Condition 59 - Responses to Monitoring Report

For the Comprehensive Stormwater Network Discharge Consent (CRC252424) Two Year Report 2024-2025

Christchurch City Council

June 2026

Christchurch City Council

Document Control	
Document location	TRIM 26/1323049
Related documents	CSNDC Two Year Report 2024-25

Version	Prepared By	Approved by	Date
1	Christopher Watt, Waterways Ecologist, Three Waters Emily Tredinnick, Team Leader Quality & Compliance Dr Salina Dhakal Poudyal, Quality Assurance Officer, Three Waters	Emily Tredinnick, Team Leader Quality & Compliance	18/06/2026

Contents

1. Executive Summary

Christchurch City Council holds a Comprehensive Stormwater Network Discharge Consent (CSNDC), which requires water quality monitoring and investigations into exceedance of consent Attribute Target Levels (ATLs) in the receiving environment. This report presents results of investigations in response to consent ATL exceedances, as required by condition 59 of the consent.

Based on results from 2023 and previous monitoring, three sites were prioritised for further investigation, two in Curletts Stream and one in Nottingham Stream. These sites were priorities due to frequent exceedances of consent ATLs (especially zinc) and due to increasing contaminant concentrations. Investigations involved wet weather water quality monitoring, which found that copper, zinc, and total suspended solids (TSS) issues at HALS03 (Nottingham Stream at Candys Road), HEATH10 (Curletts Road Stream upstream of Heathcote River) and HEATH14 (Curletts Road Stream at Southern Motorway) sites are most likely due in part to stormwater discharges authorised under the CSNDC. Targeted wet weather monitoring in Nottingham Stream also confirmed ATL exceedances were the result of stormwater discharges. However, there are also likely other illicit (e.g., dry weather) discharges not authorised under the consent that may be impacting contaminant levels. To address the impacts from stormwater, a new stormwater treatment facility is proposed.

Following review of the 2024 and 2025 monitoring data, two new sites have been recommended for further investigation: Stream Reserve Drain in Governors Bay and Cashmere Stream at Sutherlands Road. These two new sites exceeded multiple ATLs, had increasing trends for zinc, and they are both sensitive receiving environments. Over the coming two years, Council will commence investigations into the source of contamination in these two waterways.

Targeted wet weather sampling in Charlesworth Drain, Styx Drain, and Richardson Terrace sub-catchments were undertaken to help identify potential sources of contamination to receiving environments, treatment efficiency, and to inform mitigation options under the SMPs.

Industrial site audits were conducted in 2024 and 2025 in Heathcote River and Curletts Stream catchments. The focus has been on building strong relationships with businesses. Efforts have included supporting improvements to trade waste connections, promoting updated approaches to stormwater runoff treatment, and undertaking regular discharge sampling to assess the effectiveness of implemented actions.

Key projects underway to improve stormwater quality at priority sites include capital projects for new stormwater treatment facilities in Addington Brook, Riccarton Stream, and Nottingham Stream. Council are gathering information for design of a facility in the Charlesworth Drain catchment, and optimisation of treatment facilities in Curletts and Bells Creek catchments.

Council proposes gathering more data on where contaminants are coming from through targeted wet weather monitoring within the Addington Brook catchment, Curletts Stream catchment, Stream Reserve Drain and Cashmere Stream at Sutherlands Road. We seek to gather more information about Addington Brook because of observations of illicit discharges made during the enhancement of Addington Brook. Further investigation ahead of the construction of a stormwater treatment device in this area will help to ensure its success.

The targeted monitoring programme enables Council to locate high contaminant sources, target treatment of stormwater with the highest contaminant load before discharge to the waterways and prevent illicit discharges. Further investigations and liaison will then feed into the Industrial Site Audit Programme.

Council considers work under this condition to be a long-term project. Each annual report will consider whether sites are regularly being prioritised for investigation, and the project will be iterative and adaptive, building on lessons learned in previous years.

