16.2	3	7.91	
20/10/2020	OH6	67.76	7.3	18	3	8.71	
27/10/2020	OH6		7.3	20	3	6.89	
2/11/2020	OH6	9.7	7.4	19.6	3	7.55	54.2
9/11/2020	OH6	30.4	7.1	17.2	3	7.8	
16/11/2020	OH6	36.7	7.1	18.6	3	7.28	
23/11/2020	OH6	43.3	6.9	17.6	3	7.37	
3/12/2020	OH6	78.4	7.3	18.8	3	6.74	78.5
6/12/2020	OH6	76.6	8.5	19.7	3	7.09	
15/12/2020	OH6	66.9	7.1	18.5	3	7.17	
21/12/2020	OH6	47.7	7.6	22	3	7.08	
29/12/2020	OH6	21	7.2	21	3	6.82	
5/01/2021	OH6	80.4	7.1	23.7	3	6.81	83.2
11/01/2021	OH6	108.3	7.1	23.1	3	6.87	
18/01/2021	OH6	123.2	7	22.9	3	7.5	
25/01/2021	OH6	129.5	7	20	3	6.99	

Date	Site	FLS EC (mS/m)	pH (lab)	FLS Temp	Total Suspended Solids (g/m3)	pH (pH unit)	Electrical Conductivity (EC) (mS/m)
2/02/2021	OH6	135.7	7.2	21	3	8.66	
9/02/2021	OH6	12.08	7.4	21.9	3	7.38	77.1
15/02/2021	OH6	21.2	7.1	21.2	3	7.22	
22/02/2021	OH6	50.5	6.8	20	3	7.7	
2/03/2021	OH6	85.8	6.9	22.7	3	7.61	75.2
8/03/2021	OH6	116	6.9	18.8	3	7.19	
15/03/2021	OH6	107.4	7.3	20.1	3		
22/03/2021	OH6	96.2	7.5	19.9	3	6.38	
29/03/2021	OH6	99.5	6.8	19	5	6.88	
7/04/2021	OH6	93.3	7.2	18.2	3	6.84	99.8
12/04/2021	OH6	90.7	7.4	19.8	3	7.16	
19/04/2021	OH6	98.5	7.1	17.5	3	7.3	
27/04/2021	OH6	78.4	7.1	14.7	3	6.51	
3/05/2020	RU1		7		3	6.6	21
2/06/2020	RU1	15.1	6.6	14.6	5	8.37	24.5
6/07/2020	RU1	16.7	6.4	13.3	10	8.33	20.2
3/08/2020	RU1	10.7	6.6	13.6	3	6	11.4
8/09/2020	RU1	11.4	6.8	12.9	3	8	11
5/10/2020	RU1	13.9	7	17.9	3		14.2
2/11/2020	RU1	9.6	7.1	18.2	3		13.5
3/12/2020	RU1	11.8	6.9	18.3	3		12.8
5/01/2021	RU1	14.2	7.2	20.4	3		14.4
9/02/2021	RU1	20.3	7.3	21.2	3		19.4
2/03/2021	RU1	15.8	7	22.5	3		13
7/04/2021	RU1	14.2	7.2	18.2	3		14.9

Table D2 *Receiving water nitrogen and phosphorus water quality between 1 May 2020 and 30 April 2021.*

Date	Site	Nitrate-N (g/m3)	Nitrite-N (g/m3)	Nitrate-N + Nitrite-N (g/m3)	Free Ammonia (g/m3 at 10°C)	Nitrogen-Total Ammoniacal (g/m3)	Dissolved Inorganic Nitrogen (g/m3)	Total Kjeldahl Nitrogen (TKN) (g/m3)	Phosphorus-Total (g/m3)	Reactive Phosphorus-Dissolved (g/m3)
3/05/2020	OC2	0.2	0.1	0.2		0.01	0.21	0.13	0.012	0.004
2/06/2020	OC2	2.3	0.1	2.3		0.033	2.33	0.23	0.016	0.007
6/07/2020	OC2	0.97	0.1	0.98		0.043	1.02	0.27	0.058	0.011
3/08/2020	OC2	0.83	0.1	0.83		0.01	0.84	0.1	0.009	0.004
8/09/2020	OC2	0.75	0.1	0.75		0.01	0.76	0.1	0.006	0.004
5/10/2020	OC2	0.39	0.1	0.39		0.01	0.4	0.18	0.009	0.004
2/11/2020	OC2	0.15	0.1	0.15		0.01	0.16	0.1	0.012	0.004
3/12/2020	OC2	0.18	0.1	0.18		0.01	0.19	0.1	0.007	0.004
5/01/2021	OC2	0.1	0.1	0.1		0.01	0.11	0.16	0.013	0.004
9/02/2021	OC2	0.1	0.1	0.1		0.01		0.1	0.012	0.004
2/03/2021	OC2	0.19	0.1	0.19		0.01		0.1	0.011	0.004
7/04/2021	OC2	0.17	0.1	0.17		0.01		0.1	0.006	0.004
3/05/2020	OH3	0.18	0.1	0.18		0.01		0.18	0.016	0.004
2/06/2020	OH3	2.3	0.1	2.3		0.026		0.2	0.018	0.007
6/07/2020	OH3	0.98	0.1	0.98		0.032		0.25	0.05	0.009
3/08/2020	OH3	0.81	0.1	0.82		0.01		0.1	0.011	0.005
8/09/2020	OH3	0.74	0.1	0.74		0.01		0.1	0.006	0.004
5/10/2020	OH3	0.39	0.1	0.39		0.01		0.1	0.005	0.005

Date	Site	Nitrate-N (g/m3)	Nitrite-N (g/m3)	Nitrate-N + Nitrite-N (g/m3)	Free Ammonia (g/m3 at 10°C)	Nitrogen-Total Ammoniacal (g/m3)	Dissolved Inorganic Nitrogen (g/m3)	Total Kjeldahl Nitrogen (TKN) (g/m3)	Phosphorus-Total (g/m3)	Reactive Phosphorus-Dissolved (g/m3)
2/11/2020	OH3	0.1	0.1	0.1		0.01		0.1	0.017	0.004
3/12/2020	OH3	0.15	0.1	0.16		0.01		0.1	0.007	0.004
5/01/2021	OH3	0.1	0.1	0.1		0.01		0.18	0.012	0.004
9/02/2021	OH3	0.1	0.1	0.1		0.01		0.13	0.013	0.004
15/02/2021	OH3	0.74	0.1	0.75	5.10E-05	0.092		0.8	0.55	0.041
2/03/2021	OH3	0.19	0.1	0.19		0.012		0.14	0.011	0.004
7/04/2021	OH3	0.15	0.1	0.15		0.01		0.11	0.006	0.004
3/05/2020	OH5	0.22	0.1	0.23		0.047	0.28	0.24	0.011	0.004
2/06/2020	OH5	2.8	0.1	2.8		0.067	2.87	0.18	0.018	0.005
6/07/2020	OH5	1.14	0.1	1.16		0.071	1.23	0.28	0.05	0.008
3/08/2020	OH5	0.96	0.1	0.98		0.041	1.02	0.1	0.027	0.005
8/09/2020	OH5	0.89	0.1	0.9		0.029	0.93	0.1	0.004	0.004
5/10/2020	OH5	0.57	0.1	0.58		0.036	0.62	0.19	0.01	0.004
2/11/2020	OH5	0.22	0.1	0.23		0.032	0.26	0.1	0.04	0.004
3/12/2020	OH5	1.59	0.13	1.72		0.31	2.03	0.63	0.005	0.004
5/01/2021	OH5	1.86	0.1	1.89		0.25	2.14	0.4	0.009	0.004
9/02/2021	OH5	0.62	0.1	0.65		0.27		0.42	0.007	0.004
15/02/2021	OH5	0.76	0.1	0.77	7.00E-05	0.101		0.87	0.65	0.035
2/03/2021	OH5	1.4	0.15	1.55		0.146		0.3	0.007	0.004
7/04/2021	OH5	0.15	0.1	0.16		0.01		0.12	0.007	0.004
3/05/2020	OH6	0.41	0.1	0.45		0.06	0.51	0.18	0.01	0.004
2/06/2020	OH6	2.9	0.1	2.9		0.072	2.97	0.27	0.024	0.007
6/07/2020	OH6	1.18	0.1	1.19		0.047	1.24	0.25	0.041	0.005
3/08/2020	OH6	1.09	0.1	1.1		0.028	1.13	0.1	0.004	0.004
8/09/2020	OH6	0.94	0.1	0.94		0.015	0.96	0.1	0.004	0.004
5/10/2020	OH6	0.7	0.1	0.71		0.034	0.74	0.1	0.004	0.004
2/11/2020	OH6	0.22	0.1	0.23		0.014	0.24	0.1	0.009	0.004
3/12/2020	OH6	1.56	0.16	1.72		0.28	2	0.64	0.006	0.004
5/01/2021	OH6	2.1	0.1	2.2		0.111	2.31	0.32	0.007	0.004
9/02/2021	OH6	0.21	0.1	0.21		0.011		0.12	0.007	0.004
2/03/2021	OH6	1.03	0.11	1.13		0.08		0.22	0.01	0.004
7/04/2021	OH6	0.63	0.12	0.75		0.097		0.28	0.005	0.004
3/05/2020	RU1	0.1	0.1	0.1		0.01		0.1	0.008	0.004
2/06/2020	RU1	3.2	0.1	3.2		0.091		0.36	0.042	0.004
6/07/2020	RU1	1.48	0.1	1.48		0.036		0.37	0.036	0.005
3/08/2020	RU1	1.44	0.1	1.44		0.01		0.11	0.009	0.005
8/09/2020	RU1	1.05	0.1	1.05		0.01		0.1	0.008	0.004
5/10/2020	RU1	0.33	0.1	0.33		0.01		0.1	0.009	0.005
2/11/2020	RU1	0.1	0.1	0.1		0.01		0.11	0.016	0.004
3/12/2020	RU1	0.3	0.1	0.3		0.01		0.11	0.009	0.004
5/01/2021	RU1	0.1	0.1	0.1		0.01		0.15	0.011	0.004
9/02/2021	RU1	0.1	0.1	0.1		0.01		0.11	0.01	0.004
2/03/2021	RU1	0.13	0.1	0.13		0.01		0.11	0.017	0.005
7/04/2021	RU1	0.1	0.1	0.1		0.01		0.12	0.006	0.004

Table D3 Receiving water quality between 1 May 2020 and 30 April 2021.

Date	Site	Cyanide-Total (g/m3)	Weak Acid Dissociable (WAD) Cyanide (g/m3)	Hardness-Total (g/m3 as CaCO3)	Iron-Dissolved (g/m3)	Lead-Dissolved (g/m3)	Magnesium-Dissolved (g/m3)	Manganese-Dissolved (g/m3)	Mercury-Acid Soluble (g/m3)	Mercury-Dissolved (g/m3)	Nickel-Dissolved (g/m3)	Silver-Dissolved (g/m3)	Zinc-Dissolved (g/m3)
3/05/2020	OC2	0.002	0.002	18.2	0.1	0.0001	2.3	0.0043	8.00E-05	8.00E-05	0.0005	0.0001	0.0012
2/06/2020	OC2	0.002	0.002	19.2	0.05	0.0001	2.3	0.046	8.00E-05	8.00E-05	0.0005	0.0001	0.0054
6/07/2020	OC2	0.002	0.002	14.9	0.11	0.0001	1.74	0.0179	8.00E-05	8.00E-05	0.0005	0.0001	0.0045
3/08/2020	OC2	0.002	0.002	14.9	0.07	0.0001	1.81	0.0105	8.00E-05	8.00E-05	0.0005	0.0001	0.0028
8/09/2020	OC2	0.002	0.002	13.8	0.07	0.0001	1.66	0.0096	8.00E-05	8.00E-05	0.0005	0.0001	0.002
5/10/2020	OC2	0.002	0.002	15.6	0.1	0.0001	1.94	0.007	8.00E-05	8.00E-05	0.0005	0.0001	0.0014
2/11/2020	OC2	0.002	0.002	16.4	0.16	0.0001	1.99	0.002	8.00E-05	8.00E-05	0.0005	0.0001	0.0036
3/12/2020	OC2	0.002	0.002	15.5	0.13	0.0001	1.94	0.0019	8.00E-05	8.00E-05	0.0005	0.0001	0.001
5/01/2021	OC2	0.002	0.002	15.1	0.21	0.0001	1.98	0.01	8.00E-05	8.00E-05	0.0005	0.0001	0.0032
9/02/2021	OC2	0.002	0.002	18.1	0.19	0.0001	2.3	0.0099	8.00E-05	8.00E-05	0.0005	0.0001	0.0011
2/03/2021	OC2	0.002	0.002	16.8	0.25	0.0001	1.86	0.0147	8.00E-05	8.00E-05	0.0005	0.0001	0.0012
7/04/2021	OC2	0.002	0.002	17.9	0.12	0.0001	2.2	0.0053	8.00E-05	8.00E-05	0.0005	0.0001	0.0012
3/05/2020	OH3	0.002	0.002	18.4	0.1	0.0001	2.3	0.0046	8.00E-05	8.00E-05	0.0005	0.0001	0.006
2/06/2020	OH3	0.002	0.002	20	0.05	0.0001	2.4	0.047	8.00E-05	8.00E-05	0.0005	0.0001	0.0067
6/07/2020	OH3	0.002	0.002	15	0.1	0.0001	1.73	0.0175	8.00E-05	8.00E-05	0.0005	0.0001	0.0045
3/08/2020	OH3	0.002	0.002	14.9	0.06	0.0001	1.81	0.0109	8.00E-05	8.00E-05	0.0005	0.0001	0.0029
8/09/2020	OH3	0.002	0.002	14.5	0.07	0.0001	1.8	0.0098	8.00E-05	8.00E-05	0.0005	0.0001	0.0026
5/10/2020	OH3	0.002	0.002	16.2	0.1	0.0001	2	0.006	8.00E-05	8.00E-05	0.0005	0.0001	0.0015
2/11/2020	OH3	0.002	0.002	15.9	0.18	0.0001	1.97	0.0035	8.00E-05	8.00E-05	0.0005	0.0001	0.001
3/12/2020	OH3	0.002	0.002	15.7	0.13	0.0001	1.97	0.0009	8.00E-05	8.00E-05	0.0005	0.0001	0.001
5/01/2021	OH3	0.002	0.002	38	0.19	0.0001	3.6	0.02	8.00E-05	8.00E-05	0.0005	0.0001	0.0021
9/02/2021	OH3	0.002	0.002	17.5	0.2	0.0001	2.2	0.0097	8.00E-05	8.00E-05	0.0005	0.0001	0.001
15/02/2021	OH3	0.02	0.02	7.3	0.33	0.00015	0.85	0.069	8.00E-05	8.00E-05	0.0005	0.0001	0.0031
2/03/2021	OH3	0.002	0.002	16.7	0.24	0.0001	1.84	0.0123	8.00E-05	8.00E-05	0.0005	0.0001	0.0013
7/04/2021	OH3	0.002	0.002	18.4	0.12	0.0001	2.2	0.004	8.00E-05	8.00E-05	0.0005	0.0001	0.001
3/05/2020	OH5	0.002	0.002	88	0.09	0.0001	4.9	0.0091	8.00E-05	8.00E-05	0.0005	0.0001	0.0011
2/06/2020	OH5	0.002	0.002	42	0.04	0.0001	3.2	0.047	8.00E-05	8.00E-05	0.0005	0.0001	0.0051
6/07/2020	OH5	0.002	0.002	66	0.08	0.0001	3.8	0.0183	8.00E-05	8.00E-05	0.0005	0.0001	0.0043

Date	Site	Cyanide-Total (g/m3)	Weak Acid Dissociable (WAD) Cyanide (g/m3)	Hardness-Total (g/m3 as CaCO3)	Iron-Dissolved (g/m3)	Lead-Dissolved (g/m3)	Magnesium-Dissolved (g/m3)	Manganese-Dissolved (g/m3)	Mercury-Acid Soluble (g/m3)	Mercury-Dissolved (g/m3)	Nickel-Dissolved (g/m3)	Silver-Dissolved (g/m3)	Zinc-Dissolved (g/m3)
3/08/2020	OH5	0.002	0.002	96	0.05	0.0001	4.7	0.0108	8.00E-05	8.00E-05	0.0005	0.0001	0.0024
8/09/2020	OH5	0.002	0.002	88	0.06	0.0001	3.9	0.0098	8.00E-05	8.00E-05	0.0005	0.0001	0.0021
5/10/2020	OH5	0.002	0.002	189	0.08	0.0001	8.2	0.0069	8.00E-05	8.00E-05	0.0005	0.0001	0.0016
2/11/2020	OH5	0.002	0.002	300	0.08	0.0001	11	0.0047	8.00E-05	8.00E-05	0.0005	0.0001	0.0025
3/12/2020	OH5	0.002	0.002	370	0.07	0.0001	14.8	0.0047	8.00E-05	8.00E-05	0.0005	0.0001	0.001
5/01/2021	OH5	0.002	0.002	470	0.13	0.0001	15.8	0.021	8.00E-05	8.00E-05	0.0005	0.0001	0.0014
9/02/2021	OH5	0.002	0.002	600	0.11	0.0001	31	0.0097	8.00E-05	8.00E-05	0.0005	0.0001	0.0021
15/02/2021	OH5	0.02	0.02	13.5	0.31	0.00018	1.2	0.083	8.00E-05	8.00E-05	0.0005	0.0001	0.0037
2/03/2021	OH5	0.002	0.002	370	0.14	0.0001	16.5	0.0162	8.00E-05	8.00E-05	0.0005	0.0001	0.001
7/04/2021	OH5	0.002	0.002	20	0.13	0.0001	2.3	0.0063	8.00E-05	8.00E-05	0.0005	0.0001	0.0013
3/05/2020	OH6	0.002	0.002	250	0.06	0.0001	10.2	0.023	8.00E-05	8.00E-05	0.0005	0.0001	0.0051
2/06/2020	OH6	0.002	0.002	49	0.05	0.00017	3.7	0.083	8.00E-05	8.00E-05	0.001	0.0001	0.0076
6/07/2020	OH6	0.002	0.002	59	0.07	0.0001	3.5	0.041	8.00E-05	8.00E-05	0.0007	0.0001	0.0057
3/08/2020	OH6	0.002	0.002	82	0.05	0.0001	4.4	0.0154	8.00E-05	8.00E-05	0.0005	0.0001	0.0047
8/09/2020	OH6	0.002	0.002	84	0.06	0.0001	4.1	0.014	8.00E-05	8.00E-05	0.0005	0.0001	0.0031
5/10/2020	OH6	0.002	0.002	260	0.09	0.0001	11	0.0189	8.00E-05	8.00E-05	0.0005	0.0001	0.0025
2/11/2020	OH6	0.002	0.002	220	0.1	0.0001	8.6	0.0109	8.00E-05	8.00E-05	0.0005	0.0001	0.0026
3/12/2020	OH6	0.002	0.002	350	0.08	0.0001	14.2	0.005	8.00E-05	8.00E-05	0.0005	0.0001	0.0013
5/01/2021	OH6	0.002	0.002	390	0.12	0.0001	12.6	0.021	8.00E-05	8.00E-05	0.0005	0.0001	0.0014
9/02/2021	OH6	0.002	0.002	370	0.12	0.0001	20	0.026	8.00E-05	8.00E-05	0.0005	0.0001	0.0012
2/03/2021	OH6	0.002	0.002	350	0.16	0.0001	15.9	0.026	8.00E-05	8.00E-05	0.0005	0.0001	0.0018
7/04/2021	OH6	0.002	0.002	500	0.06	0.0001	26	0.0071	8.00E-05	8.00E-05	0.0005	0.0001	0.001
3/05/2020	RU1	0.002	0.002	31	0.08	0.0001	3.4	0.0127	8.00E-05	8.00E-05	0.0005	0.0001	0.0015
2/06/2020	RU1	0.002	0.002	69	0.07	0.0001	5.6	0.24	8.00E-05	8.00E-05	0.0031	0.0001	0.02
6/07/2020	RU1	0.002	0.002	63	0.07	0.0001	4	0.082	8.00E-05	8.00E-05	0.0009	0.0001	0.0112
3/08/2020	RU1	0.002	0.002	22	0.07	0.0001	2.4	0.034	8.00E-05	8.00E-05	0.0005	0.0001	0.0074
8/09/2020	RU1	0.002	0.002	19	0.07	0.0001	2.1	0.022	8.00E-05	8.00E-05	0.0005	0.0001	0.0043
5/10/2020	RU1	0.002	0.002	30	0.14	0.0001	2.9	0.024	8.00E-05	8.00E-05	0.0005	0.0001	0.003
2/11/2020	RU1	0.002	0.002	22	0.27	0.0001	2.5	0.02	8.00E-05	8.00E-05	0.0005	0.0001	0.0033
3/12/2020	RU1	0.002	0.002	21	0.24	0.00014	2.3	0.0189	8.00E-05	8.00E-05	0.0005	0.0001	0.0019
5/01/2021	RU1	0.002	0.002	22	0.28	0.0001	2.6	0.025	8.00E-05	8.00E-05	0.0005	0.0001	0.0019
9/02/2021	RU1	0.002	0.002	31	0.19	0.0001	3.6	0.025	8.00E-05	8.00E-05	0.0005	0.0001	0.0011

Date	Site	Cyanide-Total (g/m3)	Weak Acid Dissociable (WAD) Cyanide (g/m3)	Hardness-Total (g/m3 as CaCO3)	Iron-Dissolved (g/m3)	Lead-Dissolved (g/m3)	Magnesium-Dissolved (g/m3)	Manganese-Dissolved (g/m3)	Mercury-Acid Soluble (g/m3)	Mercury-Dissolved (g/m3)	Nickel-Dissolved (g/m3)	Silver-Dissolved (g/m3)	Zinc-Dissolved (g/m3)
2/03/2021	RU1	0.002	0.002	22	0.33	0.0001	2.3	0.04	8.00E-05	8.00E-05	0.0005	0.0001	0.0023
7/04/2021	RU1	0.002	0.002	24	0.14	0.0001	2.5	0.0194	8.00E-05	8.00E-05	0.0005	0.0001	0.0013

Table D4 Receiving water metal/metalloid concentrations between 1 May 2020 and 30 April 2021.

Date	Site	Antimony-Acid Soluble (g/m3)	Antimony-Dissolved (g/m3)	Fluoride (g/m3)	Selenium-Acid Soluble (g/m3)	Selenium-Dissolved (g/m3)	Arsenic-Dissolved (g/m3)	Cadmium-Dissolved (g/m3)	Chloride (g/m3)	Chromium-Hexavalent (g/m3)	Cobalt-Dissolved (g/m3)	Copper-Dissolved (g/m3)
3/05/2020	OC2	0.0002	0.0002			0.0002	0.001	5.00E-05	12	0.01	0.0002	0.0005
10/05/2020	OC2	0.0002	0.0002		0.001	0.001						
17/05/2020	OC2	0.0002	0.0002		0.001	0.001						
24/05/2020	OC2		0.0002		0.001	0.001						
2/06/2020	OC2	0.0002	0.0002			0.0002	0.001	5.00E-05	11	0.01	0.0003	0.0005
7/06/2020	OC2	0.0002	0.0002		0.001	0.001						
15/06/2020	OC2	0.0002	0.0002		0.001	0.001						
22/06/2020	OC2	0.0002	0.0002		0.001	0.001						
2/07/2020	OC2		0.0002		0.001	0.001						
6/07/2020	OC2	0.0002	0.0002			0.0002	0.001	5.00E-05	12.1	0.01	0.0002	0.0005
13/07/2020	OC2	0.0002	0.0002		0.001	0.001						
20/07/2020	OC2	0.0002	0.0002		0.001	0.001						
26/07/2020	OC2	0.0002	0.0002		0.001	0.001						
3/08/2020	OC2	0.0002	0.0002		0.001	0.0002	0.001	5.00E-05	10	0.01	0.0002	0.0005
9/08/2020	OC2	0.0002	0.0002		0.001	0.001						
18/08/2020	OC2	0.0002	0.0002		0.001	0.001						
24/08/2020	OC2	0.0002	0.0002		0.001	0.001						
30/08/2020	OC2		0.0002		0.001	0.001						
8/09/2020	OC2	0.0002	0.0002			0.0002	0.001	5.00E-05	13	0.01	0.0002	0.0005
14/09/2020	OC2	0.0002	0.0002		0.001	0.001						
21/09/2020	OC2	0.0002	0.0002		0.001	0.001						
27/09/2020	OC2		0.0002		0.001	0.001						
5/10/2020	OC2	0.0002	0.0002			0.0002	0.001	5.00E-05	12	0.01	0.0002	0.0005
12/10/2020	OC2	0.0002	0.0002		0.001	0.001						
20/10/2020	OC2	0.0002	0.0002		0.001	0.001						
27/10/2020	OC2		0.0002		0.001	0.001						
2/11/2020	OC2	0.0002	0.0002			0.0002	0.001	5.00E-05	12	0.01	0.0002	0.0005
9/11/2020	OC2	0.0002	0.0002		0.001	0.001						
16/11/2020	OC2	0.0002	0.0002		0.001	0.001						
23/11/2020	OC2		0.0002		0.001	0.001						