2. Introduction

As part of Christchurch City Council's Comprehensive Stormwater Network Discharge Consent (CSNDC1), Council is required to meet Receiving Environment Objectives and Attribute Target Levels (ATLs) in the receiving environment. Condition 59 of the consent requires that for sites where the ATLs have not been met, investigations shall be undertaken to determine whether this is due to stormwater discharges authorised under the CSNDC. If ATL exceedances are attributed to consented stormwater discharges, Condition 59 further requires that Council identifies options for corrective actions (e.g., new stormwater treatment facilities), along with stipulating a timeline for implementation.

The purpose of this report is to meet the reporting requirements for Condition 59 of the CSNDC. Section 2 outlines which monitoring sites have been prioritised for further investigation, based on recent water quality monitoring reports. Section 3 describes results of wet weather water quality monitoring that aimed to better characterise water quality at priority sites. Section 4 summarises results of industrial audits that pose a high risk to receiving environment water quality. Section 5 then summarises activities undertaken by Council to improve stormwater quality.

This work is fundamental to the success of the adaptive management framework on which the CSNDC is based. Prioritisation of catchments through surface water quality monitoring enables Council to proactively respond to water quality issues across the city. Water quality monitoring and reporting facilitates the identification of priority investigative sites such as Cashmere at Sutherlands Road in the Heathcote Catchment and Stream Reserve Drain in the Banks Peninsula. Investigating contaminant sources during wet weather events, and comparing these results with dry weather data, provides a high level of confidence that observed water quality exceedances are driven by stormwater inputs.

Targeted wet weather monitoring further refines the understanding of contaminant sources or pollution 'hot spots' within a catchment, allowing investigations to be focused on priority areas for source control. Where necessary, the findings can also support the development of business cases for additional stormwater treatment infrastructure or maintenance/optimisation of existing infrastructure.

[1] Environment Canterbury consent number CRC252424.

***Table 1**: Three priority sites not meeting Attribute Target Levels (ATLs) for Total Suspended Solids (TSS), copper, and zinc, and which ATLs were exceeded. Note: there were no exceedances for lead.*

Site	ATL Exceeded
Curletts Road Stream upstream of Heathcote River (HEATH10)	Dissolved copper: limit exceeded and statistically significant increase Dissolved zinc: limit exceeded and statistically significant increase TSS: statistically significant increase
Curlett Stream at Motorway (HEATH14)	Dissolved copper: limit exceeded Dissolved zinc: limit exceeded and statistically significant increase
Nottingham Stream at Candys Road (HALS03)	Dissolved zinc: limit exceeded and statistically significant increase

3. Sites Prioritised for Further Investigation

Priority Sites from 2023 Monitoring

Compliance with total suspended solids (TSS), copper, lead, and zinc ATLs for surface water (waterways and coastal waters) for the 2023 calendar year (January – December) were assessed in the 2024 annual surface water quality monitoring report (Noakes & Marshall, 2024). Sites that both exceeded ATLs and recorded an increasing trend triggered further investigation. These sites were Curletts at Motorway, Addington Brook and Nottingham Stream at Candys Rd. The Heathcote River at Ferrymead Bridge site was triggered in 2021 and 2022, but not in 2023, however, after discussions with Environment Canterbury this site was included in the 2024 Condition 59 report. The following sections summarise investigations undertaken at the prioritised Curletts Stream sites and Nottingham Stream site.