Date	Site	Antimony-Acid Soluble (g/m3)	Antimony-Dissolved (g/m3)	Fluoride (g/m3)	Selenium-Acid Soluble (g/m3)	Selenium-Dissolved (g/m3)	Arsenic-Dissolved (g/m3)	Cadmium-Dissolved (g/m3)	Chloride (g/m3)	Chromium-Hexavalent (g/m3)	Cobalt-Dissolved (g/m3)	Copper-Dissolved (g/m3)
3/12/2020	OC2	0.0002	0.0002			0.0002	0.001	5.00E-05	13	0.01	0.0002	0.0005
6/12/2020	OC2	0.0002	0.0002		0.001	0.001						
15/12/2020	OC2	0.0002	0.0002		0.001	0.001						
21/12/2020	OC2	0.0002	0.0002		0.001	0.001						
29/12/2020	OC2		0.0002		0.001	0.001						
5/01/2021	OC2	0.0002	0.0002			0.0002	0.001	5.00E-05	11	0.01	0.0002	0.0005
11/01/2021	OC2	0.0002	0.0002		0.001	0.001						
18/01/2021	OC2	0.0002	0.0002		0.001	0.001						
25/01/2021	OC2	0.0002	0.0002		0.001	0.001						
2/02/2021	OC2		0.0002		0.001	0.001						
9/02/2021	OC2	0.0002	0.0002			0.0002	0.001	5.00E-05	11	0.01	0.0002	0.0005
15/02/2021	OC2	0.0002	0.0002		0.001	0.001						
22/02/2021	OC2		0.0002		0.001	0.001						
2/03/2021	OC2	0.0002	0.0002			0.0002	0.001	5.00E-05	11	0.01	0.0002	0.0005
8/03/2021	OC2	0.0002	0.0002		0.001	0.001						
15/03/2021	OC2	0.0002	0.0002		0.001	0.001						
22/03/2021	OC2	0.0002	0.0002		0.001	0.001						
29/03/2021	OC2		0.0002		0.001	0.001						
7/04/2021	OC2	0.0004	0.0004			0.0002	0.001	5.00E-05	13	0.01	0.0002	0.0005
12/04/2021	OC2	0.0002	0.0002		0.002	0.002						
19/04/2021	OC2	0.0002	0.0002		0.001	0.001						
27/04/2021	OC2		0.0002		0.001	0.001						
3/05/2020	OH3		0.0002			0.0002	0.001	5.00E-05	12	0.01	0.0002	0.0005
2/06/2020	OH3		0.0002			0.0002	0.001	5.00E-05	11	0.01	0.0003	0.0005
6/07/2020	OH3	0.0002	0.0002			0.0002	0.001	5.00E-05	12.2	0.01	0.0002	0.0005
3/08/2020	OH3		0.0002		0.001	0.0002	0.001	5.00E-05	11	0.01	0.0002	0.0005
8/09/2020	OH3		0.0002			0.0002	0.001	5.00E-05	13	0.01	0.0002	0.0005
5/10/2020	OH3		0.0002			0.0002	0.001	5.00E-05	12	0.01	0.0002	0.0005
2/11/2020	OH3		0.0002			0.0002	0.001	5.00E-05	13	0.01	0.0002	0.0005
3/12/2020	OH3		0.0002			0.0002	0.001	5.00E-05	13	0.01	0.0002	0.0008
5/01/2021	OH3		0.0002			0.0002	0.001	5.00E-05	11	0.01	0.0002	0.0005
9/02/2021	OH3	0.0002	0.0002			0.0002	0.001	5.00E-05	11	0.01	0.0002	0.0005

Date	Site	Antimony-Acid Soluble (g/m3)	Antimony-Dissolved (g/m3)	Fluoride (g/m3)	Selenium-Acid Soluble (g/m3)	Selenium-Dissolved (g/m3)	Arsenic-Dissolved (g/m3)	Cadmium-Dissolved (g/m3)	Chloride (g/m3)	Chromium-Hexavalent (g/m3)	Cobalt-Dissolved (g/m3)	Copper-Dissolved (g/m3)
15/02/2021	OH3		0.0002	0.05	0.001	0.001	0.001	5.00E-05	6.7	0.001	0.0005	0.0012
2/03/2021	OH3		0.0002			0.0002	0.001	5.00E-05	11	0.01	0.0002	0.0005
7/04/2021	OH3		0.0003			0.0002	0.001	5.00E-05	13	0.01	0.0002	0.0005
3/05/2020	OH5	0.0009	0.001			0.0002	0.001	5.00E-05	13	0.01	0.0002	0.0005
10/05/2020	OH5	0.0011	0.001		0.001	0.001						
17/05/2020	OH5	0.0003	0.0003		0.001	0.001						
24/05/2020	OH5		0.0002		0.001	0.001						
2/06/2020	OH5	0.0002	0.0002			0.0002	0.001	5.00E-05	12	0.01	0.0004	0.0005
7/06/2020	OH5	0.0008	0.0009		0.001	0.001						
15/06/2020	OH5	0.0002	0.0002		0.001	0.001						
22/06/2020	OH5	0.0002	0.0002		0.001	0.001						
2/07/2020	OH5		0.0002		0.001	0.001						
6/07/2020	OH5	0.0002	0.0002			0.0002	0.001	5.00E-05	13.4	0.01	0.0002	0.0005
13/07/2020	OH5	0.0002	0.0002		0.001	0.001						
20/07/2020	OH5	0.0002	0.0002		0.001	0.001						
26/07/2020	OH5	0.0003	0.0003		0.001	0.001						
3/08/2020	OH5	0.0002	0.0003		0.001	0.0002	0.001	5.00E-05	10	0.01	0.0002	0.0005
9/08/2020	OH5	0.0004	0.0003		0.001	0.001						
18/08/2020	OH5	0.0002	0.0002		0.001	0.001						
24/08/2020	OH5	0.0002	0.0002		0.001	0.001						
30/08/2020	OH5		0.0002		0.001	0.001						
8/09/2020	OH5	0.0003	0.0003			0.0002	0.001	5.00E-05	14	0.01	0.0002	0.0005
14/09/2020	OH5	0.0003	0.0003		0.001	0.001						
21/09/2020	OH5	0.0004	0.0004		0.001	0.001						
27/09/2020	OH5		0.0004		0.001	0.001						
5/10/2020	OH5	0.0005	0.0005			0.0002	0.001	5.00E-05	15	0.01	0.0003	0.0005
12/10/2020	OH5	0.0005	0.0005		0.001	0.001						
20/10/2020	OH5	0.0006	0.0006		0.001	0.001						
27/10/2020	OH5		0.0004		0.001	0.001						
2/11/2020	OH5	0.0003	0.0004			0.0002	0.001	5.00E-05	16	0.01	0.0003	0.0006
9/11/2020	OH5	0.0002	0.0003		0.001	0.001						
16/11/2020	OH5	0.0003	0.0003		0.001	0.001						

Date	Site	Antimony-Acid Soluble (g/m3)	Antimony-Dissolved (g/m3)	Fluoride (g/m3)	Selenium-Acid Soluble (g/m3)	Selenium-Dissolved (g/m3)	Arsenic-Dissolved (g/m3)	Cadmium-Dissolved (g/m3)	Chloride (g/m3)	Chromium-Hexavalent (g/m3)	Cobalt-Dissolved (g/m3)	Copper-Dissolved (g/m3)
23/11/2020	OH5		0.0019		0.001	0.001						
3/12/2020	OH5	0.0003	0.0004			0.0014	0.001	5.00E-05	18	0.01	0.0017	0.0005
6/12/2020	OH5	0.0004	0.0004		0.001	0.001						
15/12/2020	OH5	0.0003	0.0003		0.001	0.001						
21/12/2020	OH5	0.0004	0.0004		0.001	0.001						
29/12/2020	OH5		0.0004		0.001	0.001						
5/01/2021	OH5	0.0002	0.0002			0.0002	0.001	5.00E-05	15	0.01	0.0002	0.0005
11/01/2021	OH5	0.0003	0.0003		0.001	0.001						
18/01/2021	OH5	0.0002	0.0002		0.001	0.001						
25/01/2021	OH5	0.0003	0.0002		0.001	0.001						
2/02/2021	OH5		0.0002		0.001	0.001						
9/02/2021	OH5	0.0002	0.0002			0.0002	0.001	5.00E-05	17	0.01	0.0004	0.0005
15/02/2021	OH5	0.0002	0.0002		0.001	0.001						
15/02/2021	OH5	0.0002	0.0002	0.05	0.001	0.001	0.001	5.00E-05	6.9	0.001	0.0006	0.0011
22/02/2021	OH5		0.0008		0.001	0.001						
2/03/2021	OH5	0.0017	0.0015			0.0004	0.001	5.00E-05	15	0.01	0.0009	0.0005
8/03/2021	OH5	0.0003	0.0003		0.001	0.001						
15/03/2021	OH5	0.0008	0.0009		0.001	0.001						
22/03/2021	OH5	0.0022	0.0023		0.001	0.001						
29/03/2021	OH5		0.0002		0.0014	0.0013						
7/04/2021	OH5	0.0021	0.0021			0.0002	0.001	5.00E-05	13	0.01	0.0002	0.0005
12/04/2021	OH5	0.0008	0.0008		0.002	0.002						
19/04/2021	OH5	0.0025	0.0025		0.001	0.001						
27/04/2021	OH5		0.0011		0.0016	0.0016						
3/05/2020	OH6	0.0011	0.0012			0.0003	0.001	5.00E-05	16	0.01	0.0011	0.0005
10/05/2020	OH6	0.0011	0.0011		0.001	0.001						
17/05/2020	OH6	0.0013	0.0015		0.001	0.001						
24/05/2020	OH6		0.0002		0.001	0.001						
2/06/2020	OH6	0.0002	0.0002			0.0002	0.001	5.00E-05	14	0.01	0.0006	0.0005
7/06/2020	OH6	0.0008	0.0008		0.001	0.001						
15/06/2020	OH6	0.0002	0.0002		0.001	0.001						
22/06/2020	OH6	0.0002	0.0002		0.001	0.001						

Date	Site	Antimony-Acid Soluble (g/m3)	Antimony-Dissolved (g/m3)	Fluoride (g/m3)	Selenium-Acid Soluble (g/m3)	Selenium-Dissolved (g/m3)	Arsenic-Dissolved (g/m3)	Cadmium-Dissolved (g/m3)	Chloride (g/m3)	Chromium-Hexavalent (g/m3)	Cobalt-Dissolved (g/m3)	Copper-Dissolved (g/m3)
2/07/2020	OH6		0.0002		0.001	0.001						
6/07/2020	OH6	0.0002	0.0002			0.0002	0.001	5.00E-05	14	0.01	0.0003	0.0005
13/07/2020	OH6	0.0002	0.0002		0.001	0.001						
20/07/2020	OH6	0.0002	0.0002		0.001	0.001						
26/07/2020	OH6	0.0002	0.0002		0.001	0.001						
3/08/2020	OH6	0.0002	0.0002		0.001	0.0002	0.001	5.00E-05	12	0.01	0.0002	0.0005
9/08/2020	OH6	0.0002	0.0002		0.001	0.001						
18/08/2020	OH6	0.0002	0.0002		0.001	0.001						
24/08/2020	OH6	0.0002	0.0002		0.001	0.001						
30/08/2020	OH6		0.0002		0.001	0.001						
8/09/2020	OH6	0.0002	0.0002			0.0002	0.001	5.00E-05	15	0.01	0.0003	0.0005
14/09/2020	OH6	0.0003	0.0003		0.001	0.001						
21/09/2020	OH6	0.0003	0.0003		0.001	0.001						
27/09/2020	OH6		0.0005		0.001	0.001						
5/10/2020	OH6	0.0004	0.0004			0.0002	0.001	5.00E-05	16	0.01	0.0006	0.0005
12/10/2020	OH6	0.0004	0.0004		0.001	0.001						
20/10/2020	OH6	0.0004	0.0004		0.001	0.001						
27/10/2020	OH6		0.0003		0.001	0.001						
2/11/2020	OH6	0.0003	0.0004			0.0002	0.001	5.00E-05	15	0.01	0.0006	0.0005
9/11/2020	OH6	0.0002	0.0002		0.001	0.001						
16/11/2020	OH6	0.0003	0.0002		0.001	0.001						
23/11/2020	OH6		0.0017		0.001	0.001						
3/12/2020	OH6	0.0004	0.0004			0.0013	0.001	5.00E-05	19	0.01	0.0017	0.0005
6/12/2020	OH6	0.0004	0.0004		0.001	0.001						
15/12/2020	OH6	0.0003	0.0003		0.001	0.001						
21/12/2020	OH6	0.0004	0.0004		0.001	0.001						
29/12/2020	OH6		0.0003		0.001	0.001						
5/01/2021	OH6	0.0003	0.0003			0.0002	0.001	5.00E-05	15	0.01	0.0003	0.0005
11/01/2021	OH6	0.0003	0.0003		0.001	0.001						
18/01/2021	OH6	0.0002	0.0002		0.001	0.001						
25/01/2021	OH6	0.0002	0.0002		0.001	0.001						
2/02/2021	OH6		0.0002		0.001	0.001						

Date	Site	Antimony-Acid Soluble (g/m3)	Antimony-Dissolved (g/m3)	Fluoride (g/m3)	Selenium-Acid Soluble (g/m3)	Selenium-Dissolved (g/m3)	Arsenic-Dissolved (g/m3)	Cadmium-Dissolved (g/m3)	Chloride (g/m3)	Chromium-Hexavalent (g/m3)	Cobalt-Dissolved (g/m3)	Copper-Dissolved (g/m3)
9/02/2021	OH6	0.0002	0.0002			0.0002	0.001	5.00E-05	14	0.01	0.0008	0.0005
15/02/2021	OH6	0.0002	0.0002		0.001	0.001						
22/02/2021	OH6		0.0007		0.001	0.001						
2/03/2021	OH6	0.0017	0.0015			0.0004	0.001	5.00E-05	15	0.01	0.0008	0.0005
8/03/2021	OH6	0.0005	0.0005		0.001	0.001						
15/03/2021	OH6	0.0009	0.001		0.001	0.001						
22/03/2021	OH6	0.0027	0.0028		0.001	0.001						
29/03/2021	OH6		0.0006		0.0016	0.0016						
7/04/2021	OH6	0.0021	0.0021			0.0003	0.001	5.00E-05	19	0.01	0.0009	0.0005
12/04/2021	OH6	0.001	0.0011		0.002	0.002						
19/04/2021	OH6	0.0023	0.0025		0.001	0.001						
27/04/2021	OH6		0.0002		0.0015	0.0014						
3/05/2020	RU1		0.0002			0.0004	0.001	5.00E-05	14	0.01	0.0054	0.0005
2/06/2020	RU1		0.0002			0.0005	0.001	0.00011	15	0.01	0.0021	0.0005
6/07/2020	RU1	0.0002	0.0002			0.0003	0.001	8.00E-05	15.8	0.01	0.0007	0.0005
3/08/2020	RU1		0.0002		0.001	0.0003	0.001	5.00E-05	13	0.01	0.0005	0.0005
8/09/2020	RU1		0.0002			0.0003	0.001	5.00E-05	17	0.01	0.0005	0.0005
5/10/2020	RU1		0.0002			0.0002	0.001	5.00E-05	15	0.01	0.0015	0.0005
2/11/2020	RU1		0.0002			0.0002	0.001	5.00E-05	16	0.01	0.0021	0.0005
3/12/2020	RU1		0.0002			0.0002	0.001	5.00E-05	17	0.01	0.0009	0.0005
5/01/2021	RU1		0.0002			0.0002	0.001	5.00E-05	15	0.01	0.0017	0.0005
9/02/2021	RU1		0.0002			0.0003	0.001	5.00E-05	14	0.01	0.0044	0.0005
2/03/2021	RU1		0.0002			0.0002	0.001	5.00E-05	15	0.01	0.0009	0.0005
7/04/2021	RU1					0.0002	0.001	5.00E-05	17	0.01	0.0017	0.0005

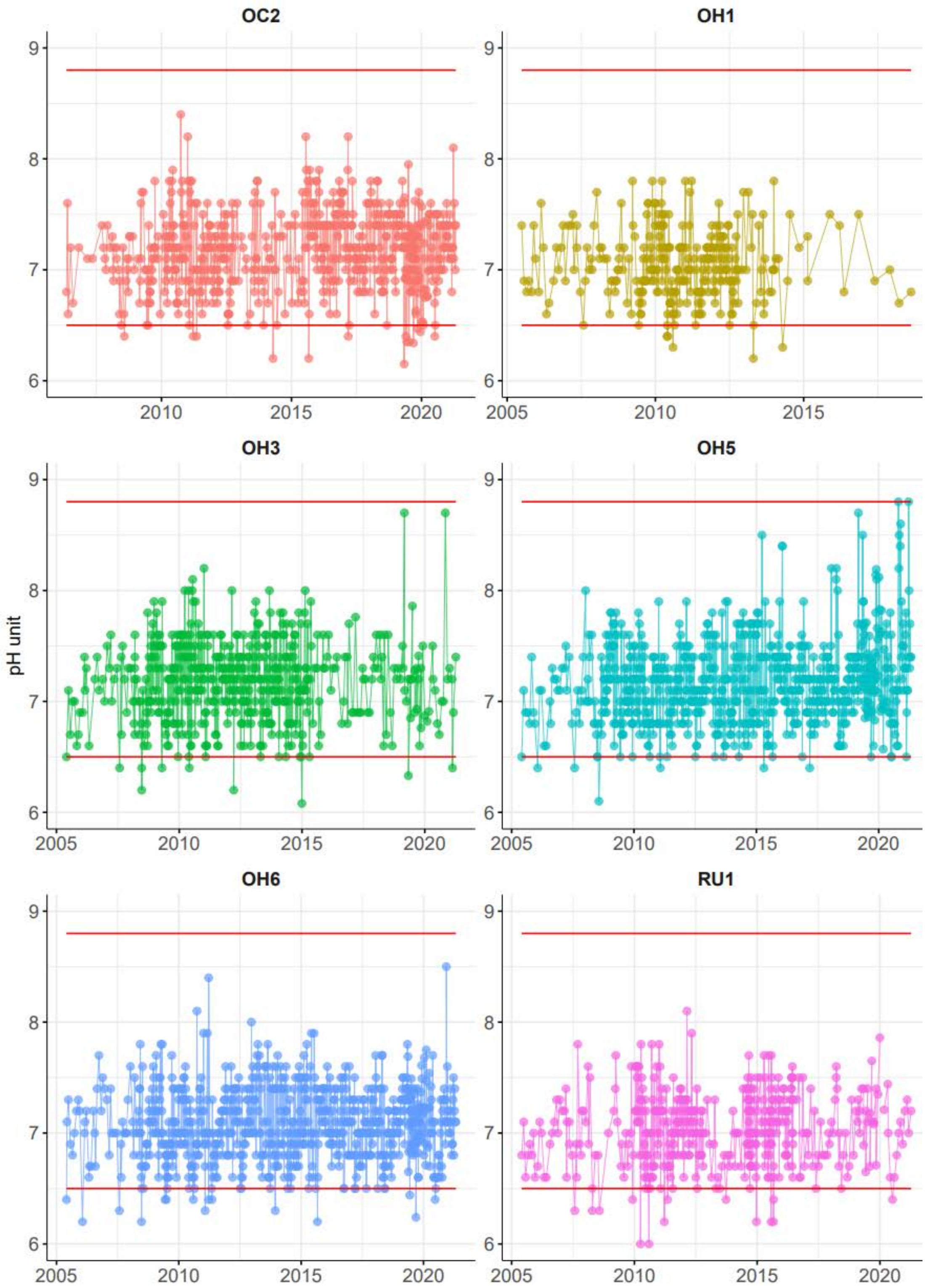

Figure D1 pH of receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1.

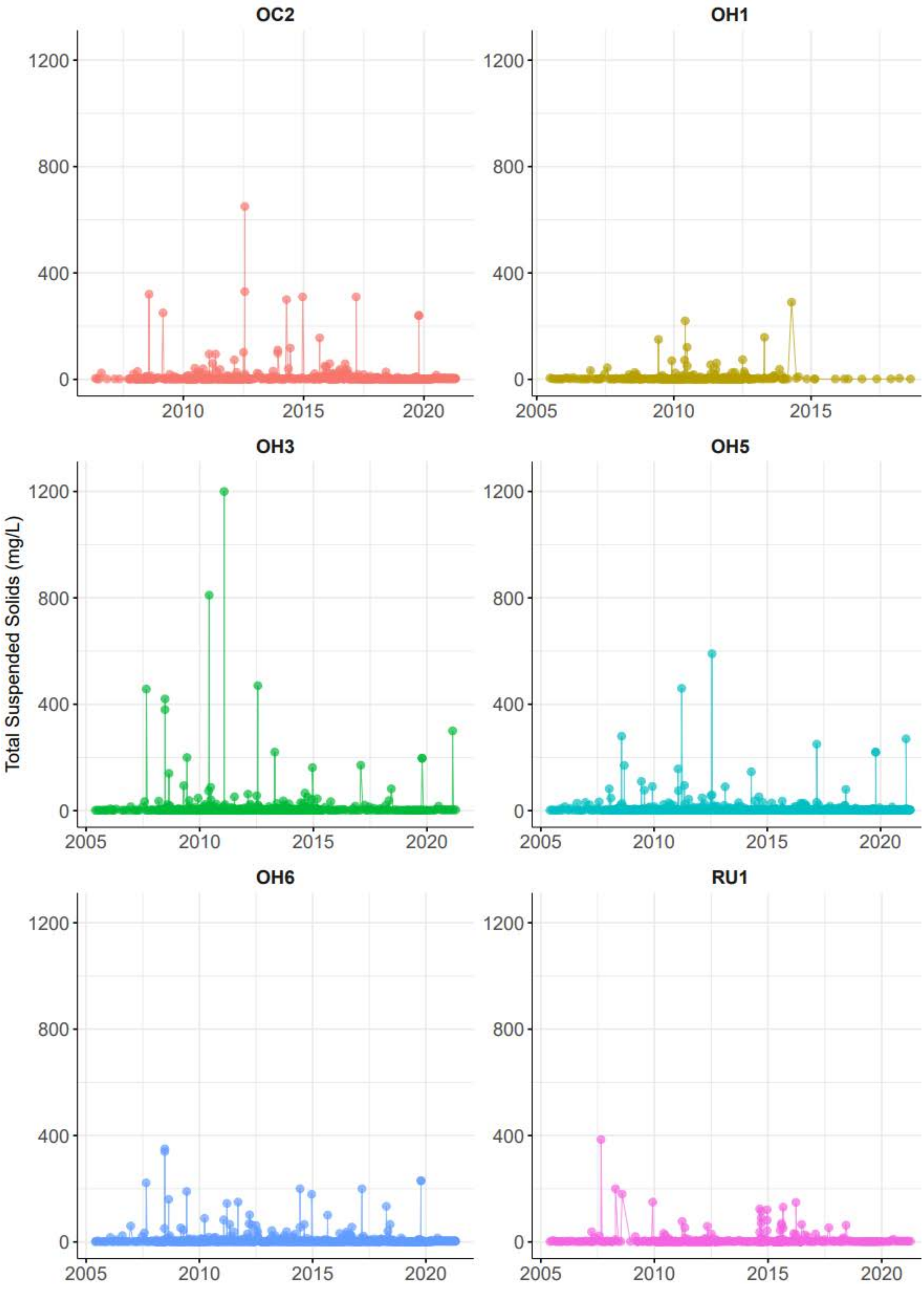

Figure D2 Total suspended solids concentration in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1.

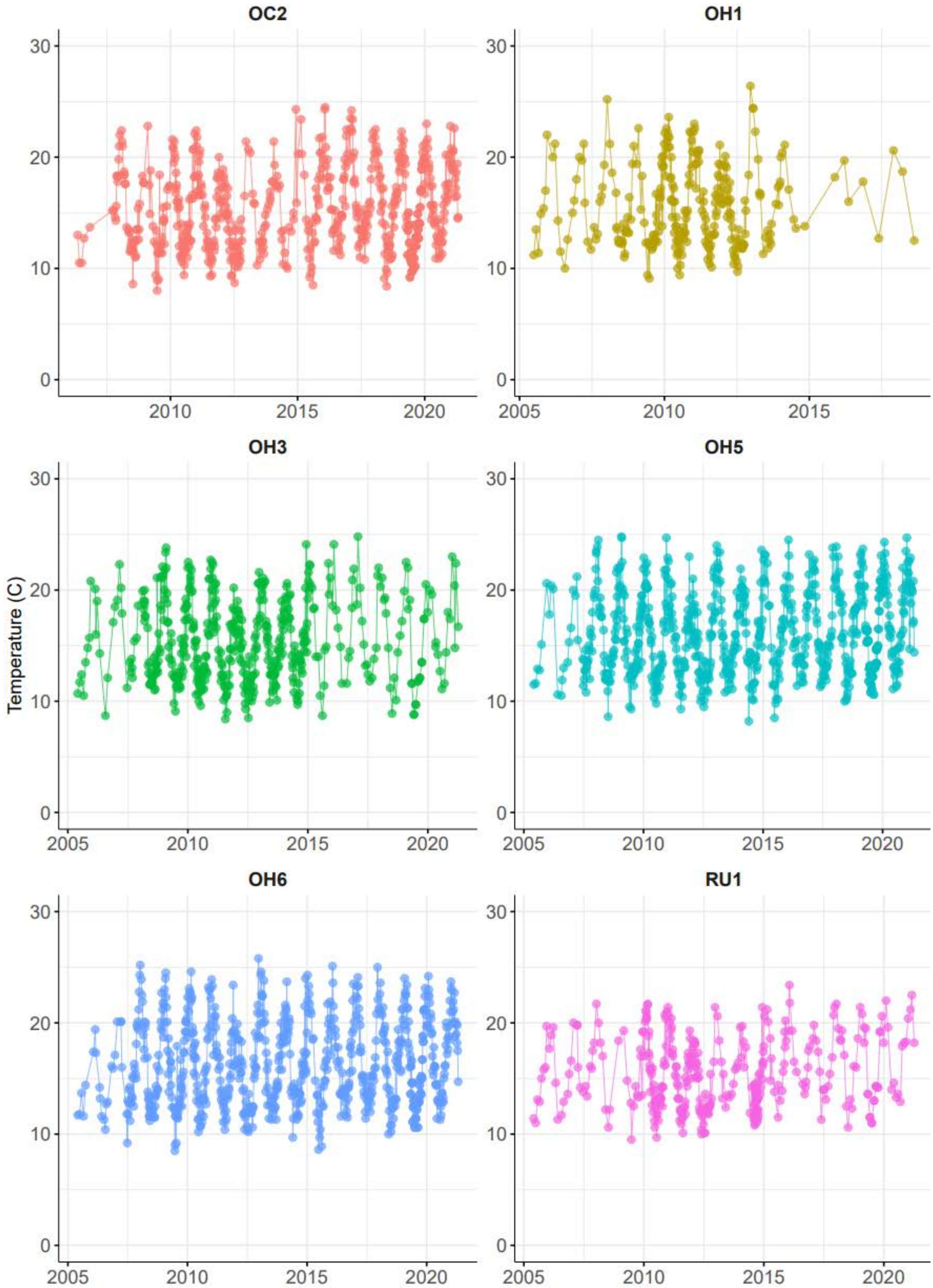

Figure D3 Water temperature of receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1.