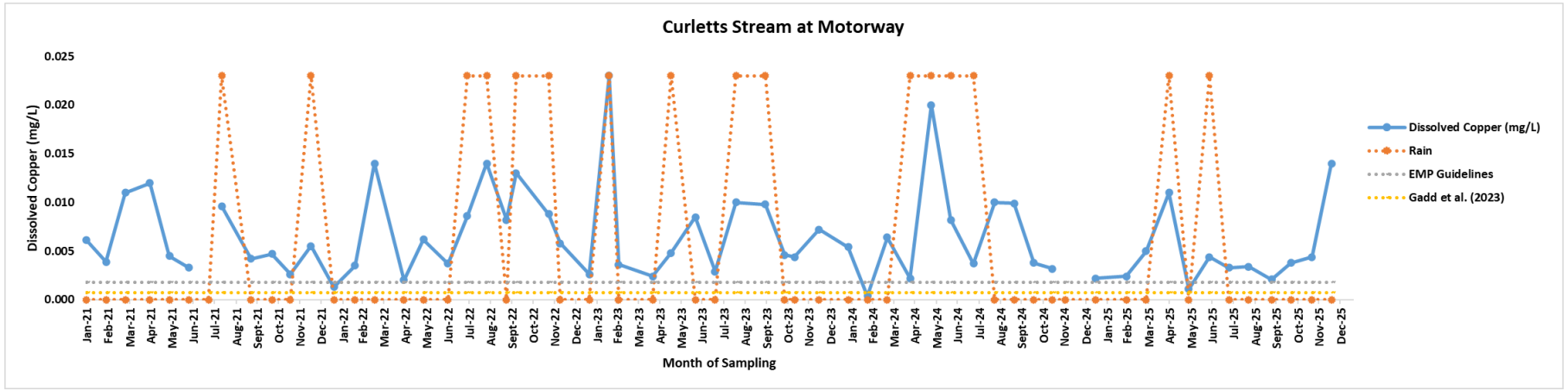
Curletts Stream at Motorway (HEATH14)

The Curletts Stream at Southern Motorway site is located at the inlet to the Curletts stormwater facility, immediately downstream of the motorway. The site at this location consists of a large pond. Land uses upstream of this site are predominantly commercial and industrial. The monthly monitoring results for copper, zinc, and TSS at this site for the 2024 - 2025 monitoring years show that copper and zinc nearly always exceeded their respective ATL (Figure 2). In addition, several of the copper and zinc samples exceeded the ATLs when no rainfall occurred, indicating that dry weather discharges are a significant source of metals. 92% of the zinc samples collected during the 2025 monitoring year exceeded the ATL **(Figure 1)**. The most and largest exceedances were associated with rainfall, indicating stormwater is also

a major contributor of copper and zinc to the stream.

Detailed wet weather monitoring has previously been undertaken in the catchment as part of the Targeted Wet Weather Monitoring Programme (TWWMP) under Schedule 3(k) of the CSNDC (Borne & Gadd, 2022). This monitoring indicated high concentrations of contamination during both dry and wet weather. Overall, the monitoring identified additional wet weather monitoring is required to address the objectives of the project and to determine how corrective action/remediation will be carried out to address Condition 59. The report included several recommendations for the next stage of monitoring.

No further investigations were carried out in the Curletts Stream catchment over this 2024 – 2025 monitoring period. That is partly because Nottingham Stream was prioritised so that data could feed into designs for stormwater treatment in the Nottingham Stream catchment. However, 16 industrial site audits have been carried out within the Curletts Stream catchment since the consent was granted.