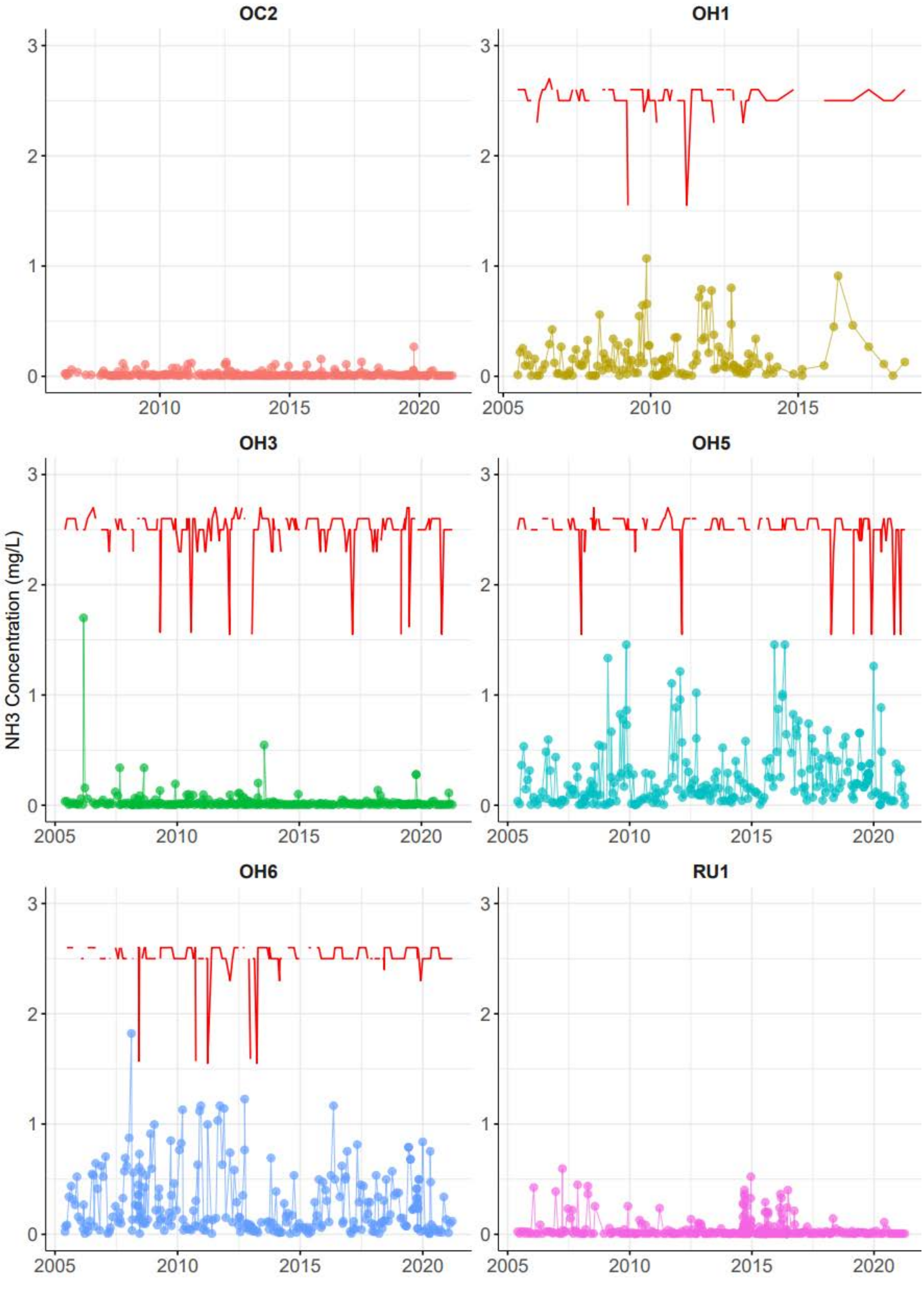

Figure D4 Total ammonia concentration in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1. Compliance value (pH and temperature dependent) denoted by the red line where relevant.

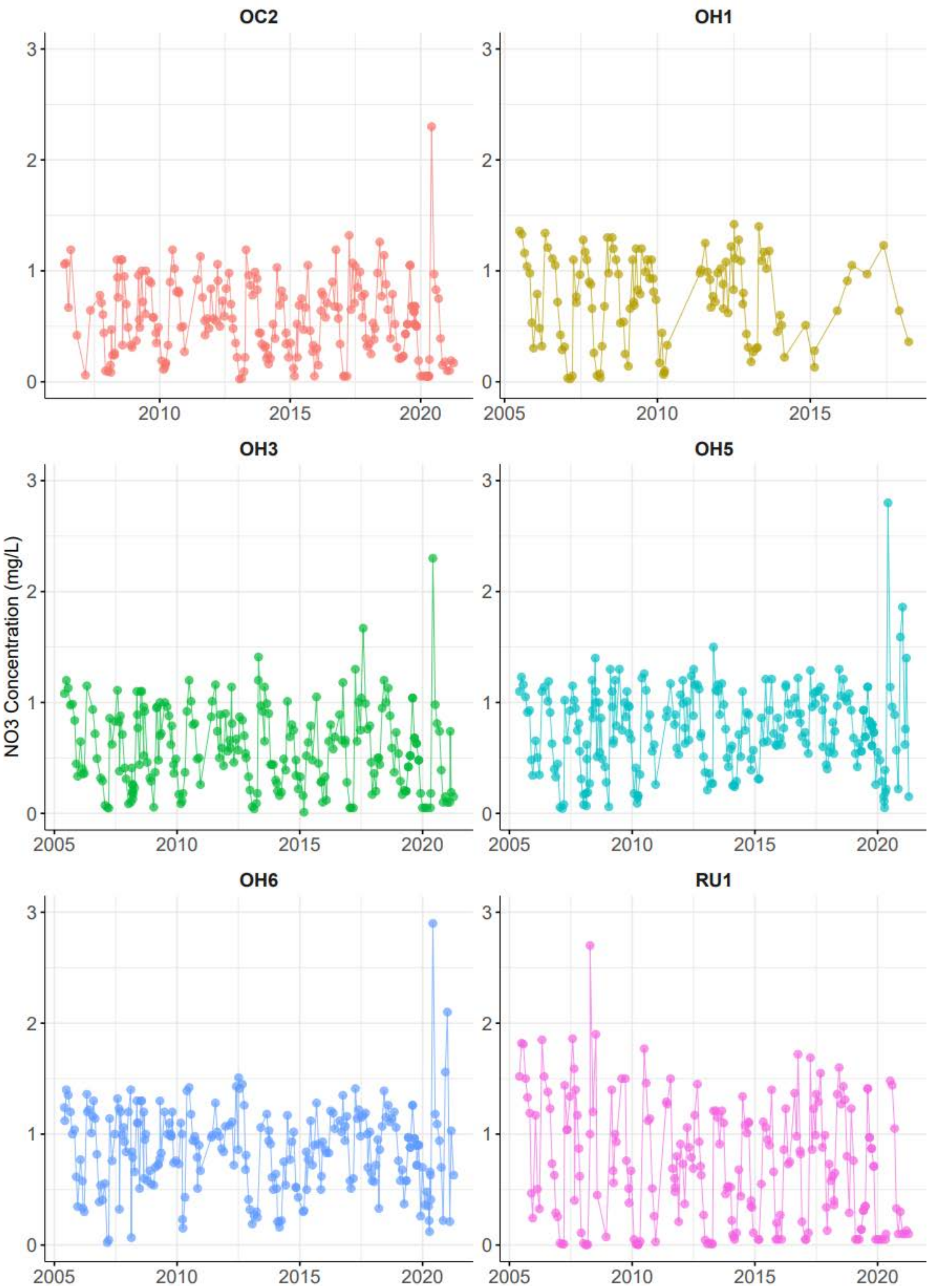

Figure D5 *Nitrate-nitrogen concentrations in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1.*

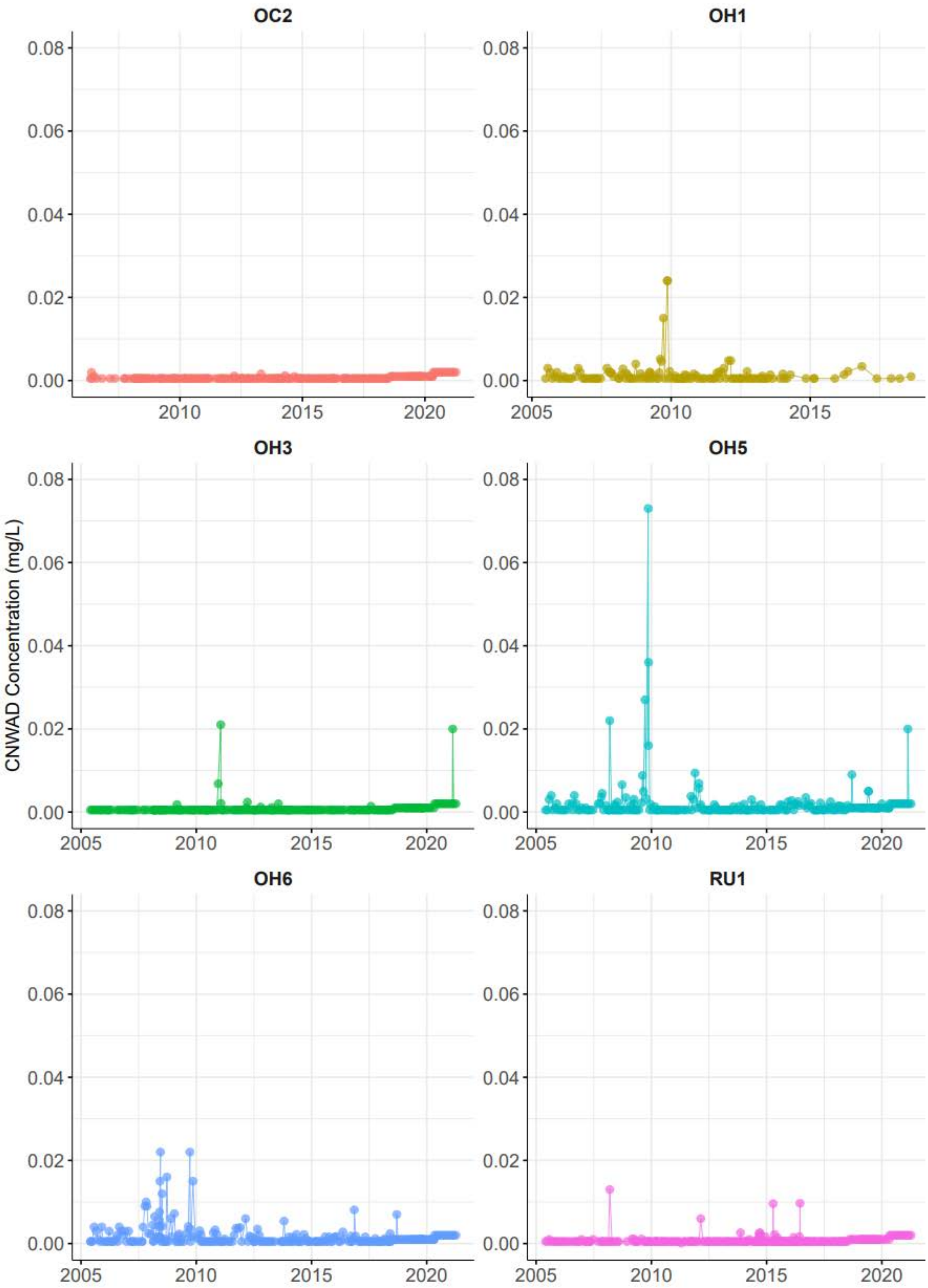

Figure D6 Weak acid dissociable cyanide concentrations in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1.

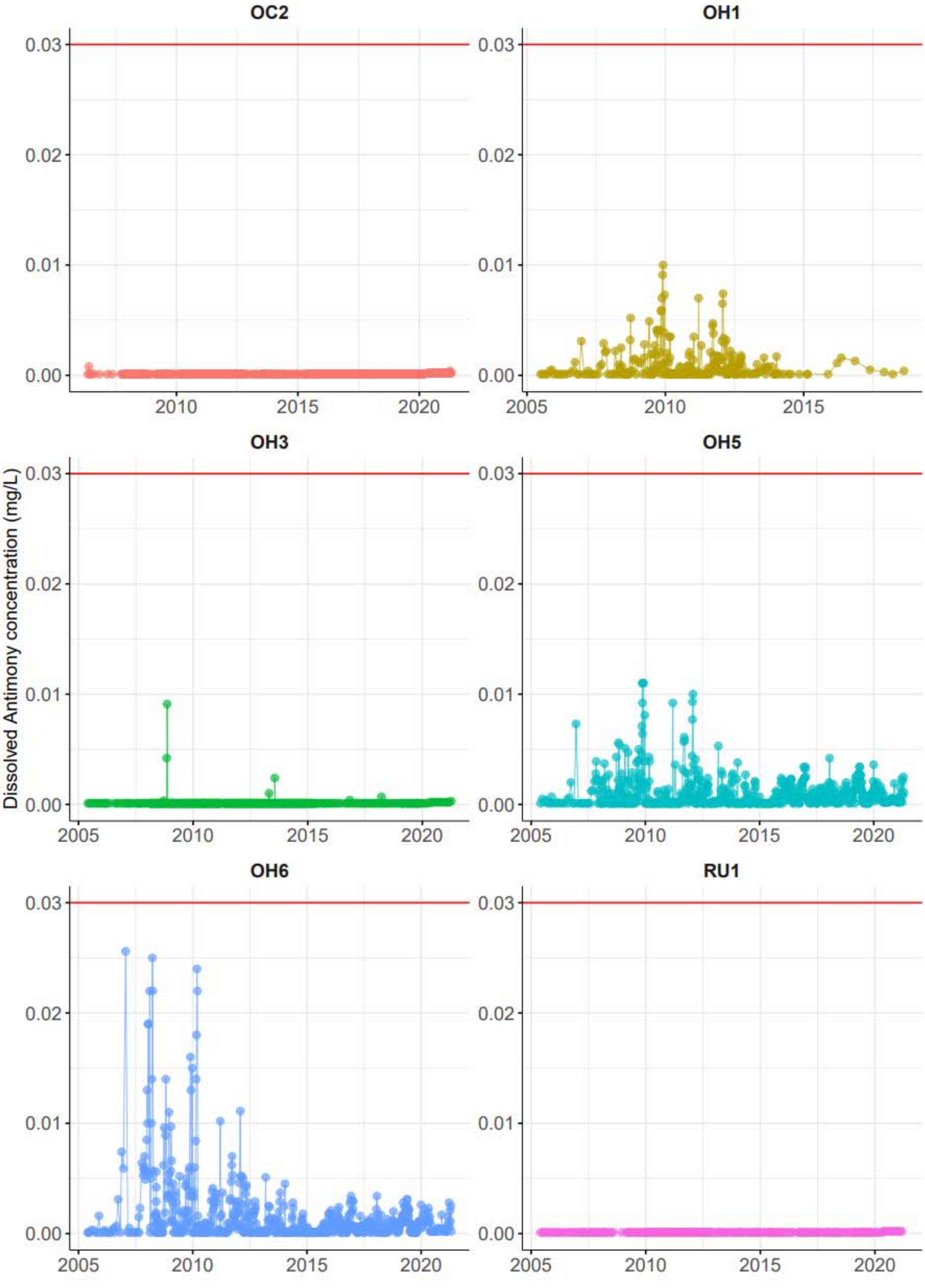

Figure D7 *Dissolved antimony concentrations in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1. Compliance value denoted by the red line where relevant.*

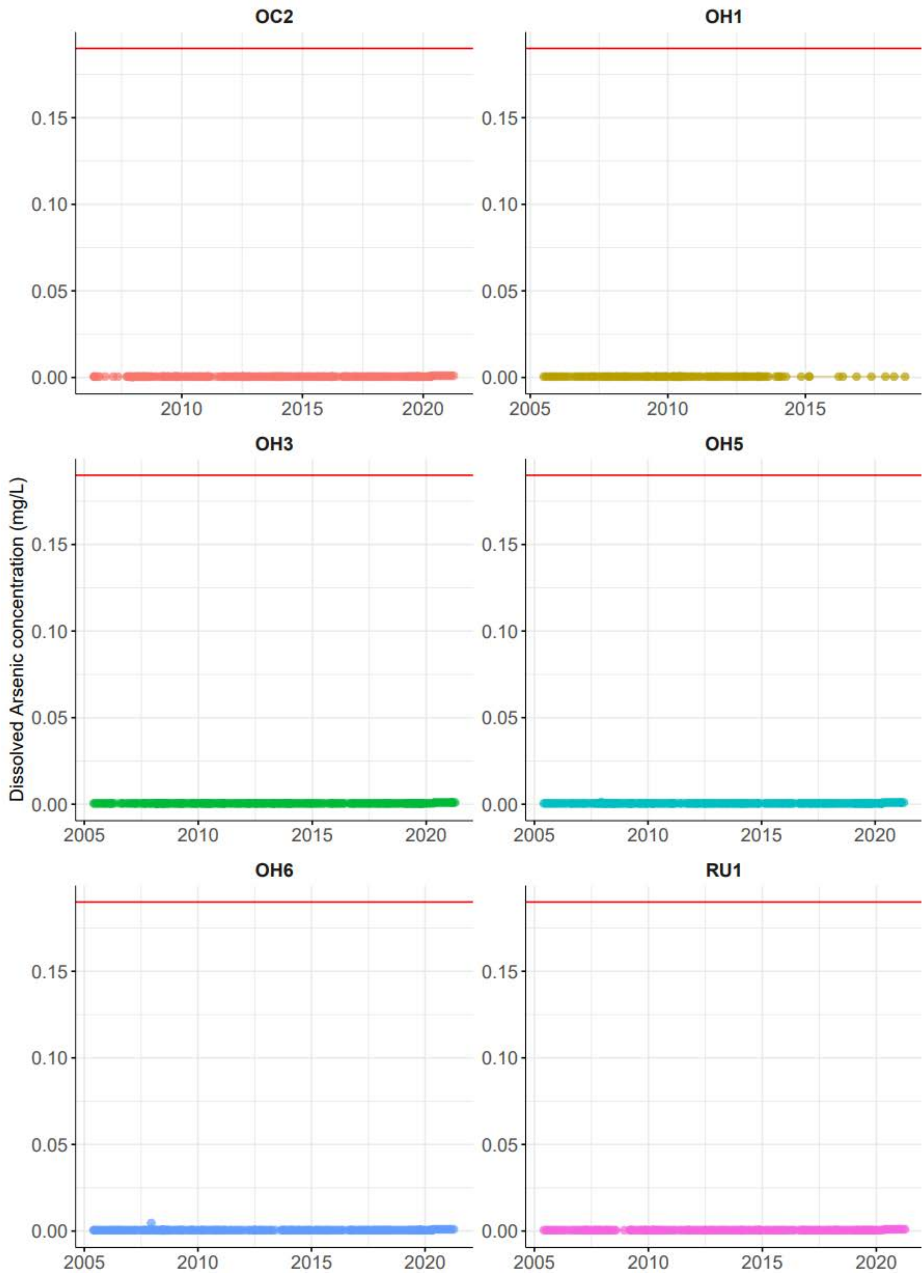

Figure D8 *Dissolved arsenic concentrations in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1. Compliance value denoted by the red line where relevant.*

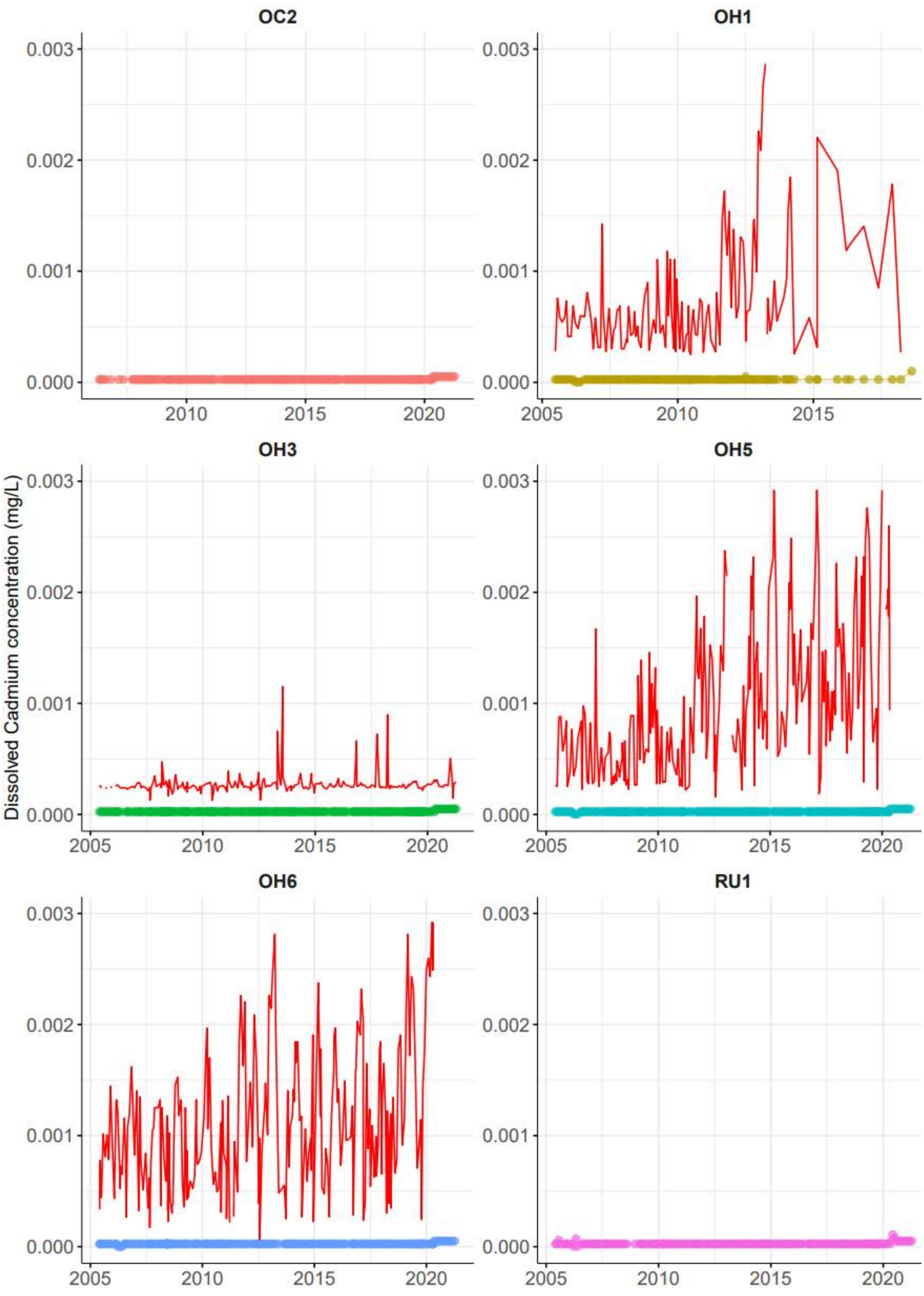

Figure D9 *Dissolved cadmium concentrations in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1. Compliance value denoted by the red line where relevant.*

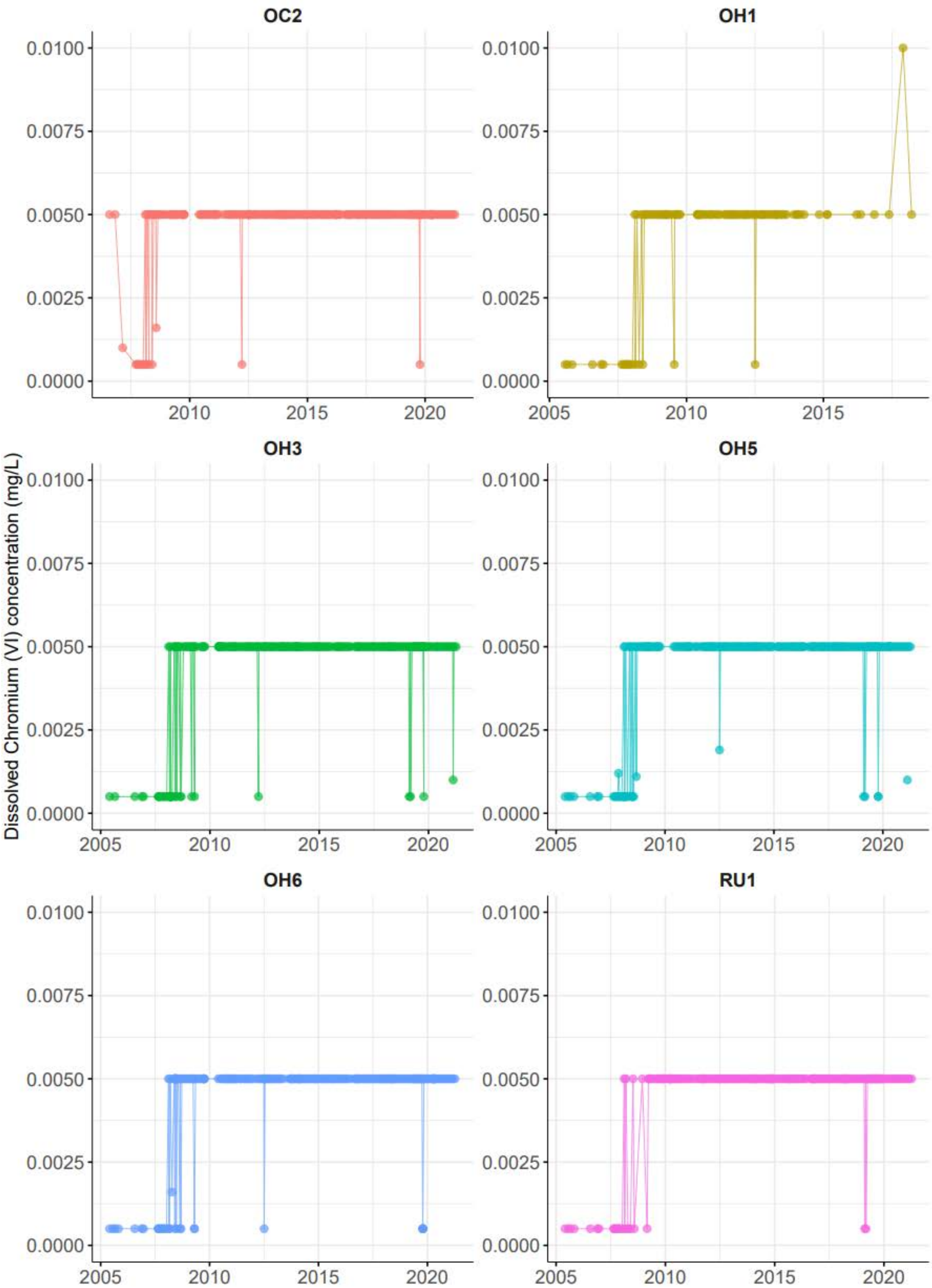

Figure D10 Dissolved chromium-VI concentrations in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1.

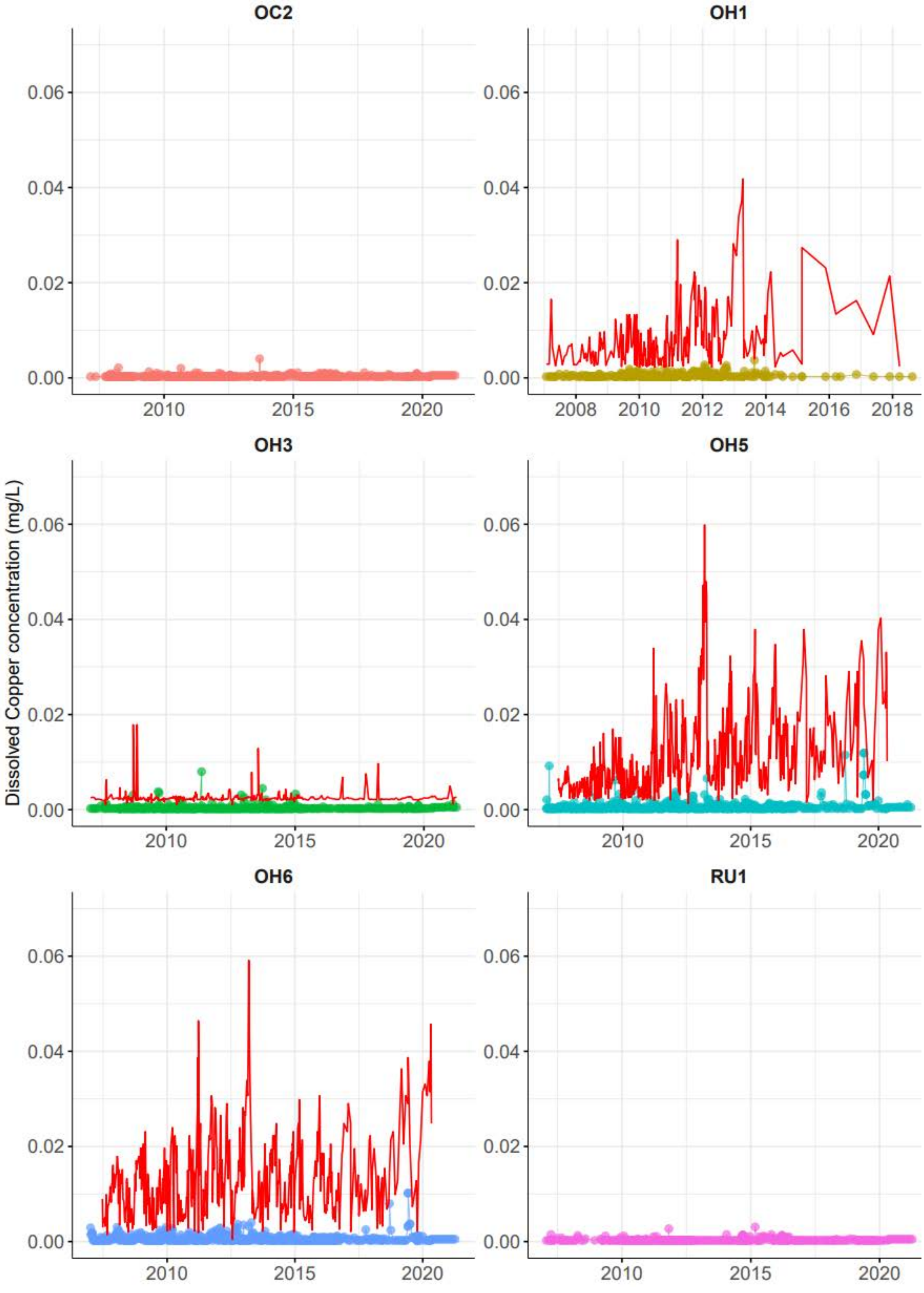

Figure D11 *Dissolved copper concentrations in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1. Compliance value denoted by the red line where relevant.*

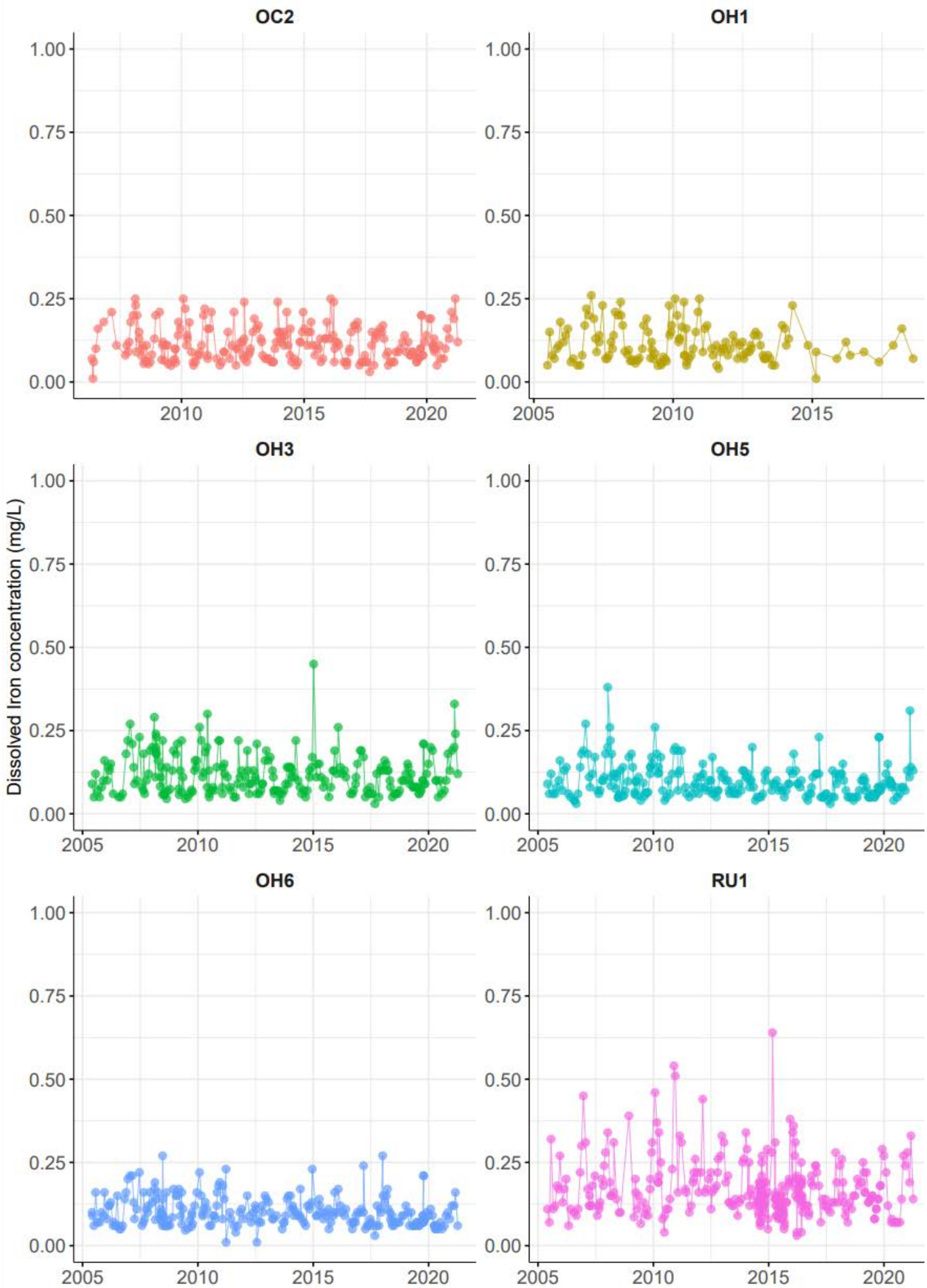

Figure D12 *Dissolved iron concentrations in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1.*

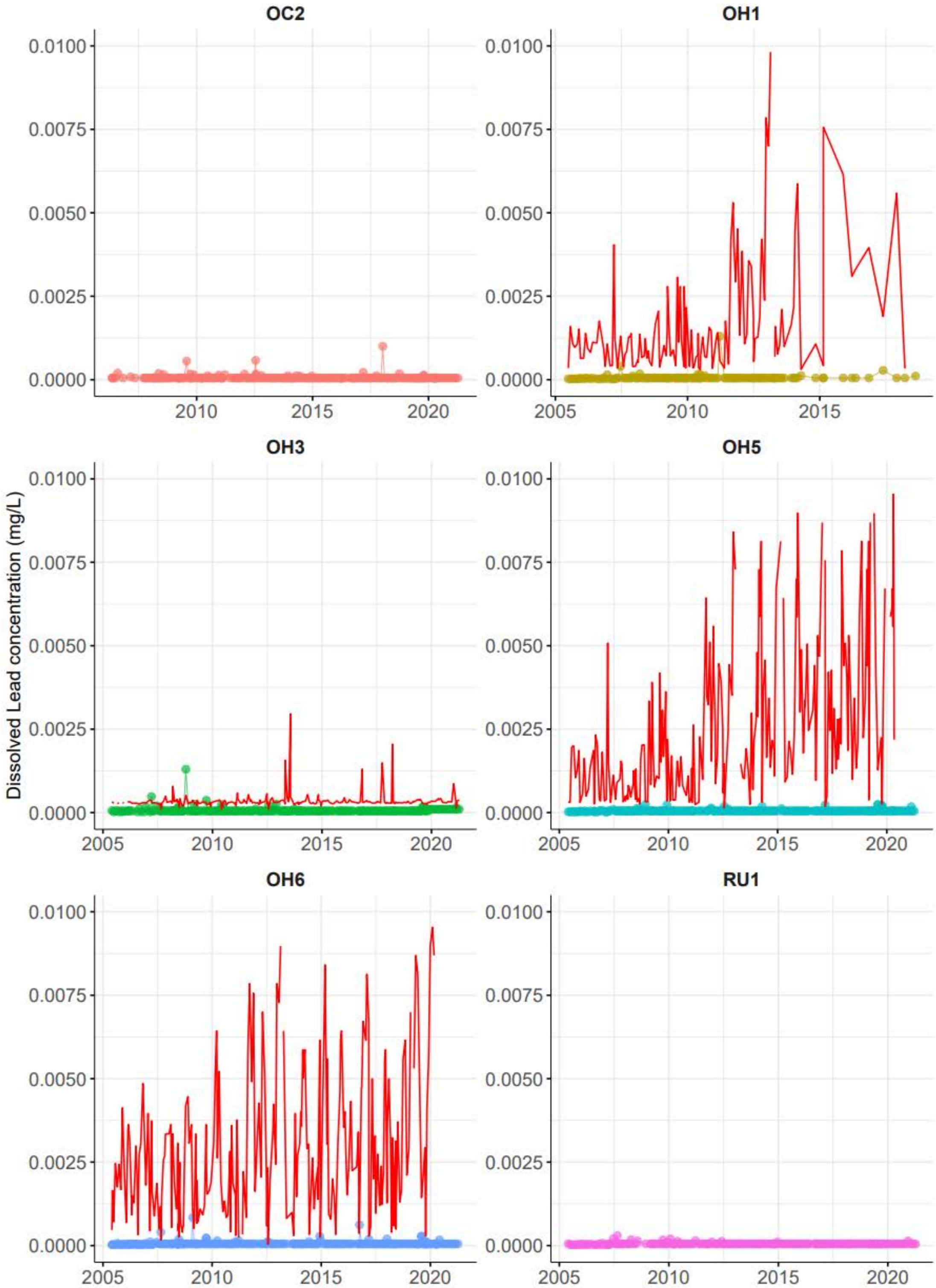

Figure D13 *Dissolved lead concentrations in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1. Compliance value denoted by the red line where relevant.*

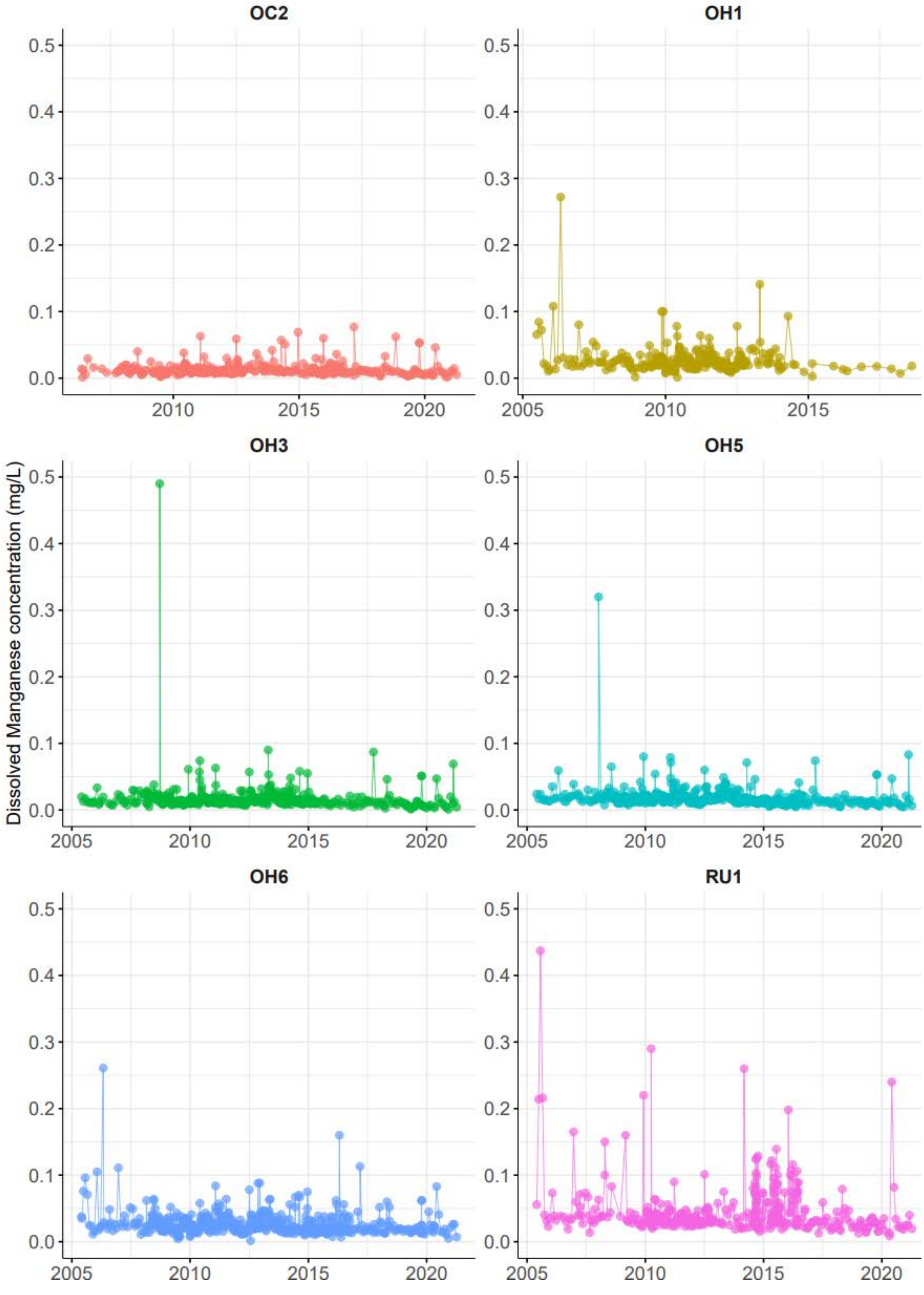

Figure D14 Dissolved manganese concentrations in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1.

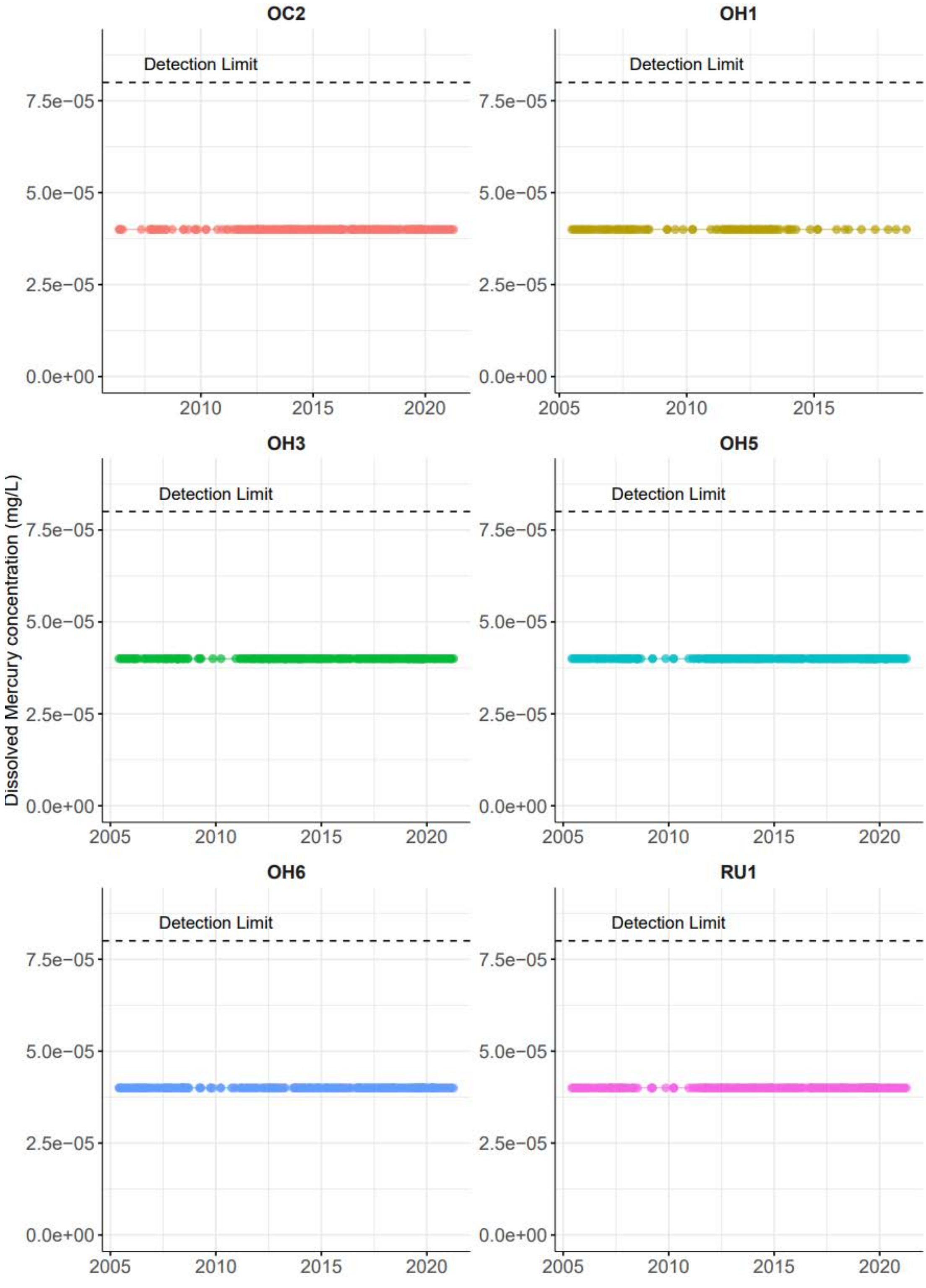

Figure D15 *Dissolved mercury concentrations in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1.*

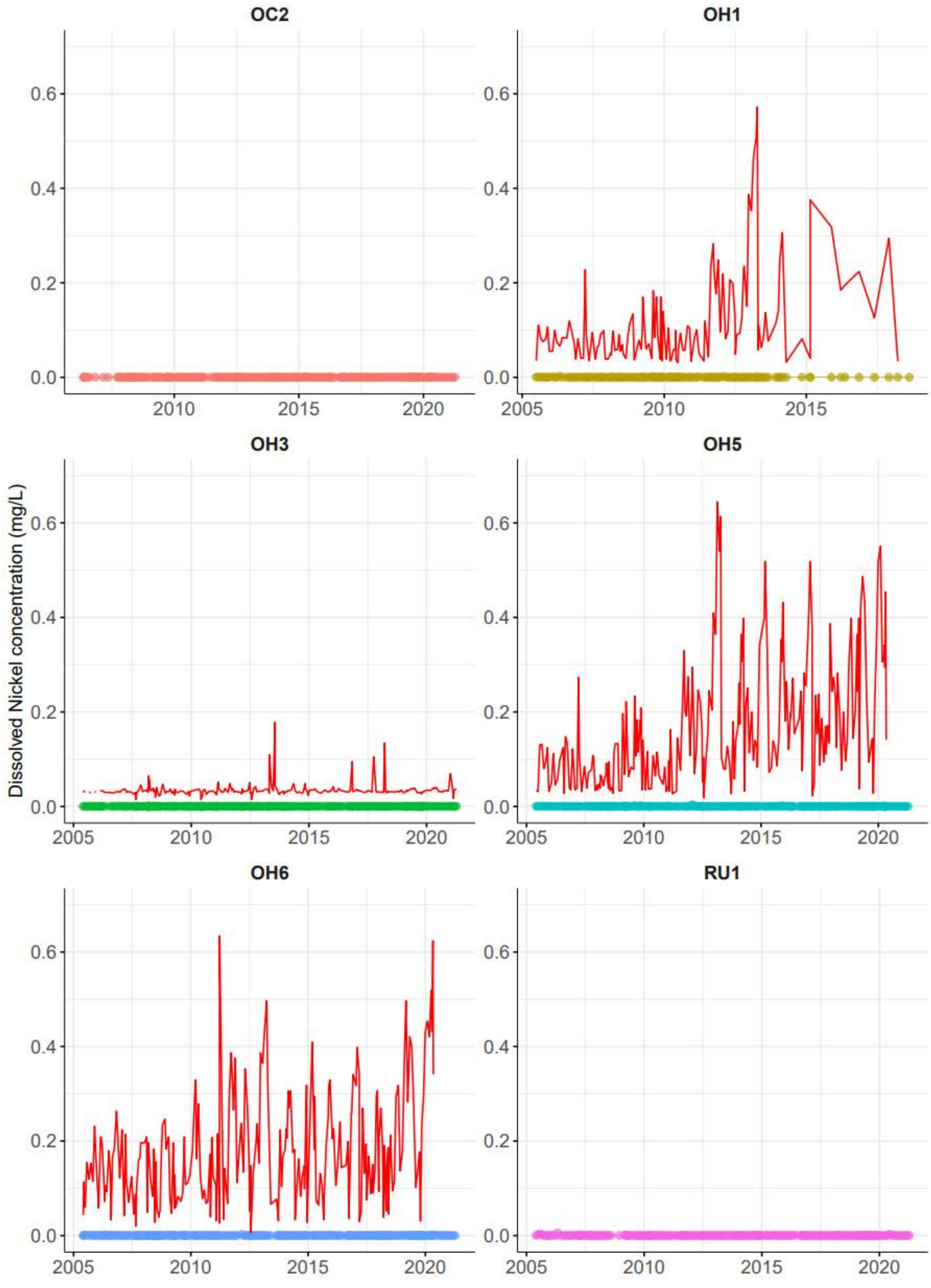

Figure D16 *Dissolved nickel concentrations in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1. Compliance value denoted by the red line where relevant.*

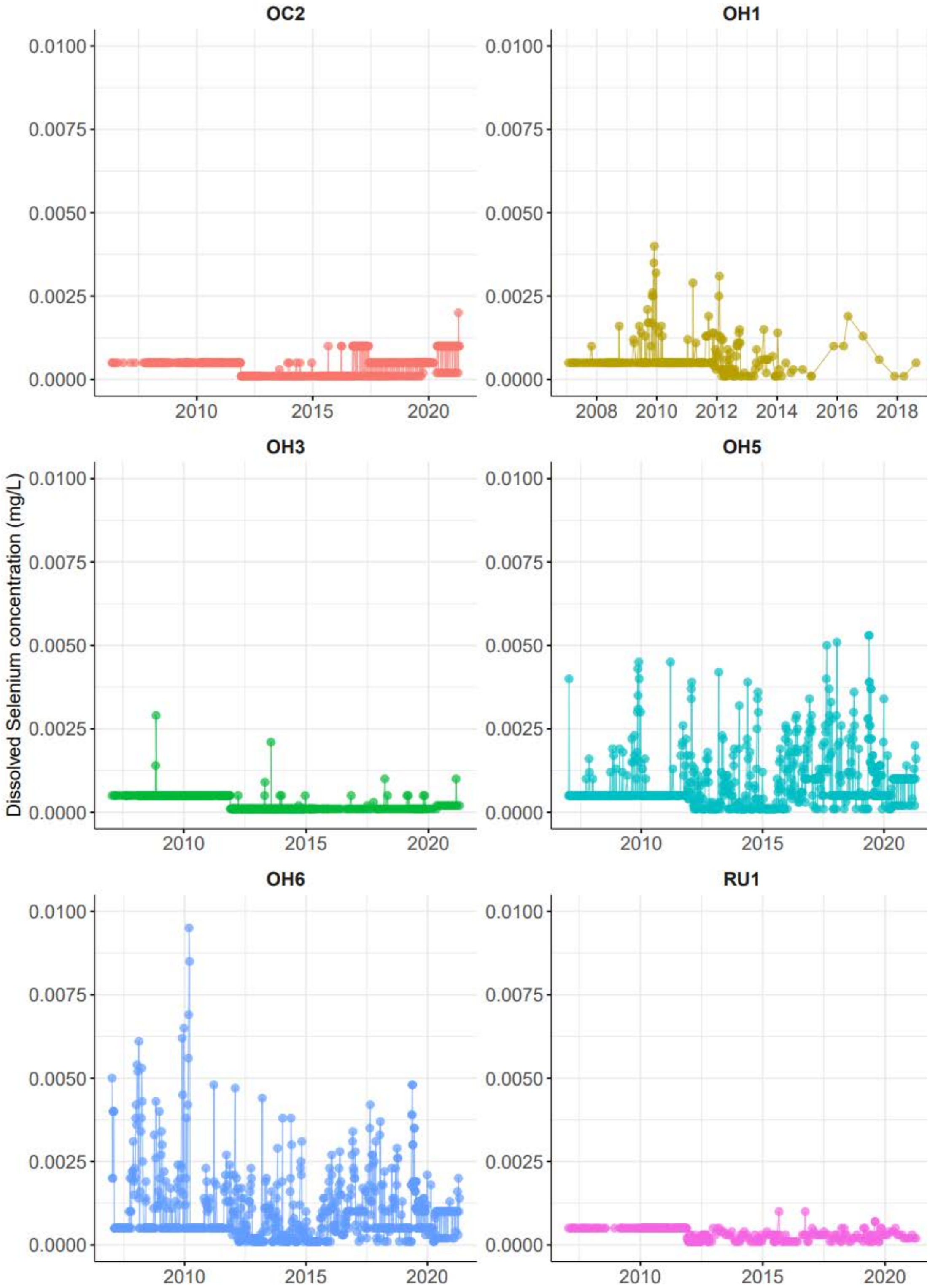

Figure D17 Dissolved selenium concentrations in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1.