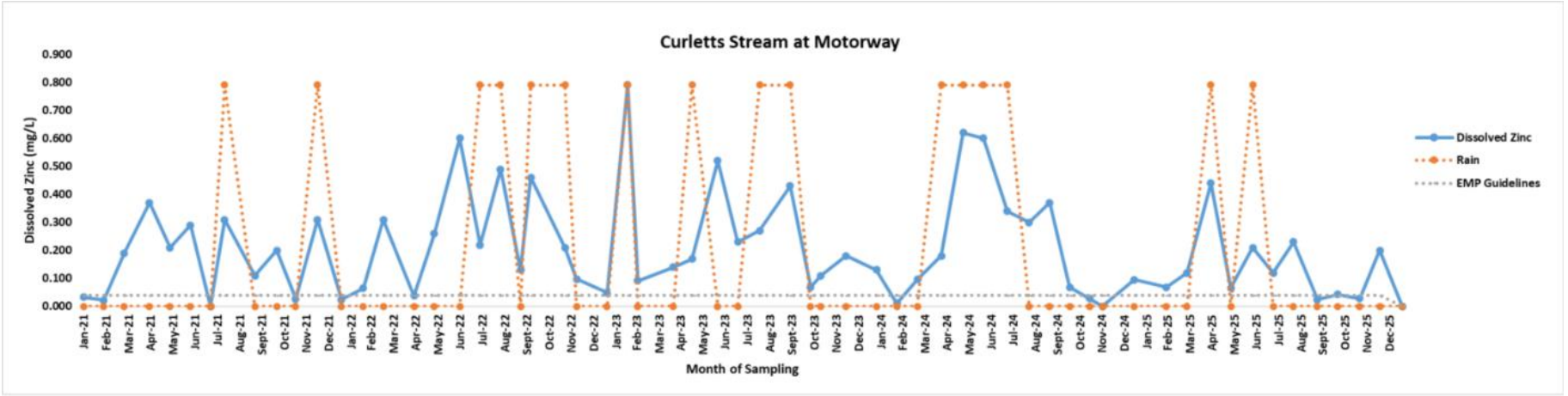


***Figure 1**: The presence or absence of recent rainfall versus dissolved copper and dissolved zinc concentrations at Curletts Stream (January 2021-December 2025)*

Rainfall versus dissolved copper (top graph) and dissolved zinc levels (bottom graph) in surface water during monthly monitoring from January 2021-December 2025. Recent rainfall in the graphs is shown for rain that fell either the previous day or on the sampling day. EMP Guidelines for dissolved copper for Curletts Stream at Motorway is ≤0.0018mg/L (ANZG (2022) (95th percentile, 90% species protection) and dissolved zinc is ≤0.0396 mg/L (ANZG (2022), HMGV (95th percentile, 90% species protection). Gadd et al. (2023)-Default Guideline Value for Dissolved Copper (mg/L) (Annual 95th percentile): Ōpāwaho-Heathcote River Catchments (90% species protection) is ≤0.00073mg/L

Curletts Stream upstream of Heathcote River confluence (HEATH10)

The Curletts Stream upstream of Heathcote River confluence site is located approximately 400m downstream of the outlet of the Curletts stormwater facility, immediately upstream of the confluence with the Heathcote River. There are additional stormwater inputs between the outlet of the basin and this site, hence it cannot be used for direct treatment performance comparisons. Land uses upstream of this site are predominantly commercial and industrial, with approximately 12 Ha of residential area being the difference between this site and HEATH14.

The monthly monitoring results for copper, zinc, and TSS at this site for the 2024 - 2025 monitoring years show that copper and zinc nearly always exceeded their respective ATL (**Figure 2**). In addition, several of the copper and zinc samples exceeded the ATLs when no rainfall occurred, indicating that dry weather discharges are a significant source of metals and that further source investigations would be beneficial. Additional wet weather monitoring will help us to focus our source control investigations. The largest contaminant concentrations were generally recorded during rainfall, indicating stormwater is a major contributor of copper and zinc to the stream.

Detailed wet weather monitoring has previously been undertaken in the catchment as part of the Targeted Wet Weather Monitoring Programme (TWWMP) under Schedule 3(k) of the CSNDC (Borne & Gadd, 2022). This monitoring indicated high concentrations of contamination during both dry and wet weather. Overall, the monitoring identified additional wet weather monitoring is required to address the objectives of the project and to determine how corrective action/remediation will be carried out to address Condition 59. The report included several recommendations for the next stage of monitoring.

The Instream Contaminant Concentration Model (ICCM) was used to estimate contaminant load and instream concentrations within the Curletts sub-catchment before and after treatment. Based on the results of that model, we suspect that the Curletts Basin treatment facility vegetation is still establishing and full treatment potential has not yet been achieved.

Indicative treatment performance is summarised in Table 2. The modelled results predict that the treatment basin should achieve substantial reductions in contaminant concentrations, particularly for TSS and copper. Despite these improvements, the modelled post-treatment concentrations are still predicted to exceed relevant water quality guideline values at this location. However, the concentrations for contaminants from the ICCM are much higher than what is seen through monitoring. For this reason, we consider it beneficial to undertake validation of the ICCM against the annual surface water monitoring data.

The Curletts sub-catchment will remain a priority area for further investigation. We

propose continuing targeted wet weather monitoring, source control investigations and investigating potential improvements to Curletts Basin.