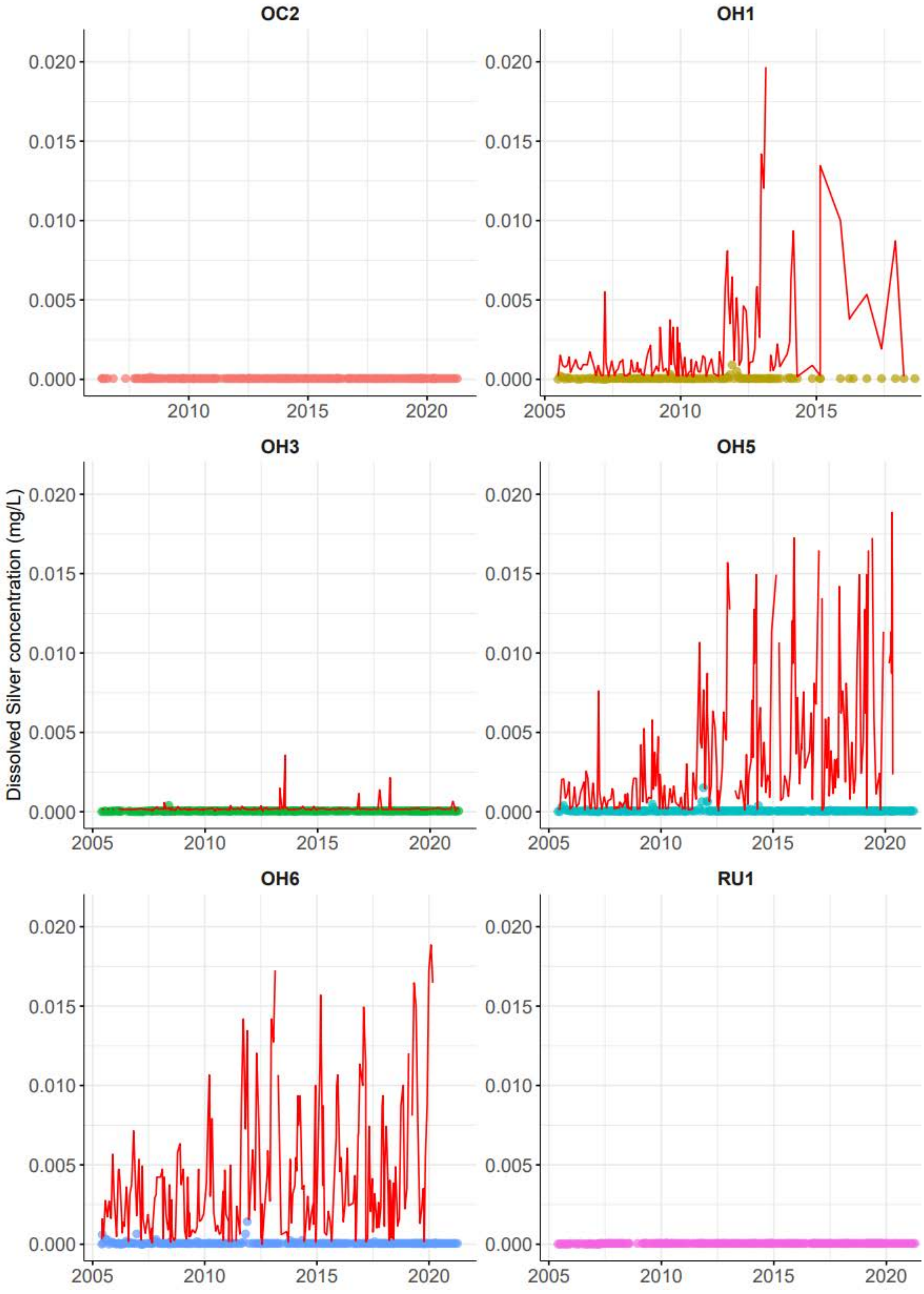

Figure D18 *Dissolved silver concentrations in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1. Compliance value denoted by the red line where relevant.*

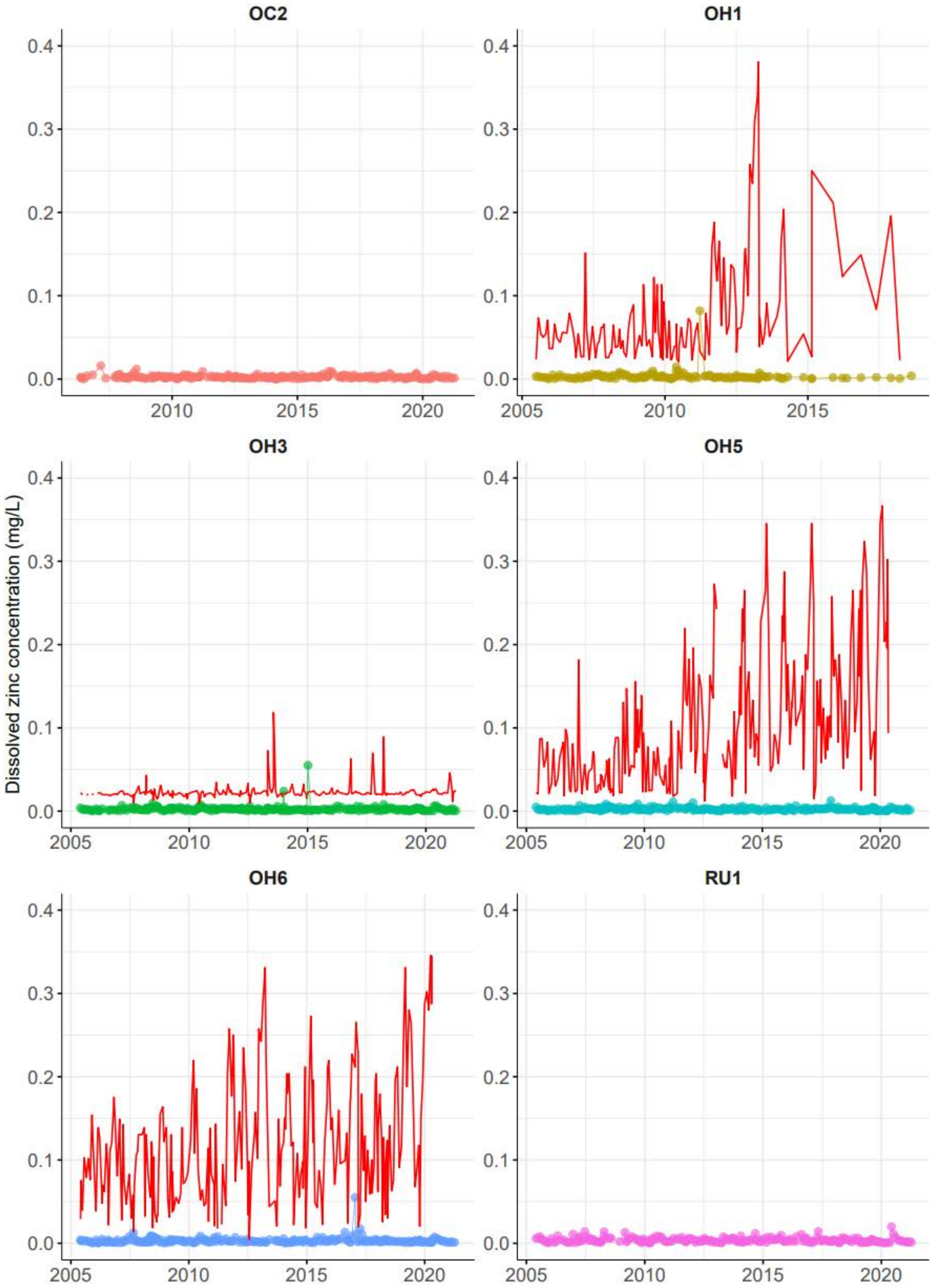

Figure D19 *Dissolved zinc concentrations in receiving waters at Sites OC2, OH3, OH5, OH1, OH6 and RU1.*

APPENDIX E: Sediment Quality Data

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

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

Certificate of Analysis

SPv1

Client:	Ryder Environmental Limited	**Lab No:**	2493530
Contact:	G Ryder	**Date Received:**	14-Dec-2020
	C/- Ryder Environmental Limited	**Date Reported:**	07-Jan-2021
	PO Box 1023	**Quote No:**	88303
	Dunedin 9054	**Order No:**	
		Client Reference:	Tender Quote
		Submitted By:	G Ryder

Sample Type: Sediment

Sample Name:		OC2 10-Dec-2020	OH3 10-Dec-2020	OH5 10-Dec-2020	OH1 10-Dec-2020	OH6 10-Dec-2020
Lab Number:		2493530.1	2493530.2	2493530.3	2493530.4	2493530.5
Individual Tests						
Dry Matter	g/100g as rcvd	52	69	44	78	59
Total Recoverable Antimony	mg/kg dry wt	< 0.08	< 0.08	< 0.08	< 0.08	0.19 #1
Chromium (hexavalent)*	mg/kg dry wt	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total Recoverable Iron	mg/kg dry wt	20,000	15,900	14,300	11,200	17,500
Total Recoverable Manganese	mg/kg dry wt	220	340	120	106	83 #3
Total Recoverable Selenium	mg/kg dry wt	< 0.5	< 0.5	1.2	< 0.5	0.8
Total Recoverable Silver	mg/kg dry wt	0.07	0.03	0.07	0.04	0.25 #1
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	3.0	2.7	3.2	1.5	4.5
Total Recoverable Cadmium	mg/kg dry wt	0.105	0.079	0.118	0.041	0.25 #1
Total Recoverable Chromium	mg/kg dry wt	19.6	12.4	24	12.4	18.4
Total Recoverable Copper	mg/kg dry wt	6.6	4.2	10.4	3.2	7.7
Total Recoverable Lead	mg/kg dry wt	8.0	4.9	10.1	4.6	8.0
Total Recoverable Mercury	mg/kg dry wt	0.33	0.27	0.51	0.19	0.30 #1
Total Recoverable Nickel	mg/kg dry wt	6.7	4.7	8.9	3.7	6.8
Total Recoverable Zinc	mg/kg dry wt	52	36	49	26	55
Texture Marine (2 mm, 63 µm fractions)*						
Dry Matter of Sieved Sample	g/100g as rcvd	47	64	44	66	63
Fraction < 2 mm, >/= 63 µm*	g/100g dry wt	90.4	90.7	83.0	69.3	47.8
Fraction < 63 µm*	g/100g dry wt	5.8	0.8	16.5	3.8	1.0

Sample Name:		RU1 10-Dec-2020	OC2 [>63mm Fraction]	OH3 [>63mm Fraction]	OH5 [>63mm Fraction]	OH1 [>63mm Fraction]
Lab Number:		2493530.6	2493530.7	2493530.8	2493530.9	2493530.10
Individual Tests						
Dry Matter	g/100g as rcvd	65	-	-	-	-
Total Recoverable Antimony	mg/kg dry wt	< 0.08	0.10	0.11	< 0.08	0.21
Chromium (hexavalent)*	mg/kg dry wt	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total Recoverable Iron	mg/kg dry wt	7,800	28,000	30,000	17,100	19,900
Total Recoverable Manganese	mg/kg dry wt	300	470	1,350	103	350
Total Recoverable Selenium	mg/kg dry wt	< 0.5	1.5	2.0	1.8	2.0
Total Recoverable Silver	mg/kg dry wt	0.05	0.30	0.36	0.17	0.18
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	1.6	4.8	5.9	3.3	5.0
Total Recoverable Cadmium	mg/kg dry wt	0.193	0.52	0.93	0.123	0.29
Total Recoverable Chromium	mg/kg dry wt	3.3	25	23	27	23
Total Recoverable Copper	mg/kg dry wt	1.8	14.7	15.7	14.1	14.2
Total Recoverable Lead	mg/kg dry wt	6.0	18.2	16.8	13.5	18.7
Total Recoverable Mercury	mg/kg dry wt	0.08	0.59	0.54	0.74 #2	0.58

Sample Type: Sediment						
	Sample Name:	RU1 10-Dec-2020	OC2 [>63mm Fraction]	OH3 [>63mm Fraction]	OH5 [>63mm Fraction]	OH1 [>63mm Fraction]
	Lab Number:	2493530.6	2493530.7	2493530.8	2493530.9	2493530.10
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Nickel	mg/kg dry wt	2.2	9.1	11.1	8.0	8.1
Total Recoverable Zinc	mg/kg dry wt	38	118	116	52	77
Texture Marine (2 mm, 63 µm fractions)*						
Dry Matter of Sieved Sample	g/100g as rcvd	64	-	-	-	-
Fraction < 2 mm, >/= 63 µm*	g/100g dry wt	75.7	-	-	-	-
Fraction < 63 µm*	g/100g dry wt	2.5	-	-	-	-

	Sample Name:	OH6 [>63mm Fraction]	RU1 [>63mm Fraction]			
	Lab Number:	2493530.11	2493530.12			
Individual Tests						
Total Recoverable Antimony	mg/kg dry wt	0.30	0.13	-	-	-
Chromium (hexavalent)*	mg/kg dry wt	< 0.4	< 0.4	-	-	-
Total Recoverable Iron	mg/kg dry wt	23,000	33,000	-	-	-
Total Recoverable Manganese	mg/kg dry wt	210	1,660	-	-	-
Total Recoverable Selenium	mg/kg dry wt	1.9	2.2	-	-	-
Total Recoverable Silver	mg/kg dry wt	0.58	0.22	-	-	-
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	5.5	7.5	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.64	1.24	-	-	-
Total Recoverable Chromium	mg/kg dry wt	22	11.9	-	-	-
Total Recoverable Copper	mg/kg dry wt	16.9	12.5	-	-	-
Total Recoverable Lead	mg/kg dry wt	16.1	18.9	-	-	-
Total Recoverable Mercury	mg/kg dry wt	0.57	0.20	-	-	-
Total Recoverable Nickel	mg/kg dry wt	8.8	9.5	-	-	-
Total Recoverable Zinc	mg/kg dry wt	128	156	-	-	-

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

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

Certificate of Analysis

Client:	Ryder Environmental Limited	**Lab No:**	2568354	SPv1
Contact:	G Ryder	**Date Received:**	26-Mar-2021	
	C/- Ryder Environmental Limited	**Date Reported:**	30-Apr-2021	
	PO Box 1023	**Quote No:**	88303	
	Dunedin 9054	**Order No:**	PO000048	
		Client Reference:		
		Submitted By:	G Ryder	

Sample Type: Sediment

	Sample Name:	OC2 24-Mar-2021	RU1 24-Mar-2021	OH6 24-Mar-2021	OH5 24-Mar-2021	OH1 24-Mar-2021
	Lab Number:	2568354.1	2568354.2	2568354.3	2568354.4	2568354.5
Individual Tests						
Dry Matter	g/100g as rcvd	68	67	64	63	68
Total Recoverable Antimony	mg/kg dry wt	0.58	< 0.08	0.10	< 0.08	< 0.08
Chromium (hexavalent)*	mg/kg dry wt	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total Recoverable Iron	mg/kg dry wt	22,000	9,000	16,700	19,900	15,900
Total Recoverable Manganese	mg/kg dry wt	590	330	170	175	140
Total Recoverable Selenium	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Total Recoverable Silver	mg/kg dry wt	0.03	0.05	0.11	0.06	0.07
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	3.2	1.7	3.8	2.7	2.5
Total Recoverable Cadmium	mg/kg dry wt	0.077	0.114	0.069	0.046	0.055
Total Recoverable Chromium	mg/kg dry wt	17.7	6.6	15.1	19.0	17.1
Total Recoverable Copper	mg/kg dry wt	6.0	2.6	5.4	6.1	5.0
Total Recoverable Lead	mg/kg dry wt	8.0	5.6	6.9	7.6	5.4
Total Recoverable Mercury	mg/kg dry wt	0.20	0.13	0.29	0.29	0.27
Total Recoverable Nickel	mg/kg dry wt	5.3	2.8	6.0	6.7	6.3
Total Recoverable Zinc	mg/kg dry wt	46	34	39	43	38
Texture Marine (2 mm, 63 µm fractions)*						
Dry Matter of Sieved Sample	g/100g as rcvd	70	69	71	67	66
Fraction < 2 mm, >/= 63 µm*	g/100g dry wt	83.5	90.1	90.0	97.1	94.3
Fraction < 63 µm*	g/100g dry wt	1.5	4.1	1.4	1.3	1.1

	Sample Name:	OH3 24-Mar-2021	OC2 [<63um Fraction]	RU1 [<63um Fraction]	OH6 [<63um Fraction]	OH5 [<63um Fraction]
	Lab Number:	2568354.6	2568354.7	2568354.8	2568354.9	2568354.10
Individual Tests						
Dry Matter	g/100g as rcvd	68	-	-	-	-
Total Recoverable Antimony	mg/kg dry wt	< 0.08	0.09	0.16	0.34	0.21
Chromium (hexavalent)*	mg/kg dry wt	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total Recoverable Iron	mg/kg dry wt	15,400	32,000	33,000	46,000	36,000
Total Recoverable Manganese	mg/kg dry wt	280	1,400	1,620	650	560
Total Recoverable Selenium	mg/kg dry wt	< 0.5	1.8	2.1	2.8	2.0
Total Recoverable Silver	mg/kg dry wt	0.04	0.29	0.39	0.83	0.65
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	2.5	6.0	7.9	11.8	7.7
Total Recoverable Cadmium	mg/kg dry wt	0.044	0.72	0.80	0.45	0.25
Total Recoverable Chromium	mg/kg dry wt	14.7	26	17.7	24	26
Total Recoverable Copper	mg/kg dry wt	4.4	15.0	14.0	18.1	18.5
Total Recoverable Lead	mg/kg dry wt	5.3	21	24	18.1	23
Total Recoverable Mercury	mg/kg dry wt	0.24	0.64	0.28	0.52	0.70

Sample Type: Sediment						
	Sample Name:	OH3 24-Mar-2021	OC2 [<63um Fraction]	RU1 [<63um Fraction]	OH6 [<63um Fraction]	OH5 [<63um Fraction]
	Lab Number:	2568354.6	2568354.7	2568354.8	2568354.9	2568354.10
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Nickel	mg/kg dry wt	4.6	10.4	10.6	8.8	9.2
Total Recoverable Zinc	mg/kg dry wt	34	124	127	105	88
Texture Marine (2 mm, 63 µm fractions)*						
Dry Matter of Sieved Sample	g/100g as rcvd	72	-	-	-	-
Fraction < 2 mm, >/= 63 µm*	g/100g dry wt	93.5	-	-	-	-
Fraction < 63 µm*	g/100g dry wt	0.5	-	-	-	-

	Sample Name:	OH1 [<63um Fraction]	OH3 [<63um Fraction]			
	Lab Number:	2568354.11	2568354.12			
Individual Tests						
Total Recoverable Antimony	mg/kg dry wt	0.31	0.13	-	-	-
Chromium (hexavalent)*	mg/kg dry wt	< 0.4	< 0.4	-	-	-
Total Recoverable Iron	mg/kg dry wt	39,000	33,000	-	-	-
Total Recoverable Manganese	mg/kg dry wt	1,300	1,640	-	-	-
Total Recoverable Selenium	mg/kg dry wt	2.4	1.7	-	-	-
Total Recoverable Silver	mg/kg dry wt	0.47	0.36	-	-	-
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	8.0	5.7	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.45	0.49	-	-	-
Total Recoverable Chromium	mg/kg dry wt	28	28	-	-	-
Total Recoverable Copper	mg/kg dry wt	19.9	15.7	-	-	-
Total Recoverable Lead	mg/kg dry wt	21	17.6	-	-	-
Total Recoverable Mercury	mg/kg dry wt	0.43	0.48	-	-	-
Total Recoverable Nickel	mg/kg dry wt	11.6	10.9	-	-	-
Total Recoverable Zinc	mg/kg dry wt	105	98	-	-	-

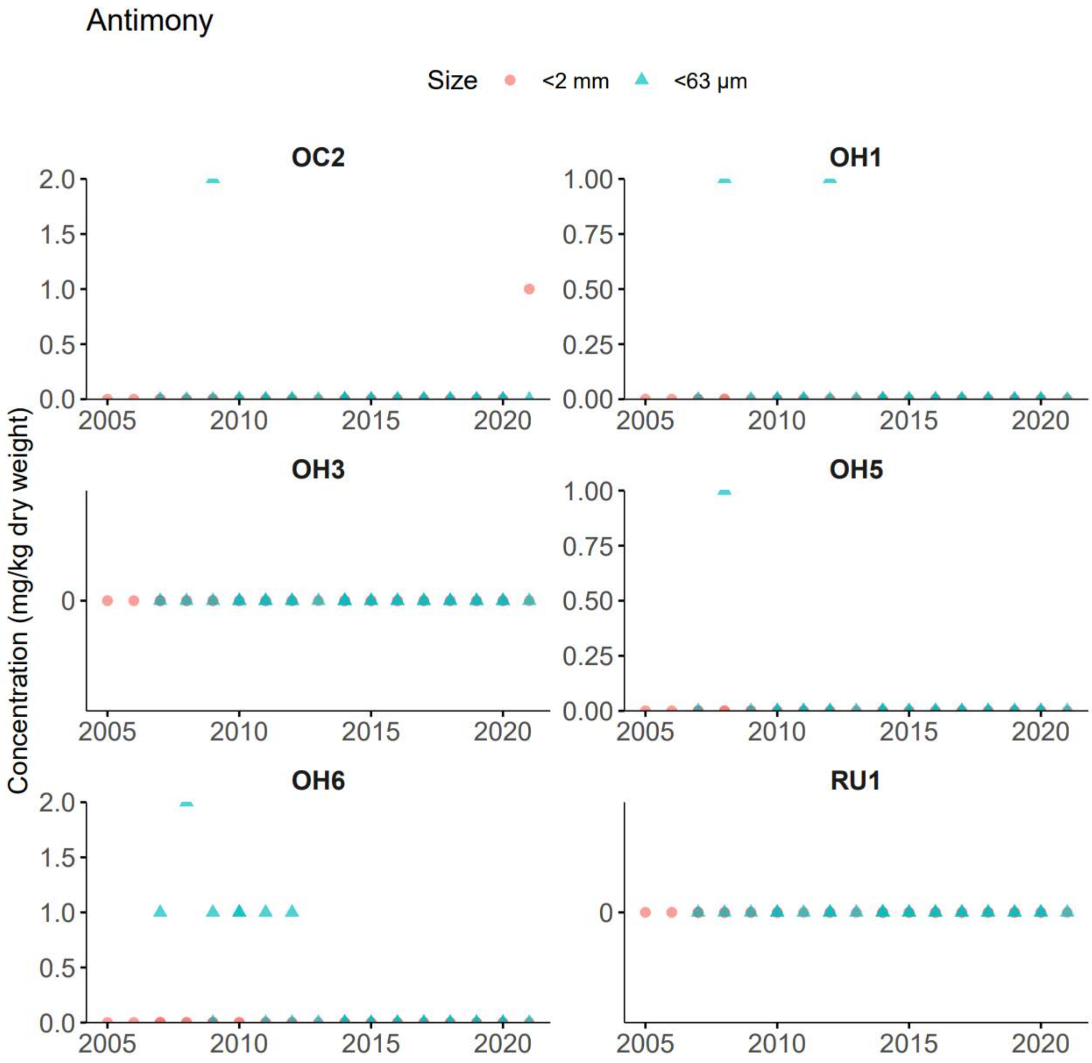


Figure E1 Antimony concentrations in the <2 mm (circles) and <63 µm (triangles) sediment size fraction at Sites OC2, OH3, OH5, OH1, OH6 and RU1.

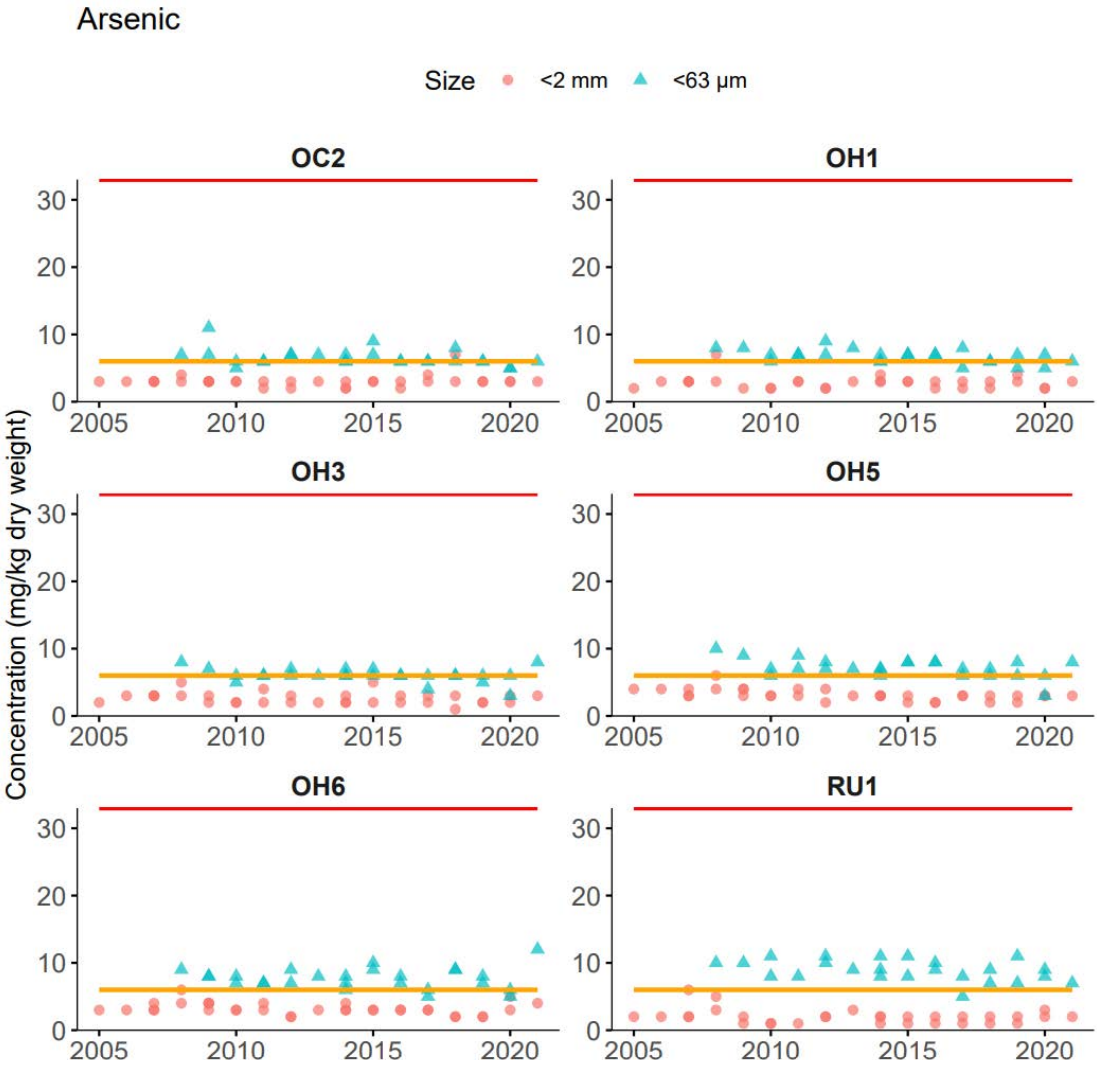


Figure E2 *Arsenic concentrations in the <2 mm (circles) and <63 µm (triangles) sediment size fraction at Sites OC2, OH3, OH5, OH1, OH6 and RU1. The OME lowest effect level is noted in orange and the severe effect level in red.*

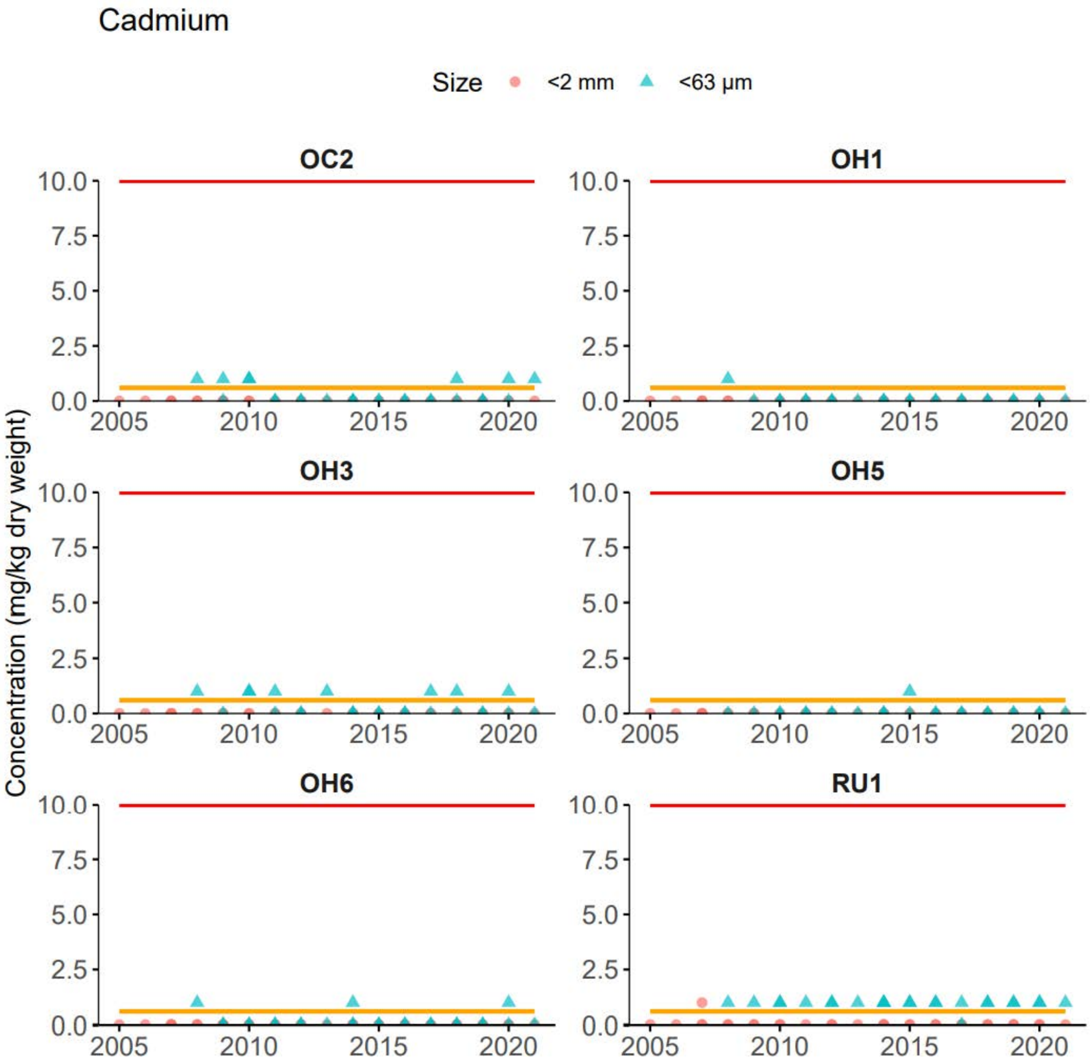


Figure E3 *Cadmium concentrations in the <2 mm (circles) and <63 µm (triangles) sediment size fraction at Sites OC2, OH3, OH5, OH1, OH6 and RU1. The OME lowest effect level is noted in orange and the severe effect level in red.*

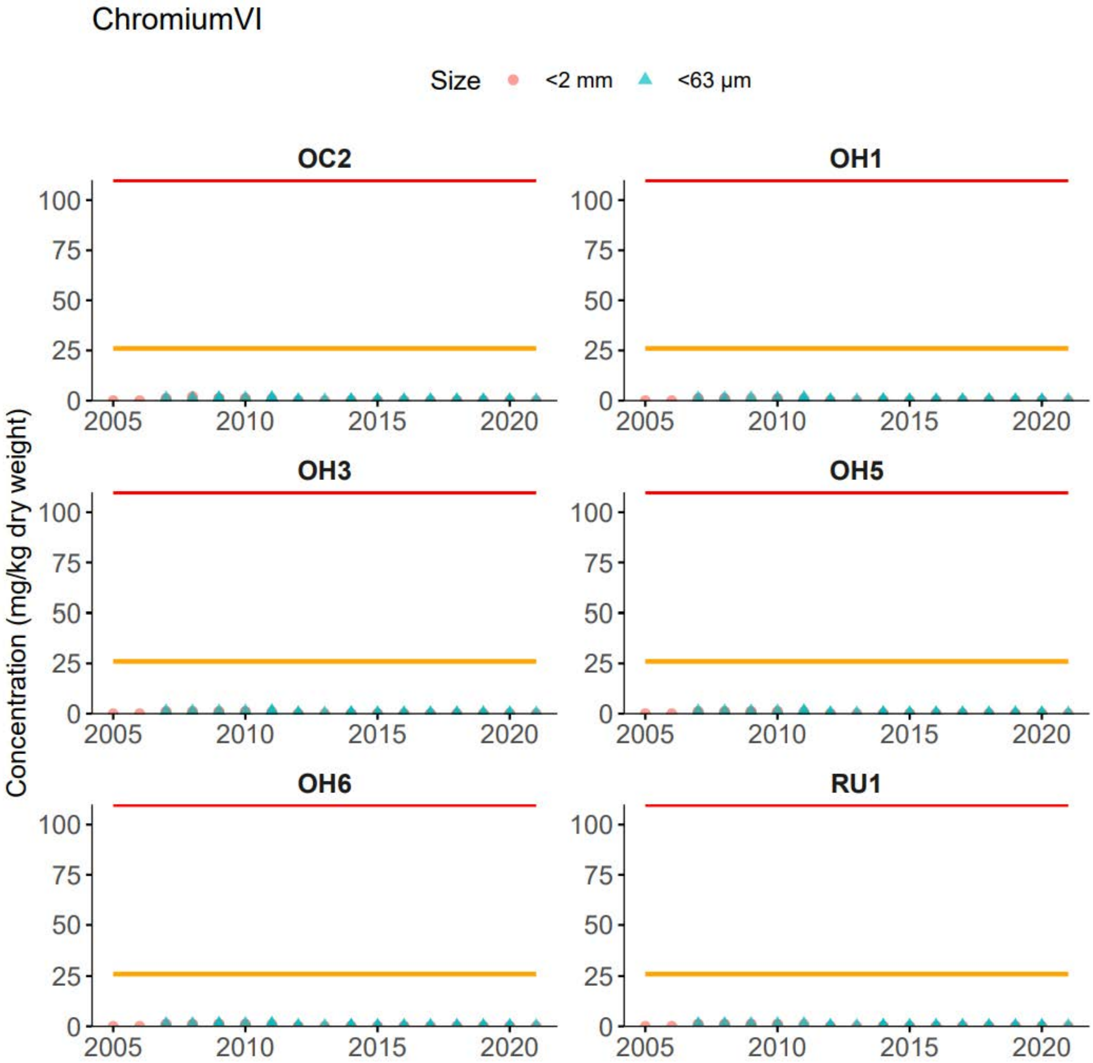


Figure E4 Hexavalent chromium concentrations in the <2 mm (circles) and <63 µm (triangles) sediment size fraction at Sites OC2, OH3, OH5, OH1, OH6 and RU1. The OME lowest effect level is noted in orange and the severe effect level in red.

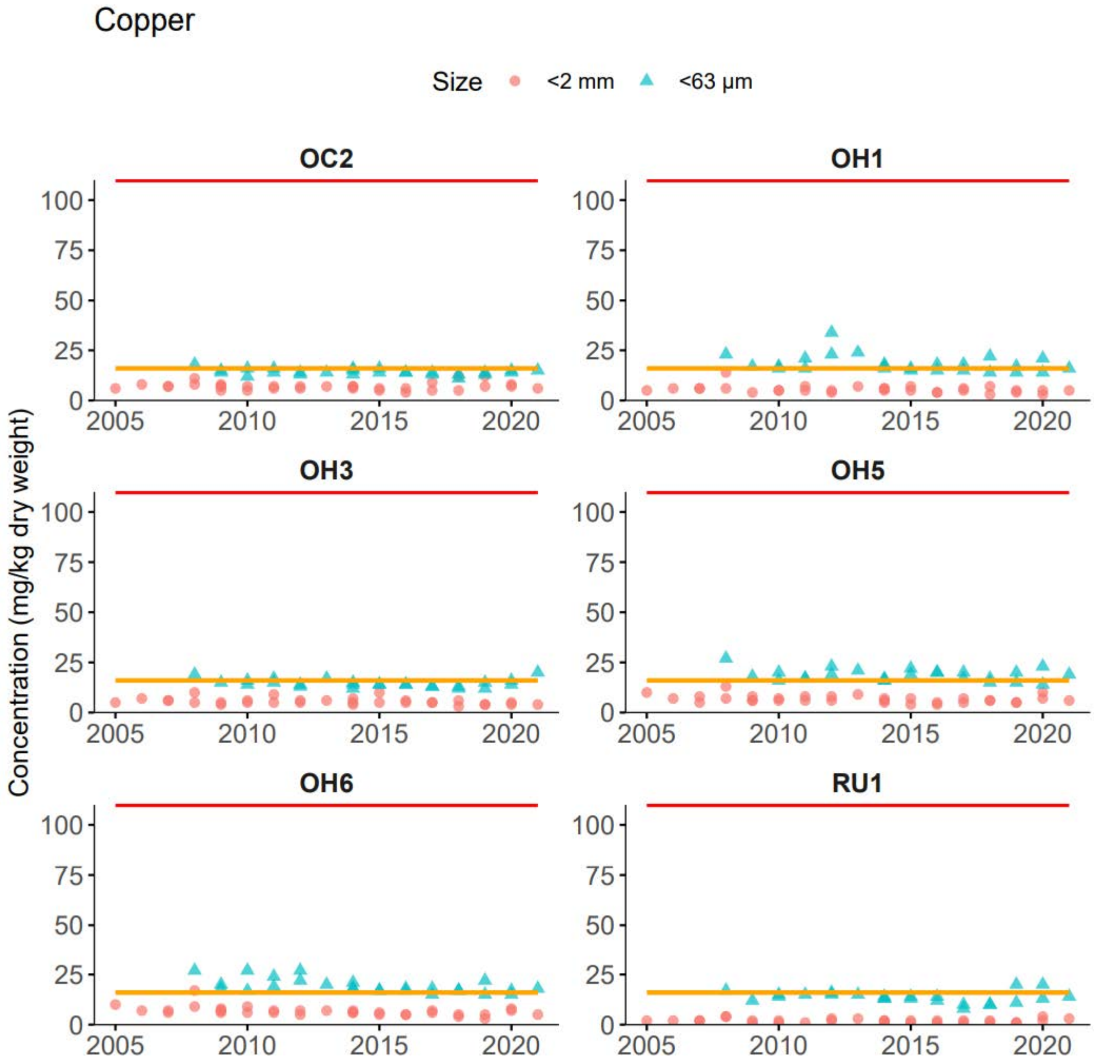


Figure E5 Copper concentrations in the <2 mm (circles) and <63 µm (triangles) sediment size fraction at Sites OC2, OH3, OH5, OH1, OH6 and RU1. The OME lowest effect level is noted in orange and the severe effect level in red.

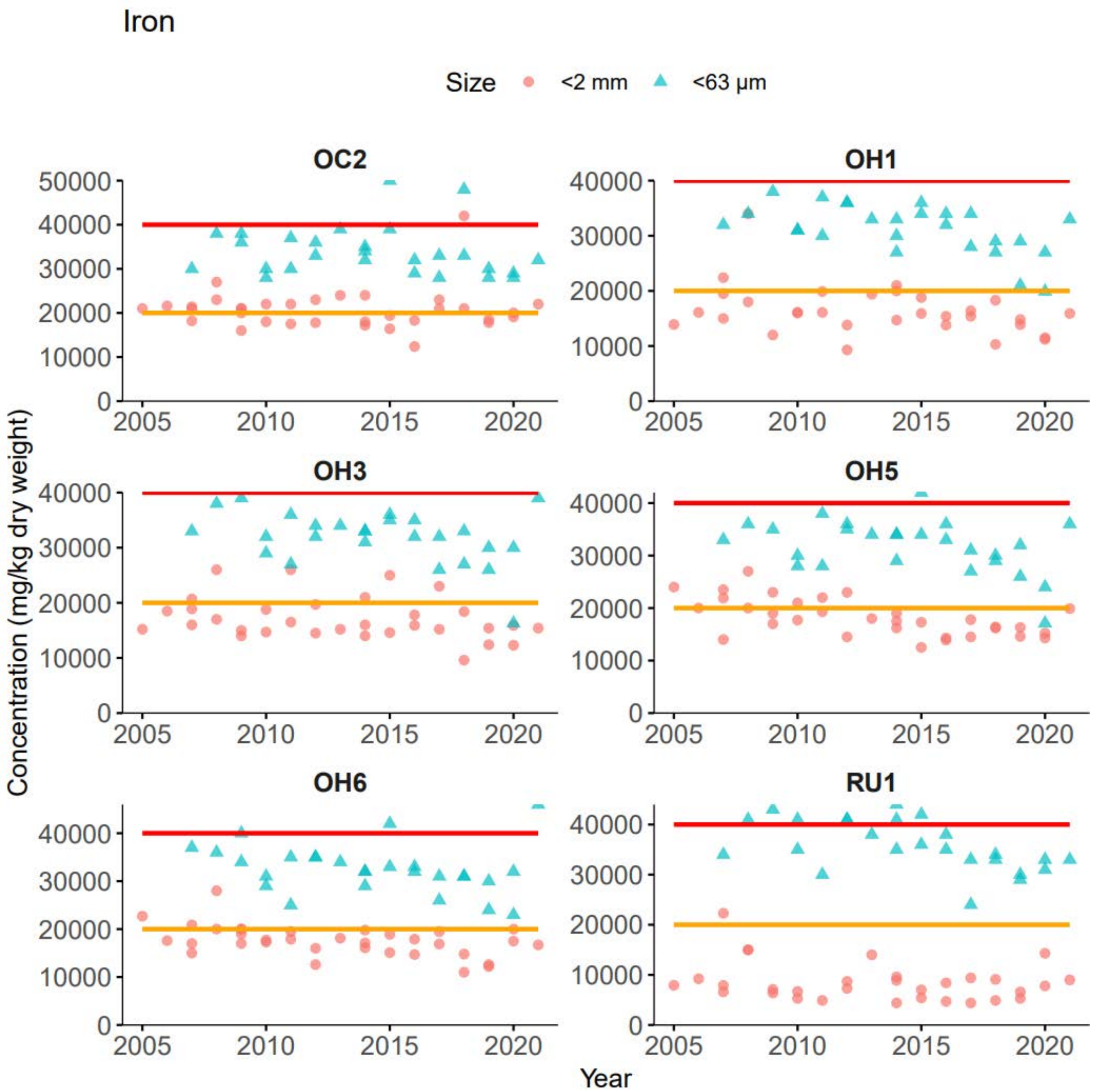


Figure E6 *Iron concentrations in the <2 mm (circles) and <63 µm (triangles) sediment size fraction at Sites OC2, OH3, OH5, OH1, OH6 and RU1. The OME lowest effect level is noted in orange and the severe effect level in red.*

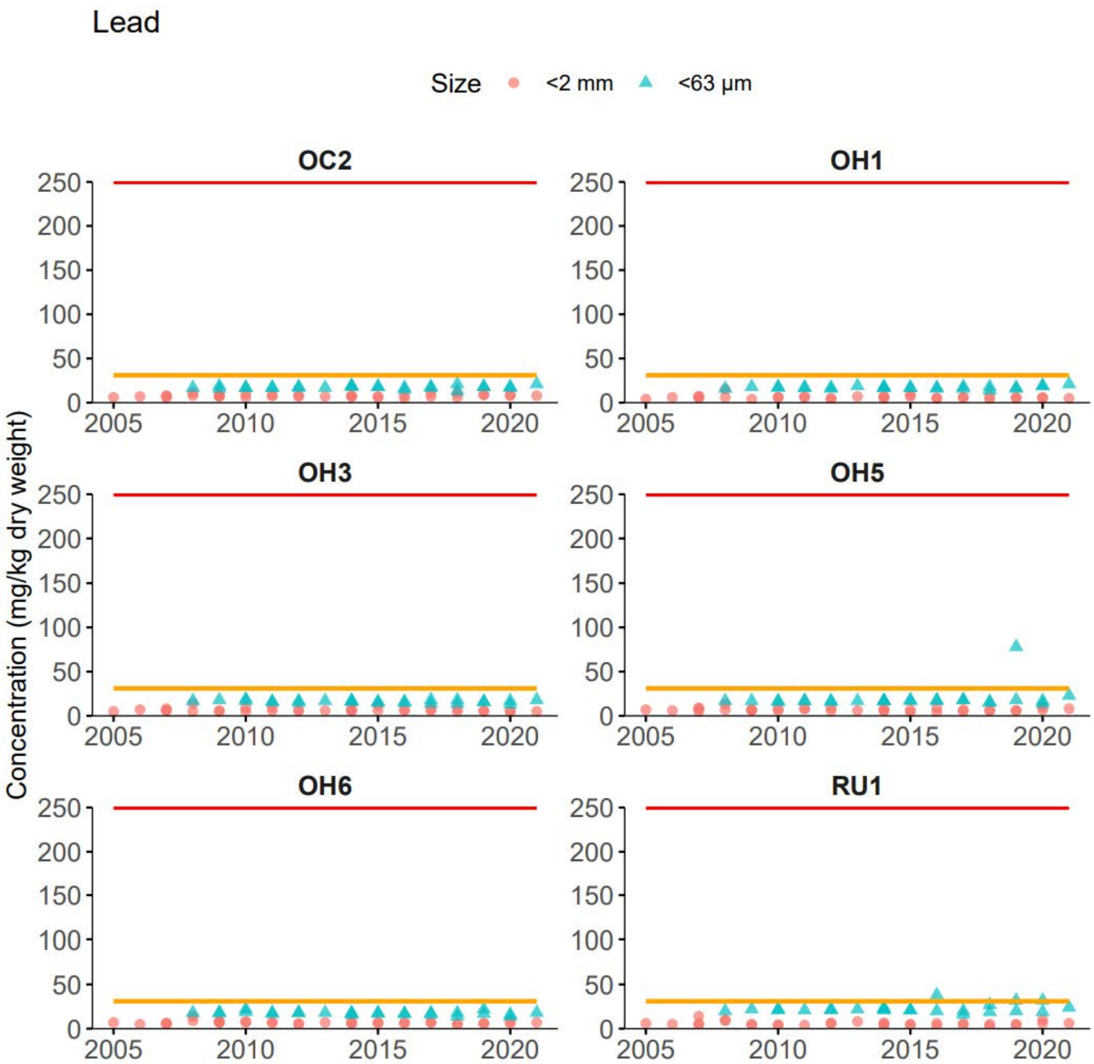


Figure E7 *Lead concentrations in the <2 mm (circles) and <63 µm (triangles) sediment size fraction at Sites OC2, OH3, OH5, OH1, OH6 and RU1. The OME lowest effect level is noted in orange and the severe effect level in red.*

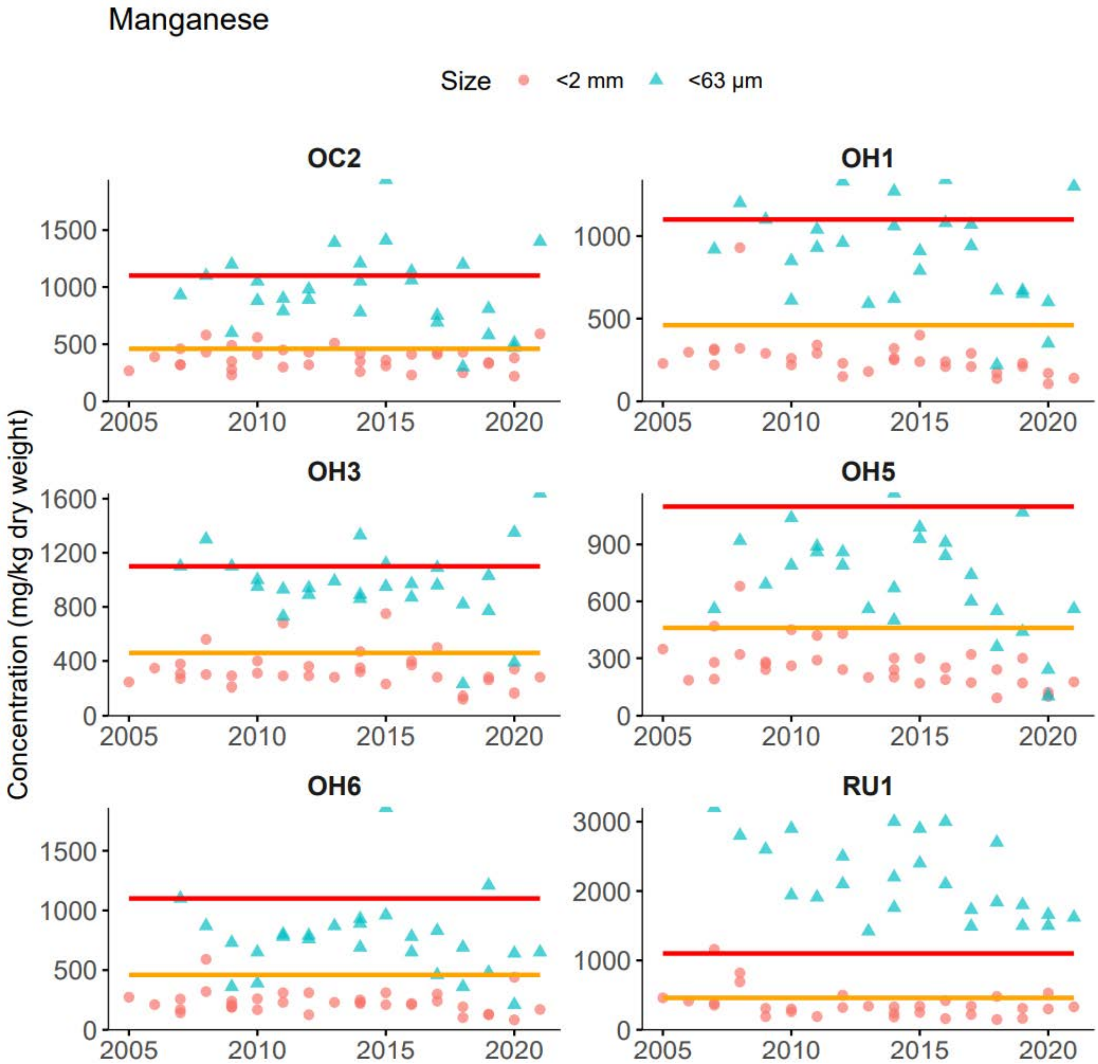


Figure E8 *Manganese concentrations in the <2 mm (circles) and <63 µm (triangles) sediment size fraction at Sites OC2, OH3, OH5, OH1, OH6 and RU1. The OME lowest effect level is noted in orange and the severe effect level in red.*