Table 2: *ICCM summary upstream and downstream of Curletts Basin*

Contaminant	Load		Guideline
	Before (kg)	After (kg)	(mg/L)
TSS	34,959.82	3,063.53	25
Zinc (dissolved)	235.62	152.92	0.0396
Zinc (total)	343.67	195.35	
Copper (dissolved)	8.95	2.02	0.0018
Copper (total)	19.46	4.48	

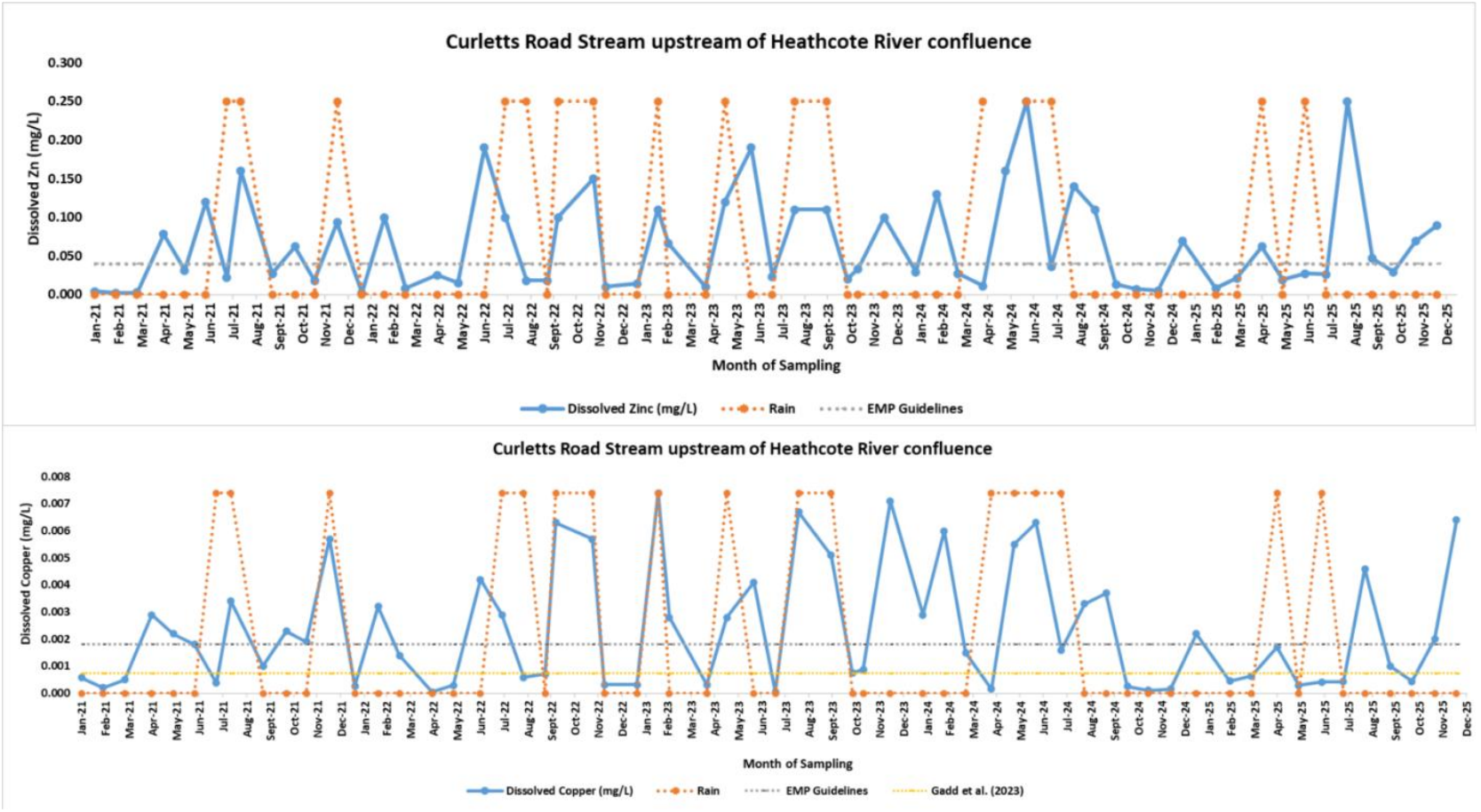


***Figure 2**: The presence of absence of recent rainfall versus dissolved copper and dissolved zinc concentrations at Curletts Stream (January 2021-December 2025)*

Rainfall versus dissolved copper (top graph) and dissolved zinc levels (bottom graph) in surface water during monthly monitoring from January 2021 - December 2025. Recent rainfall in the graphs is shown for rain that fell either the previous day or on the sampling day. EMP Guidelines for dissolved copper for Curletts Road Stream upstream of Heathcote River confluence is ≤0.0018mg/L (ANZG (2022) (95th percentile,90% species protection) and dissolved zinc is ≤0.0396 mg/L (ANZG (2022) HMGV (95th percentile, 90% species protection). Gadd et al. (2023) -Default Guideline Value for Dissolved Copper (mg/L) (Annual 95th percentile): Ōpāwaho-Heathcote River Catchments (90% species protection) is ≤0.00073mg/L.

Te Tauawa-a-Maka - Nottingham Stream at Candys Road

Te Tauawa-a-Maka - Nottingham Stream is a spring-fed plains stream that converges with another tributary to form the Huritini-Halswell River. The Nottingham Stream at Candys Road (HALS03) site is in the lower catchment of Nottingham Stream, in a predominantly rural area. The stream at this location is narrow and shallow, with incised banks. Land use in the Nottingham Stream catchment is predominantly residential, with some commercial. Small sections of Dunbars Road and Halswell Road lie in the catchment and discharge to the stream, with Dunbars Road discharging to the stream via a treatment swale.

Approximately half of the zinc samples collected during the 2024 - 2025 monitoring years exceeded the ATL (**Figure 3**). Dry weather zinc concentrations at Candys Road exceeded the EMP ATL, suggesting some background contamination. However, most exceedances were associated with rainfall, which indicates that exceedances at this site are mainly due to stormwater inputs.

A targeted wet weather monitoring investigation was undertaken by Pattle Delamore Partners (PDP) for the Nottingham Stream catchment. Results of the investigation are summarised in section 3.1 below, and the report is provided in Appendix A. Following the investigation, a stormwater treatment facility is now being designed for the Nottingham Stream catchment (see section 5.2 below).

Dry weather zinc at Candys Road exceeded the EMP ATL, suggesting some background contamination, however, wet weather zinc concentrations were substantially higher, indicating storm-driven enrichment.