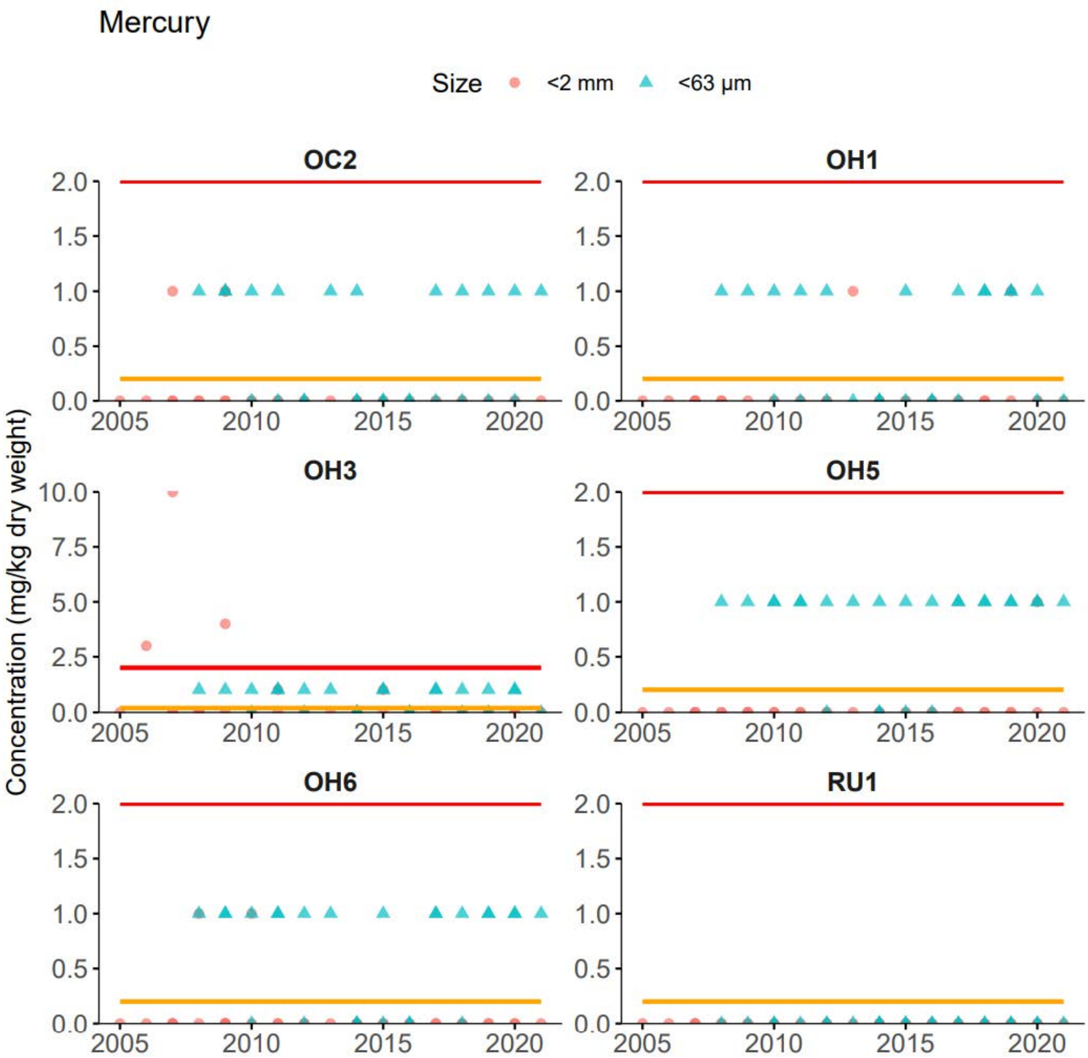


Figure E9 *Mercury concentrations in the <2 mm (circles) and <63 µm (triangles) sediment size fraction at Sites OC2, OH3, OH5, OH1, OH6 and RU1. The OME lowest effect level is noted in orange and the severe effect level in red.*

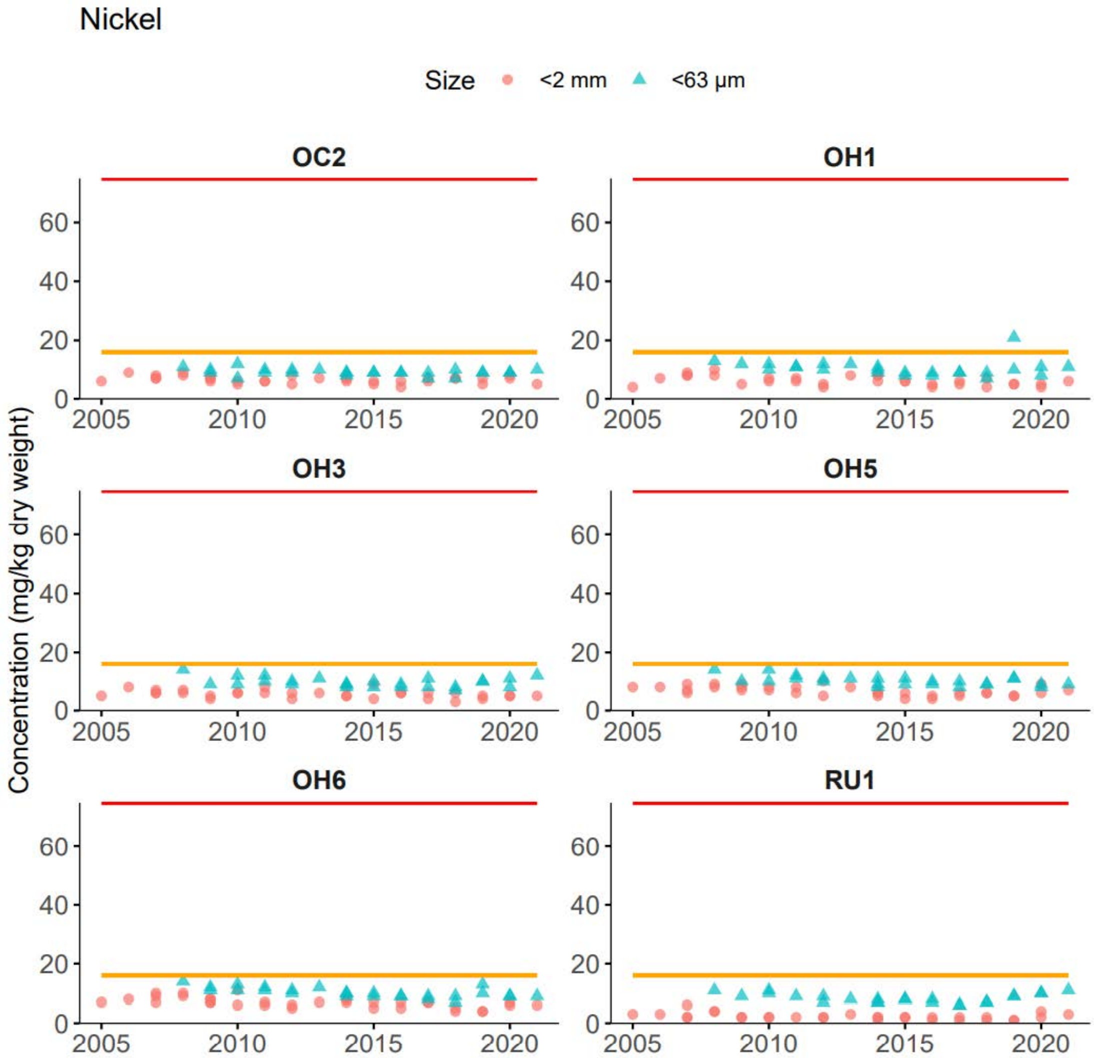


Figure E10 *Nickel concentrations in the <2 mm (circles) and <63 µm (triangles) sediment size fraction at Sites OC2, OH3, OH5, OH1, OH6 and RU1. The OME lowest effect level is noted in orange and the severe effect level in red.*

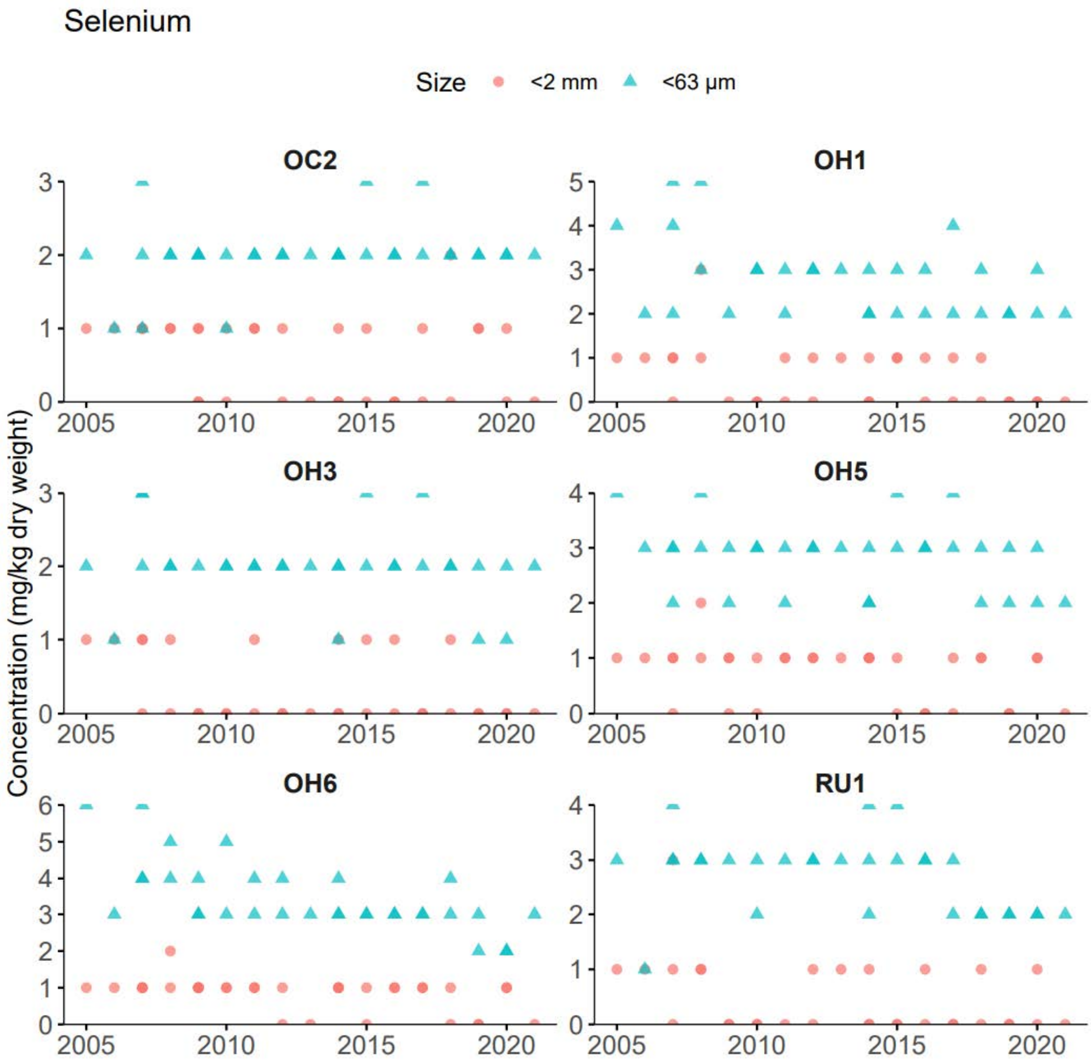


Figure E11 Selenium concentrations in the <2 mm (circles) and <63 µm (triangles) sediment size fraction at Sites OC2, OH3, OH5, OH1, OH6 and RU1.

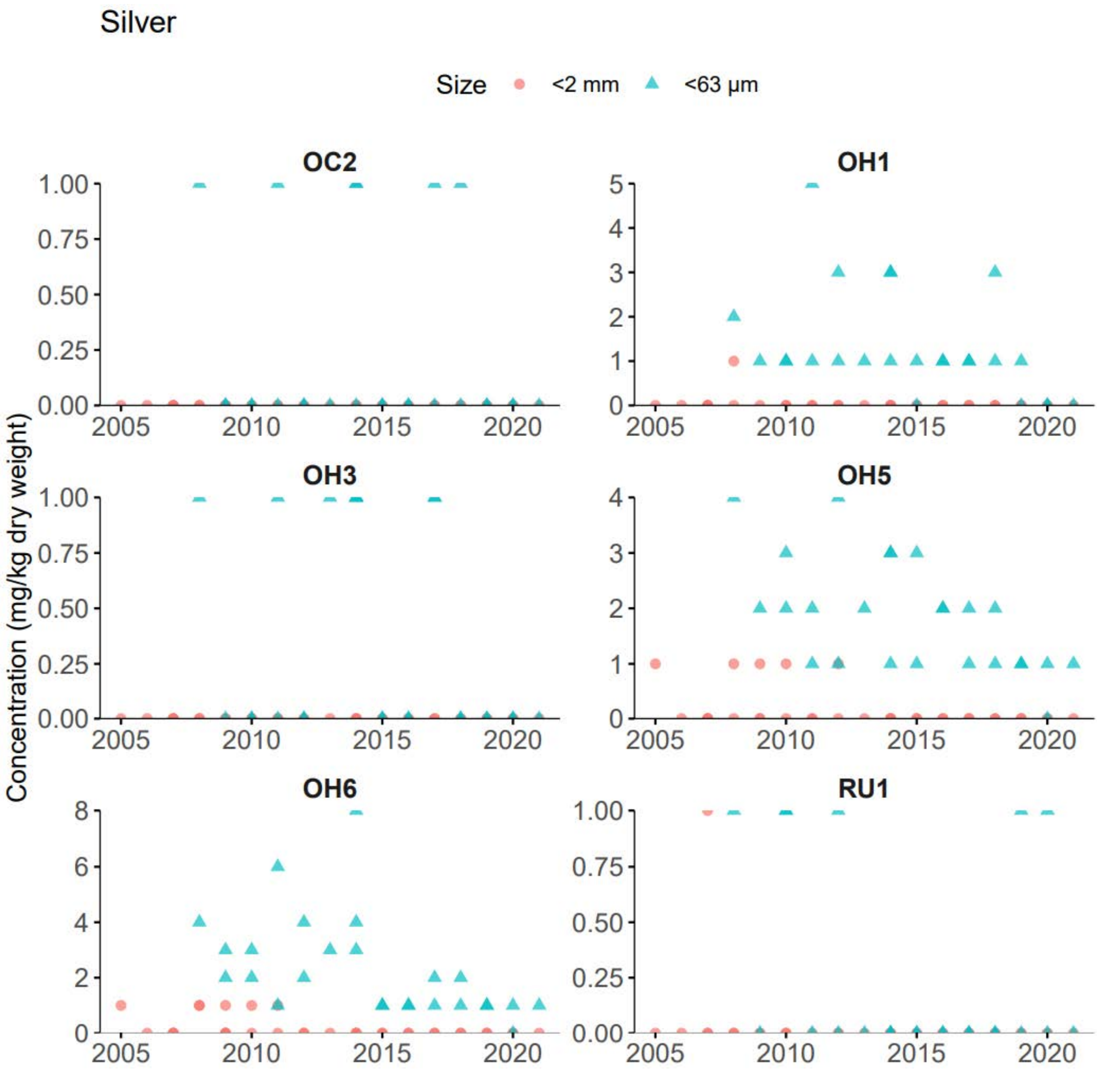


Figure E12 *Silver concentrations in the <2 mm (circles) and <63 µm (triangles) sediment size fraction at Sites OC2, OH3, OH5, OH1, OH6 and RU1.*

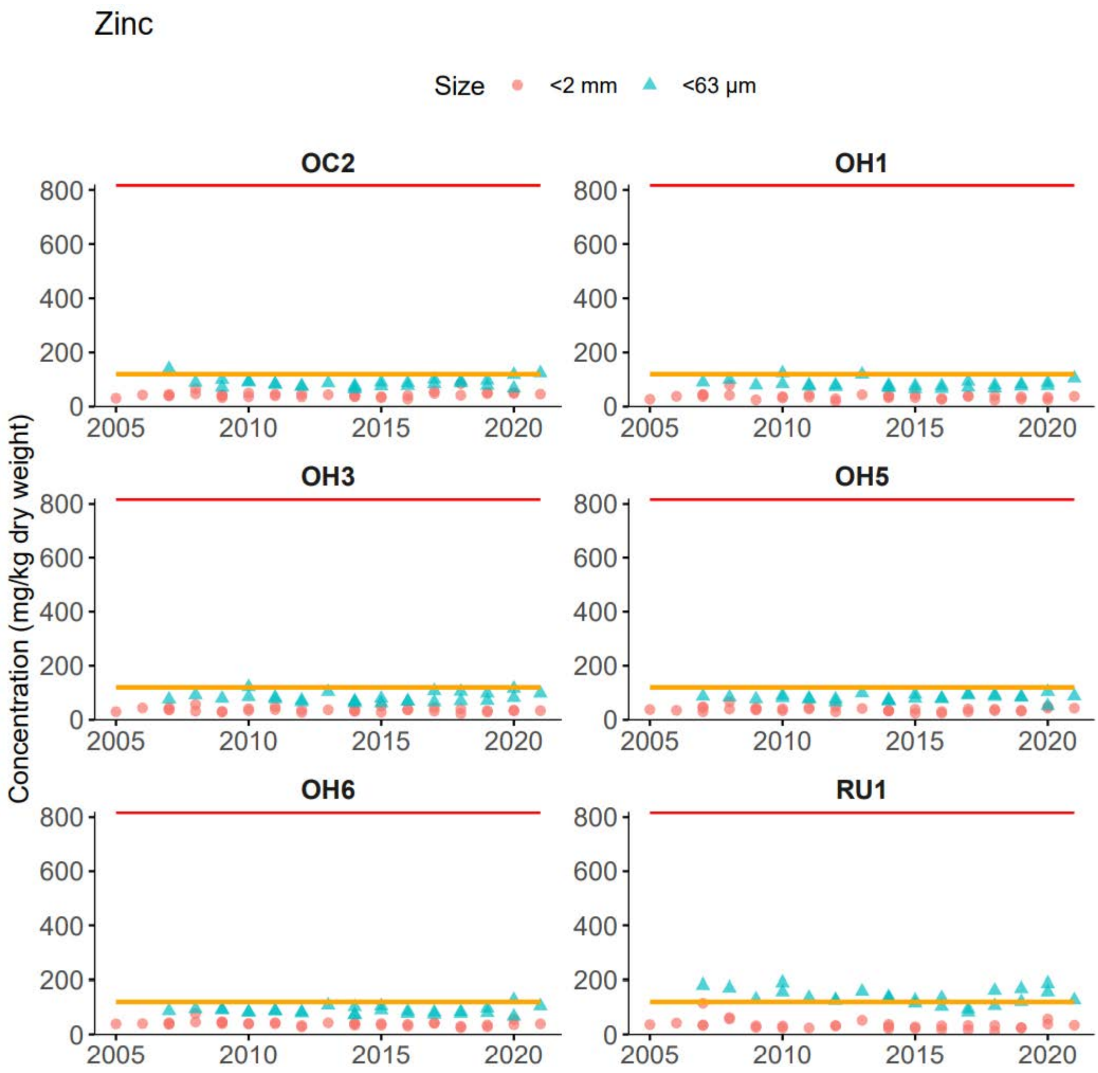


Figure E13 *Zinc concentrations in the <2 mm (circles) and <63 µm (triangles) sediment size fraction at Sites OC2, OH3, OH5, OH1, OH6 and RU1. The OME lowest effect level is noted in orange and the severe effect level in red.*

APPENDIX F: Periphyton Data

Table F3 Periphyton community composition during the spring survey in December 2020.

Phylum	Species	OC2	OH3	OH5	OH1	OH6	RU1
Charophyta	Closterium sp.						1
Charophyta	Cosmarium sp.	1					1
Chlorophyta	Acutodesmus sp.	1	1				
Chlorophyta	Cymbella aspera	1			1		1
Chlorophyta	Cymbella kappii	2					3
Chlorophyta	Cymbella sp.	4	1	1	1		1
Chlorophyta	Cymbella tumida	2			1		1
Chlorophyta	Gloeocystis sp.	1				1	2
Chlorophyta	Microspora sp.				1		
Chlorophyta	Monoraphidium sp.				1	1	
Chlorophyta	Oedogonium sp.	4	5	6	5	5	6
Chlorophyta	Scenedesmus sp.					1	
Chlorophyta	Stigeoclonium sp.					1	
Chlorophyta	Ulothrix sp.				1		
Chlorophyta	Unidentified Chlorophyte			8			
Chlorophyta	Zygnema sp.	3	1		1		
Cyanobacteria (likely not toxic)	Chamaesiphon sp.	7	7	2		6	2
Cyanobacteria (potentially toxic)	Anabaena sp.					1	
Cyanobacteria (potentially toxic)	Calothrix sp.		1				
Cyanobacteria (potentially toxic)	Heteroleibleinia sp.	6	8	5	1	8	2
Cyanobacteria (potentially toxic)	Leptolyngbya sp.	8	1				
Cyanobacteria (potentially toxic)	Merismopedia sp.	1					
Cyanobacteria (potentially toxic)	Phormidium sp.	4	3		3	1	8
Diatoms	Cocconeis sp.	3	6	3	8	6	3
Diatoms	Epithemia cf. adnata				1	1	
Diatoms	Epithemia sorex	1	1				
Diatoms	Eunotia sp.				1		
Diatoms	Fragilaria vaucheriae	1			1	2	
Diatoms	Frustulia sp.					1	
Diatoms	Gomphoneis minuta var. cassieae					1	
Diatoms	Gomphonema sp.	7	4	4	3	7	5
Diatoms	Melosira varians	4			1	2	2
Diatoms	Navicula sp.			1	1		4
Diatoms	Nitzschia sp.	1		1	2		
Diatoms	Pinnularia sp.			1	1		
Diatoms	Tryblionella sp.						1
Diatoms	Ulnaria biceps	1			1	1	
Diatoms	Ulnaria ramesii	1					
Diatoms	Ulnaria ulna	1				1	
Ochrophyta	Tribonema sp.						1
Potential problem species (taste/odour)	Spirogyra sp.	2				1	
Rhodophyta	Audouinella sp.	2	4		2	1	2

Table F4 Periphyton community composition during the autumn survey in March 2021.

Phylum	Species	OC2	OH3	OH5	OH1	OH6	RU1
Chlorophyta	Acutodesmus sp.	1					
Chlorophyta	Cymbella tumida	1					
Chlorophyta	Desmodesmus sp.					1	
Chlorophyta	Monoraphidium sp.				1		
Chlorophyta	Oedogonium sp.	2	2	2	2	1	
Chlorophyta	Palmella sp.			7	5	7	1
Cyanobacteria (not known to be toxic)	Chamaesiphon sp.		1				
Cyanobacteria (potentially toxic)	Anabaena sp.	1	1			1	
Cyanobacteria (potentially toxic)	Heteroleibleinia sp.	4	8	8	8	1	1
Cyanobacteria (potentially toxic)	Merismopedia sp.	1		1			
Cyanobacteria (potentially toxic)	Phormidium sp.		1			8	8
Diatoms	Amphicampa mirabilis		1			1	2
Diatoms	Cocconeis sp.	1	1	1	1	1	
Diatoms	Desmodesmus sp.	1					
Diatoms	Encyonema minutum	1					
Diatoms	Epithemia cf. adnata				1	1	1
Diatoms	Eunotia sp.	1					
Diatoms	Frustulia cf. rhomboides						1
Diatoms	Gomphonema sp.	8	7	5	7	2	7
Diatoms	Melosira varians	2				2	
Diatoms	Navicula sp.	3		1	3	1	1
Diatoms	Nitzschia sp.				1		1
Diatoms	Pinnularia sp.						1
Diatoms	Ulnaria acus					1	
Diatoms	Ulnaria biceps	2				1	
Potential problem species (taste/odour)	Spirogyra sp.		1			1	1
Rhodophyta	Audouinella sp.	1	1	1	2	2	1

Table F5 *Periphyton ash-free dry mass (AFDM) and chlorophyll-a biomass during the spring survey in December 2020 (spring) and March 2021 (autumn).*

Season	Site	AFDW (g/sample)	Chl-a (µg/sample)	Chl-a (mg/m²)	AFDW (g/m²)
Spring	OC2	0.33	2100	534.76	84
	OC2	0.11	850	216.45	28
	OC2	0.42	3800	967.66	107
	OC2	0.35	1700	432.9	89.1
	OC2	0.33	4300	1094.99	84
	OH1	0.1	890	226.64	25.5
	OH1	0.27	420	106.95	68.8
	OH1	0.23	2700	687.55	58.6
	OH1	0.28	2500	636.62	71.3
	OH1	0.36	1500	381.97	91.7
	OH3	0.68	3000	763.94	173.2
	OH3	0.45	1400	356.51	114.6
	OH3	0.077	940	239.37	19.6
	OH3	0.42	1700	432.9	107
	OH3	0.84	680	173.16	213.9
	OH5	0.21	940	239.37	53.5
	OH5	0.43	3800	967.66	109.5
	OH5	0.18	2000	509.3	45.8
	OH5	0.28	2200	560.23	71.3
	OH5	0.053	850	216.45	13.5
	OH6	0.3	3000	763.94	76.4
	OH6	0.3	1600	407.44	76.4
	OH6	0.16	2700	687.55	40.7
	OH6	0.34	1200	305.58	86.6
	OH6	0.28	3250	827.61	71.3
	RU1	0.055	460	117.14	14
	RU1	0.33	1700	432.9	84
	RU1	0.094	260	66.21	23.9
	RU1	0.11	600	152.79	28
	RU1	0.17	890	226.64	43.3
Autumn	OC2	0.031	130	33.1	7.9
	OC2	0.021	120	30.56	5.3
	OC2	0.015	71	18.08	3.8
	OC2	0.015	66	16.81	3.8
	OC2	0.021	130	33.1	5.3
	OH1	0.013	42	10.7	3.3
	OH1	0.023	67	17.06	5.9
	OH1	0.02	70	17.83	5.1
	OH1	0.019	120	30.56	4.8
	OH1	0.04	73	18.59	10.2
	OH3	0.034	62	15.79	8.7
	OH3	0.01	9.1	2.32	2.5
	OH3	0.13	910	231.73	33.1

Season	Site	AFDW (g/sample)	Chl-a (µg/sample)	Chl-a (mg/m^2)	AFDW (g/m^2)
	OH3	0.025	170	43.29	6.4
	OH3	0.091	540	137.51	23.2
	OH5	0.061	300	76.39	15.5
	OH5	0.02	56	14.26	5.1
	OH5	0.04	79	20.12	10.2
	OH5	0.021	88	22.41	5.3
	OH5	0.02	56	14.26	5.1
	OH6	0.06	160	40.74	15.3
	OH6	0.073	280	71.3	18.6
	OH6	0.15	550	140.06	38.2
	OH6	0.12	1100	280.11	30.6
	OH6	0.083	870	221.54	21.1
	RU1	0.08	150	38.2	20.4
	RU1	0.046	180	45.84	11.7
	RU1	0.013	46	11.71	3.3
	RU1	0.19	660	168.07	48.4
	RU1	0.071	180	45.84	18.1

APPENDIX G: Selenium Testing Results – March 2021

Hill Laboratories
TRIED, TESTED **AND TRUSTED**

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

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

Certificate of Analysis

Client:	Ryder Environmental Limited	**Lab No:**	2569045	SPv1
Contact:	G Ryder	**Date Received:**	26-Mar-2021	
	C/- Ryder Environmental Limited	**Date Reported:**	13-Apr-2021	
	PO Box 1023	**Quote No:**	88303	
	Dunedin 9054	**Order No:**	PO000048	
		Client Reference:		
		Submitted By:	Dean Olsen	

Sample Type: Fish

	Sample Name:	OC2 [Bullies] 24-Mar-2021	OH6 [Bullies] 24-Mar-2021	OC2 [Bullies Sub-Sample]	OH6 [Bullies Sub-Sample]	
	Lab Number:	2569045.1	2569045.4	2569045.7	2569045.8	
Weight*	g	12.244	18.328	12.244	18.328	-
Count of Bullies*		22	19	22	19	-
Dry Matter*	g/100g as rcvd	-	-	24	25	-
Selenium	mg/kg as rcvd	-	-	0.49	0.83	-
Selenium	mg/kg dry wt	-	-	2.1	3.3	-

Sample Type: Plant Material

	Sample Name:	OC2 [Plant] 24-Mar-2021	OC2 [Algae] 24-Mar-2021	OH6 [Plant] 24-Mar-2021	OH6 [Algae] 24-Mar-2021	
	Lab Number:	2569045.2	2569045.3	2569045.5	2569045.6	
Dry Matter*	g/100g as rcvd	5.3	7.1	5.1	5.9	-
Selenium*	mg/kg as rcvd	0.013	0.031	0.036	0.074	-
Selenium*	mg/kg dry wt	0.25	0.43	0.70	1.26	-

Summary of Methods

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

Sample Type: Fish

Test	Method Description	Default Detection Limit	Sample No
Weight*	Measurement on analytical balance.	0.0001 g	1, 4, 7-8
Count of Bullies*	Count of bullies per sample.	1	1, 4, 7-8
Dry Matter*	Drying for minimum of 24 hours at 65°C, gravimetry. Fact Sheet No 2.3.2-14, A Compendium of Chemical, Physical and Biological Methods for Assessing and Monitoring the Remediation of Contaminated Sediment Sites, 2003.	0.10 g/100g as rcvd	7-8
Sample Preparation by Foods Section*	Sample preparation as per test or client requirements.	-	1, 4

Sample Type: Plant Material

Test	Method Description	Default Detection Limit	Sample No
Homogenise*	Mincing, chopping, or blending of sample to form homogenous sample fraction.	-	2-3, 5-8
Dry Matter*	Drying for 16 hours at 103°C, gravimetry. AOAC 945.15, 19th Edition.	0.10 g/100g as rcvd	2-3, 5-6
TMAH Digestion*	Tetramethylammonium hydroxide micro digestion, filtration. P.A.Fecher, I.Goldman and A.Nagengast. Journal of Analytical Atomic Spectrometry, 1998, **13**, 977-982.	-	2-3, 5-8
Selenium*	TMAH digestion on as received basis. Analysis by ICP-MS, correction for dry matter.	0.004 mg/kg dry wt	2-3, 5-8

APPENDIX H: Macroinvertebrate Data

Table H1 Benthic macroinvertebrate data for sites in the Ohinemuri River (sites OC2, OH3 and OH5) in December 2020.

		OC2						OH3						OH5					
TAXON	MCI score	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
ACARINA	5		5													5		30	5
CNIDARIA																			
Hydra species	3			5															
COLEOPTERA																			
Berosus species	5																		
Elmidae	6	65		10	45	20	5	224	30	80	180	55	20	5	5	15	15	75	25
COLLEMBOLA	6							8		5									
CRUSTACEA																			
Copepoda	5												20						
Ostracoda	3							8									5		
Paracalliope fluviatilis	5								80	5	10	50	15	10					5
DIPTERA																			
Aphrophila species	5	25	45	65	10	30	5			5									
Austrosimulium species	3																		
Chironomus species	1																		
Corynoneura scutellata	2								10										
Empididae	3		20	30	5	20	15				5			5					
Ephydridae	4	5																	
Maoridiamesa species	3	20	20	20		5	20												
Mischoderus species	4											5							
Muscidae	3			5			10												
Orthocladiinae	2	150	50	180	85	120	355	8		25	5				5				
Polypedilum species	3																		
Tanypodinae	5	5																	
Tanytarsini	3	190	110	170	10	60	320			10		5		5					5
EPHEMEROPTERA																			
Austroclima species	9									5									
Coloburiscus humeralis	9									5									
Deleatidium species	8			5							5								
Zephlebia species	7	25				5	10	32	5	25	70	10	20	5	10	5	5	20	5
MEGALOPTERA																			
Archichauliodes diversus	7									20	10		5						
MOLLUSCA																			
Ferrissia species	3	10		15		10													5
Latia species	3	45	10	55	20	15	10				35	30					5		
Physa / Physella species	3			5			10											15	5
Potamopyrgus antipodarum	4	1510	160	500	210	715	850	1096	1025	665	445	360	435	1370	2800	830	1330	990	715
Pseudosuccinea	3													10		5		90	
NEMATODA	3								5									5	
NEMERTEA	3	5						16		5	5		20		10	5	5	5	5
OLIGOCHAETA	1	30		25	10		10	40	50	15	25	40	5	90	185	40	5	25	10
PLATYHELMINTHES	3	20	5	20	20	20	20	8	40	15		15	35	5		5		10	
TRICHOPTERA																			
Hudsonema alienum	6																		
Hudsonema amabile	6										5			10	15	5	15	50	
Hydrobiosidae early instar	5	5	10	15	5	10	20				25							5	
Hydrobiosis species	5		5	20		15	15			5									
Hydropsyche	4	25		65	5	95	40	8		5	15		5						5
Neurochorema species	6	15	10	20	10	20	5	8		5								10	
Oxyethira albiceps	2	5	10	10	10	5	35	24		20	15	20	15	5		5	10	5	15
Paroxyethira species	2							24	10		5	30	45	25	35	45	25	30	30
Pycnocentria species	7																		
Pycnocentrodes species	5	185	25	140	15	35	55			20	225	15	10	55	45	10	70	110	80
Triplectides species	5																		

Table H2 Benthic macroinvertebrate data for sites in the Ohinemuri River (OH1 and OH6) and Ruahorehore Stream (RU1) sites in December 2020.

		OH1						OH6						RU1					
TAXON	**MCI score**	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**
ACARINA	5					5		10	10					10			3		
CNIDARIA																			
Hydra species	3								10				5						
COLEOPTERA																			
Berosus species	5		1																
Elmidae	6	3	3	10	30	10	15	20	10	5		45			5	48	10	20	5
COLLEMBOLA	6									5									
CRUSTACEA																			
Copepoda	5																		
Ostracoda	3	2						10	10		5		20						
Paracalliope fluviatilis	5	3	1	10		5			60		55	5		210	80	40	3		335
DIPTERA																			
Aphrophila species	5	1			5		10			15				15				8	
Austrosimulium species	3													10		3			
Chironomus species	1															3			
Corynoneura scutellata	2	1											5	5	5				5
Empididae	3				5				20	5	5							5	
Ephydridae	4																		
Maoridiamesa species	3																	8	
Mischoderus species	4																		
Muscidae	3			5	5	5							5					5	
Orthocladiinae	2		3			5		10			5		30		55	5		28	5
Polypedilum species	3							10					5			3			
Tanypodinae	5								10										
Tanytarsini	3	6	18	255	180	170	140	400	150	255	60	140	65	5	15			23	5
EPHEMEROPTERA																			
Austroclima species	9					5									5			10	
Coloburiscus humeralis	9																		
Deleatidium species	8			5															
Zephlebia species	7	6	11		5		35	10	30			10		5	55	83			20
MEGALOPTERA																			
Archichauliodes diversus	7	2	1		5		5				5	5	5			3			
MOLLUSCA																			
Ferrissia species	3	12	14			20	30												
Latia species	3														45	3			
Physa / Physella species	3	10	3		15	20		60	20	35	35	100	35						
Potamopyrgus antipodarum	4	385	616	135	570	65	140	60	100	20	140	15	50	2025	555	128	268	130	2040
Pseudosuccinea	3																		
NEMATODA	3				10														
NEMERTEA	3	9	5			5		10	20		15					3	5		15
OLIGOCHAETA	1	2	2	25	40	10		30	80	10	20	10	30	15		5	30	8	35
PLATYHELMINTHES	3	5	5		5				20		5	5		5		3			
TRICHOPTERA																			
Hudsonema alienum	6	1																	
Hudsonema amabile	6			20	30		15	50	190	30	255	5	5	15			8	3	10
Hydrobiosidae early instar	5	1	2	15	40	10	5	60	50		10	10		15	20	5	3	23	25
Hydrobiosis species	5	1	1	5	10	15	10	10	20	55	10	15	15		5	3			
Hydropsyche	4	5	14	385	335	475	155	140	330	105	100	50	40	35	70	8		53	
Neurochorema species	6					5	5	10											
Oxyethira albiceps	2													10	5				
Paroxyethira species	2	2	1																
Pycnocentria species	7													10	30				5
Pycnocentrodes species	5	33	14	130	35	15	140	1120		60	65	15	25	125	130	70	3	8	60
Triplectides species	5	1																	5

Table H3 *Benthic macroinvertebrate data for sites in the Ohinemuri River (sites OH5, OH1 and OH6) in March 2021.*

		OH5						OH1						OH6					
TAXON	**MCI score**	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**
ACARINA	5																		
COLEOPTERA																			
Elmidae	6	2	14	24	10	8	20	20		5			5	10				8	8
COLLEMBOLA	6	2	2																
CRUSTACEA																			
Copepoda	5																		
Ostracoda	3						3												
Paracalliope fluviatilis	5																		
DIPTERA																			
Aphrophila species	5							10					5	5	5				8
Austrosimulium species	3					3		20		25	10	20	20		10	10	8		24
Chironomus species	1														5				
Empididae	3													5					
Maoridiamesa species	3																		
Muscidae	3																		16
Orthocladiinae	2			8					10	40	10	45	60	255	435	550	280	104	72
Polypedilum species	3																		
Tanypodinae	5																		
Tanytarsini	3		6	40	4			70	90	185	15	290	410	395	955	880	528	448	384
EPHEMEROPTERA																			
Austroclima species	9																		
Deleatidium species	8																		
Zephlebia species	7	4	4							10									
HIRUDINEA	3		4		2			10		5	5	5	5						
MEGALOPTERA																			
Archichauliodes diversus	7			8				10	30	10					5				
MOLLUSCA																			
Ferrissia species	3																		
Latia species	3																		
Physa / Physella species	3					3								15	10		8	8	
Potamopyrgus antipodarum	4	292	606	1328	462	575	275	1590	1030	510	1415	515	475	210	155	170	136	192	344
Sphaeriidae	3																		
NEMATODA	3																		
NEMERTEA	3		6	8			5		20				3		5	10	32	8	8
ODONATA																			
Xanthocnemis zealandica	5	14	2																
OLIGOCHAETA	1	2	16	8	4	5	5	10		5	10	5	3	10	10	100	16	16	8
PLATYHELMINTHES	3	8	3		6	8	13	10		10							16	16	24
TRICHOPTERA																			
Hudsonema amabile	6							10		10		5	3						
Hydrobiosidae early instar	5				2														
Hydrobiosis species	5				2							5						8	8
Hydropsyche	4							30		10		15	18	5	15	10	16	16	
Neurochorema species	6			8											5		8		
Oxyethira albiceps	2			8							5		18			10		16	8
Paroxyethira species	2	2		16		3				5		5	3	5	5	20			
Plectrocnemia species	8																		
Pycnocentria species	7							20							5				
Pycnocentrodes species	5					3		30		5	5		3	5	20				
Zelandoptila species	8																		

Table H4 *Benthic macroinvertebrate data for sites in the Ohinemuri River (OH3 and OC2) and Ruahorehore Stream (RU1) sites in March 2021.*

		RU1						OH3						OC2					
TAXON	**MCI score**	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**
ACARINA	5																		20
COLEOPTERA																			
Elmidae	6	5	60	38	3	8	55	140	150	570	380	420	380	45	55	360	215	100	510
COLLEMBOLA	6													5					
CRUSTACEA																			
Copepoda	5					3													
Ostracoda	3																		
Paracalliope fluviatilis	5	15	5	8	5	58	135						10			40	5		
DIPTERA																			
Aphrophila species	5	5	5	1	3		35			20	25	10	10	15				30	20
Austrosimulium species	3	20	15		5	13	15		10	10	10	10		25	5			30	20
Chironomus species	1																		
Empididae	3														5				
Maoridiamesa species	3													5					10
Muscidae	3				3									5				30	10
Orthocladiinae	2	10	15	21	35	73	410			550	135	510	50	155	150	100	15	160	200
Polypedilum species	3			3			5							5					
Tanypodinae	5	5																	
Tanytarsini	3	5	5	10	25	8			15	580	140	720	300	505	630	200	20	1200	260
EPHEMEROPTERA																			
Austroclima species	9		10	8	10	3													
Deleatidium species	8										5								
Zephlebia species	7	5	15	17	5	38	20	25	10	30	5	50	20			20		20	10
HIRUDINEA	3			1															10
MEGALOPTERA																			
Archichauliodes diversus	7			4						10	10			5				20	30
MOLLUSCA																			
Ferrissia species	3														10				
Latia species	3	5		9	3	15	25	15	50	80	120	60	40	15	15	40	5	20	
Physa / Physella species	3			1															
Potamopyrgus antipodarum	4	1050	835	131	80	320	260	915	605	1290	1135	440	550	320	425	6060	920	2020	870
Sphaeriidae	3													5					
NEMATODA	3															20			
NEMERTEA	3		5			3	10	5		10	5	20	10	20	10				
ODONATA																			
Xanthocnemis zealandica	5																		
OLIGOCHAETA	1	5		1	3	3	10	5	10		10	50	20		10	60	15	20	10
PLATYHELMINTHES	3		20	5		3	5	90	20	40	5		70	90	135	200	30	60	20
TRICHOPTERA																			
Hudsonema amabile	6						5							5	5				
Hydrobiosidae early instar	5	5											20		5				
Hydrobiosis species	5		15	2		5								15	5				
Hydropsyche	4	25	10	5	18	15	5		5	30				50	35	100	10	110	90
Neurochorema species	6									10			10	35	20			60	
Oxyethira albiceps	2	5	5	2	5	40	5									60	10		10
Paroxyethira species	2			1		5	40												
Plectrocnemia species	8			2															
Pycnocentria species	7	20	10	5	25	23	25							10	10			10	
Pycnocentrodes species	5	20	10	17	13	68	40							15	35	60	35	30	
Zelandoptila species	8					5													

APPENDIX I: Fish Data

Table I1 *Fish lengths (mm) at Ohinemuri River sites (OC2, OH5, OH1, OH6) during the March 2021 (autumn) fish population survey.*

Site OC2

Pass	Species	Length (mm)																			
Pass 1	Common bully	15	20	20	20	20	20	20	20	20	20	20	40	40	40						
Pass 1	Cran's bully	15	15	20	20	20	20	20	20	20	20	20	20	20	25	25	25	25	25	30	30
		30	30	30	30	30	30	30	30	30	35	40	40	40	40	40	45	45	45	45	50
		60																			
Pass 1	Unidentified bully	40	50																		
Pass 1	Shortfin eel	70	70	90	90	90	100	100	100	100	110	110	120	150	190	200	300				
Pass 1	Unidentifed eel	100	120	200	>600																
Pass 1	Rainbow trout	110	110	120																	
Pass 1	Koura	20	20	20	30	30															
Pass 2	Common bully	20	20	20	20	20	20	30	30												
Pass 2	Cran's bully	20	20	20	20	20	20	20	20	25	30	30	30	30	30	40	40	40	40	45	45
		50	50	50																	
Pass 2	Shortfin eel	60	110	110	120	200															
Pass 2	Unidentifed eel	60	60	60	70	70	70	80	100	110											
Pass 2	Rainbow trout	90	100	170																	

Area fished: 50 m^2

Site OH5

Pass	Species	Length (mm)			
Pass 1	Cran's bully	34	34	35	50
Pass 1	Elver	80	90		
Pass 1	Unidentified eel	200			

Area fished: 126 m^2

Site OH1

Pass	Species	Length (mm)																
Pass 1	Cran's bully	35	35	35	40	40	40	42	45	50	52	52	52	55	63			
Pass 1	Shortfin eel	90	90	100	100	110	110	120	120	140	150	160	180	180	200	220	240	300
Pass 2	Cran's bully	30	40	45														
Pass 2	Elver	80	90															
Pass 2	Shortfin eel	150																

Area fished: 110 m^2

Site OH6

Pass	Species	Length (mm)													
Pass 1	Common bully	15	20	20	30	30	30								
Pass 1	Cran's bully	20	40	55	30	30	30	30	40	40	40	40	50	50	50	65
Pass 1	Elver	70	70	90	90	90	90	100	120							
Pass 1	Shortfin eel	80	90	90	90	100	100	100	120	120	180	200	250			
Pass 1	Unidentifed eel	150	200	400	500											
Pass 1	Rainbow trout	180														
Pass 2	Cran's bully	20	20	20	30	30										
Pass 2	Elver	90	100	100	100	100										
Pass 2	Shortfin eel	100	100	100	130	150	380									
Pass 2	Rainbow trout	140	170	200												

Area fished: 60 m^2

Table I2 Fish lengths (mm) at Ohinemuri River tributary sites (RU1, R1, M1, W1) during the March 2021 (autumn) fish population survey.

Site RU1

Pass	Species	Length (mm)
Pass 1	Cran's bully	15 15 15 15 20 20 20 30 30 30 30 40 45 45 45 50 50 60 70
Pass 1	Shortfin eel	90 90 180
Pass 2	Cran's bully	20 20 20 25 25
Pass 2	Elver	90 90

Area fished: 40 m^2

Site M1

Pass	Species	Length (mm)
Pass 1	Common bully	30 30 40
Pass 1	Cran's bully	20 20 20 20 40 40 40 40 45 45 50 50 50 55 60 60 60 60 60 65
		65 70
Pass1	Unidentified bully	50 60 50 50 40
Pass 1	Elver	100
Pass 1	Longfin eel	350 550
Pass 1	Rainbow trout	100 150
Pass 1	Koura	40 50 50
Pass 2	Common bully	45
Pass 2	Cran's bully	30 40 40 45 45 65
Pass 2	Koura	20 40 40 40 50 60

Area fished: 60 m^2

Site R1

Pass	Species	Length (mm)
Pass 1	Nil	

Area fished: 15 m^2

Site W1

Pass	Species	Length (mm)
Pass 1	Common bully	20 20 45 65 65
Pass 1	Cran's bully	30 80
Pass 1	Shortfin eel	230 300
Pass 1	Unidentified eel	250 250 250 300 400 400
Pass 1	Rainbow trout	100 220
Pass 1	Koura	50
Pass 2	Crans bully	40 50
Pass 2	Shortfin eel	230
Pass 2	Unidentified eel	200 250 250
Pass 2	Koura	60

Area fished: 5.5 m^2

APPENDIX J: OGNZL-WAT-WRC 2103 Overflow event

23 March 2021

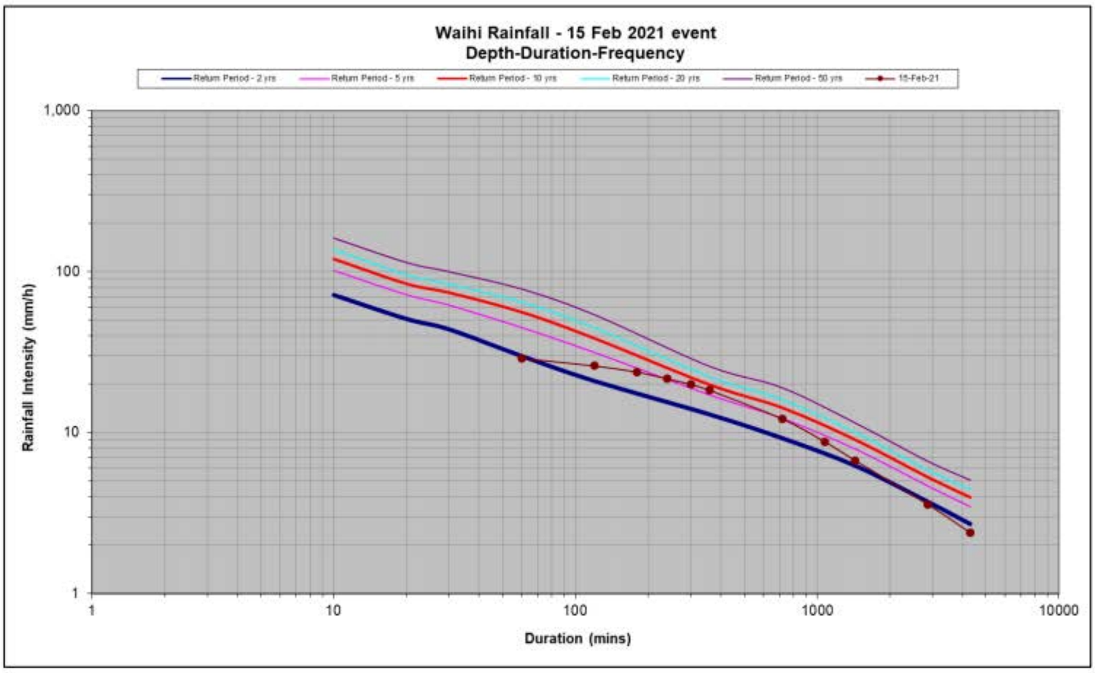
The General Manager
Waikato Regional Council
Private Bag 3038
Waikato Mail Centre
HAMILTON 3240

Attention: Ms S Roa

Notification of one pond overflow: Mill Collection Pond

Dear Sheryl,

Waihi experienced a 1 in 5-year storm event on the 15th of February 2021. 110mm fell within a six-hour period.



As a result of heavy rainfall at the start of the storm, power was lost to part of the Baxter Road site from approximately 19:30 on the 14th of February. The cause of the outage was blown fuses in an offsite power pole. It took a few attempts for PowerCo to restore the power.

Water treatment operators lost river level communications so as a precaution, stopped the water treatment discharge. Heavy rain began causing increased demand to discharge. With comms still down they began to discharge at a reduced rate. Unfortunately, this reduction in discharge allowed water volumes to build up within the site's water network. A rapid rise in MCP's water level caught the operators off guard and a small amount of water overflowed.

Oceana Gold (New Zealand) Ltd
(Incorporated in New Zealand
ARBN 061 101 773)

43 Moresby Ave
Waihi 3641
New Zealand

P O Box 190
Waihi 3610
New Zealand

Telephone: +64 7 863 8192
Facsimile: +64 7 863 8924
Website: www.oceanagold.com
www.waihigold.co.nz

OCEANAGOLD
WAIHI OPERATION

Mill Collection Pond Overflow – 15 February 2021

The intensity of the rainfall caused MCP to quickly fill and briefly overflow. MCP overflowed to the Ohinemuri River at 1500hrs and stopped at approx. 1830hrs. It is unknown how much water overflowed but the quantity is thought to be low.
Water samples were collected from the MCP, upstream (OH3) and downstream (OH5) river monitoring sites. Samples were sent for analysis as per standard procedure.

Table 1: RWQC exceedences

Date	Site	Criteria	RWQC Limit	Result
15/02/2021	OH3	Pb (g/m^3)	0.00013	0.00015
15/02/2021	OH3	pH (g/m^3)	6.5 – 9.0	6.4
15/02/2021	OH3	TSS (g/m^3)	100	300
15/02/2021	OH5	TSS (g/m^3)	100	270

Total Suspended Solids (TSS) was elevated at all river sites sampled due to the additional sediment laden water run-off. This is typical during storm events. Upstream control site OH3 recorded three results outside of RWQC. TSF2 is the only point source upstream of OH3 and was not being discharged at the time. MCP pond returned no results outside RWQC.

OGNZL has initiated an environmental incident investigation and is undertaking a review of its procedures during power outage and prioritising water treatment.

If you have any further queries, please contact Mark Burroughs on 07 863 9782 or Mark.Burroughs@oceanagold.com

Yours sincerely
OCEANA GOLD (NEW ZEALAND) LTD

Daniel Calderwood
HSE Manager

Oceana Gold (New Zealand) Ltd
(Incorporated in New Zealand
ARBN 061 101 773)

43 Moresby Ave
Waihi 3641
New Zealand

P O Box 190
Waihi 3610
New Zealand

Telephone: +64 7 863 8192
Facsimile: +64 7 863 8924
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www.waihigold.co.nz

APPENDIX K: OGNZL-WAT-WRC 2020-08 and 2020-09 Receiving water quality exceedance reports

14 August 2020

Sheryl Roa
Principal Advisor - Consents
Waikato Regional Council

Via Email

Dear Sheryl,

RE: **Receiving Water Quality Results – July 2020**

I am writing to advise that OGNZL Waihi's end of month compliance monitoring recorded four results outside of the receiving water quality criteria (RWQC) stipulated in its consents. The results are not believed to be related to mining activities and are reported to the Council as a courtesy as previously agreed.

The elevated results are summarised in Table 1 below.

Table 1: Receiving Water Quality Criteria Results – July 2020

Date	Site	Criteria	RWQC Limit	Result
06/07/2020	OC2	pH (pH units)	6.5-9.0	6.4
06/07/2020	RU1	pH (pH units)	6.5-9.0	6.4
06/07/2020	RU3	pH (pH units)	6.5-9.0	6.4
06/07/2020	ES04 South	Zn (g/m^3)	0.030	0.079

Additional Commentary

OC2, RU1, RU3 – pH

OGNZL Waihi does not believe the low pH at these sites are related to mine operations. Samples were taken during a period of rainfall. The rivers and streams often record lower pH after rain.

ES04 South

OGNZL Waihi does not believe the elevated zinc at this site is related to mine operations. The origin of the zinc is unknown but could be associated with galvanised corrugated iron fencing or vehicle brake pad runoff.

If you have any further queries, please contact Cassie on 07 863 9797 or cassie.craig@oceanagold.com

Yours sincerely,

Daniel Calderwood – HSE Manager
OCEANA GOLD (NEW ZEALAND) LTD

OCEANAGOLD
WAIHI OPERATION

15 September 2020

Sheryl Roa
Principal Advisor - Consents
Waikato Regional Council

Via Email

Dear Sheryl,

RE: **Receiving Water Quality Results – August 2020**

I am writing to advise that OGNZL Waihi's end of month compliance monitoring recorded two results outside of the receiving water quality criteria (RWQC) stipulated in its consents. The results are not believed to be related to mining activities and are reported to the Council as a courtesy as previously agreed.

The elevated results are summarised in Table 1 below.

Table 1: Receiving Water Quality Criteria Results – August 2020

Date	Site	Criteria	RWQC Limit	Result
03/08/2020	RU1b	pH (pH units)	6.5-9.0	6.4
03/08/2020	ES04 South	Zn (g/m^3)	0.028	0.038

Additional Commentary

RU1b – pH

OGNZL Waihi does not believe the low pH at these sites are related to mine operations. Samples were taken during a period of rainfall. The rivers and streams often record lower pH after rain.

ES04 South

OGNZL Waihi does not believe the elevated zinc at this site is related to mine operations. The origin of the zinc is unknown but could be associated with galvanised corrugated iron fencing or vehicle brake pad runoff.

If you have any further queries, please contact Mark on 07 863 9782 or mark.burroughs@oceanagold.com

Yours sincerely,

Daniel Calderwood – HSE Manager
OCEANA GOLD (NEW ZEALAND) LTD