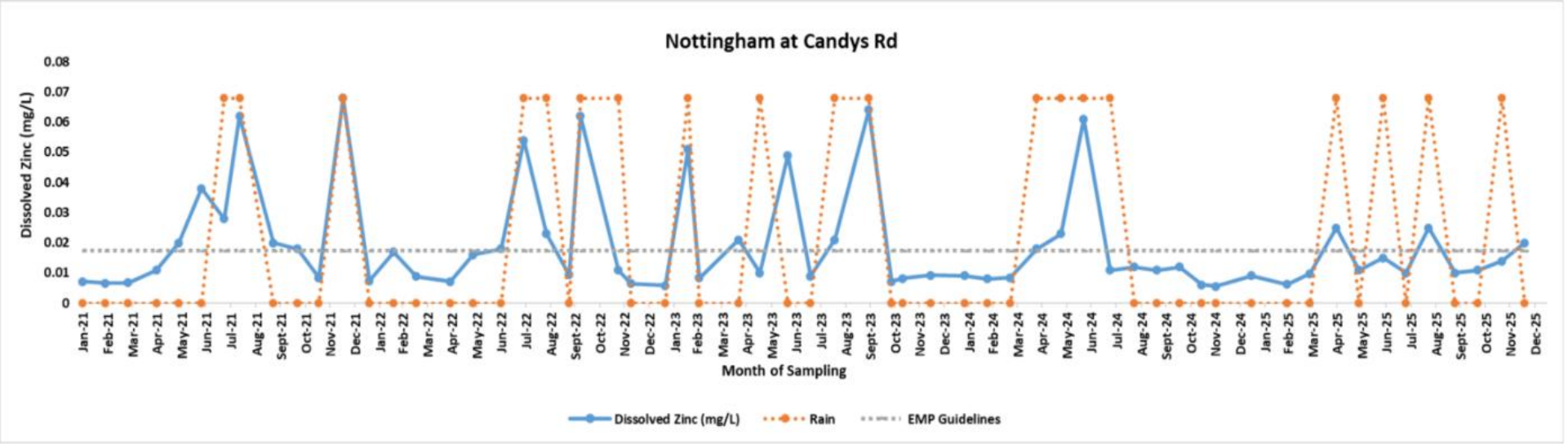


***Figure 3**: The presence of absence of recent rainfall versus dissolved zinc concentration at Nottingham Stream at Candys Rd (January 2021-December 2025)*

Rainfall versus Dissolved Zinc levels in surface water monthly monitoring from January 2021-December 2025.Recent rainfall in the graphs is shown for rain that fell either the previous day or on the sampling day. EMP Guidelines for Dissolved Zinc for Nottingham at Candy Rd ≤0.0174mg/L at 95% species protection, ANZG (2022) (HMGV, 95th percentile).

Priority Sites from 2024 and 2025 Monitoring

In 2024 and 2025, 23 and 31 of the 50 monitoring sites were identified as not meeting at least one of the ATLs (Instream Consulting 2026). Curletts at Motorway and Nottingham at Candys Rd have been prioritised for the past five years, with the addition of Curletts Road Stream upstream of Heathcote River (HEATH10). Heathcote at Ferrymead Bridge remains 'not a priority' for investigation as it has improving trends for all stormwater contaminants and has not been included in this report.

Two new sites have been recommended for further investigation: Stream Reserve Drain in Governors Bay and Cashmere Stream at Sutherlands Road. These two new sites have been prioritised due to exceeding multiple ATLs, increasing trends for zinc concentration, and they are both sensitive receiving environments. Over the next two years, Council will commence investigations into the source of contamination in these two waterways, with a goal of investigating mitigation and halting the decline in water quality.

Targeted Wet Weather Monitoring

The Targeted Wet Weather Monitoring (TWWM) Programme (Schedule 3k) is to improve the level of detail of receiving environments, contaminant inputs and to inform mitigation options required under the SMPs. Council also consider this is an opportunity to investigate and protect our more sensitive receiving environments, rather than focussing on the "most contaminated sites", as required by Condition 59.

Previous revisions of the EMP required two rounds of wet weather monitoring at 32 sites operating on a five-yearly rotation by catchment. The outcome is an average of 13 wet weather samples collected per year. The latest version of the EMP[2] requires the same minimum of 13 wet weather samples collected per year, but the sampling adopts targeted investigations such as catchments exhibiting rapid urbanisation and assessing stormwater treatment effectiveness.

In addition to the monitoring at Nottingham Stream, Council pursued monitoring at three sub-catchments: Charlesworth Drain, Styx Drain and the Richardson Terrace Stormfilter™ sub-catchments, as detailed in the following sections.

Te Tauawa-a-Maka - Nottingham Stream at Candys Road

Full details of the Nottingham Stream investigation are attached as Appendix A. In summary, the investigation (PDP, 2025) combined information from eight sample sites (six utilising the grab technique and two autosamplers). Samples were gathered across these sites during five rainfall events. Investigations compared dry and wet scenarios against EMP ATLs followed by an assessment to determine whether elevated concentrations observed in Nottingham Stream are

[2] Version 11, dated November 2025.

driven by stormwater discharges. Evaluations focused on imperviousness and concentration, antecedent dry period, wet hours, total rainfall event depth and peak intensity rainfall. These were considered cumulatively to determine:

- Spatial relationships between upstream stormwater-generating surfaces and contaminant concentrations, and,
- Event-scale behaviour of contaminants in relation to rainfall characteristics consistent with stormwater runoff processes.

The stormwater investigation along with previous monthly water quality monitoring at sites within the sub catchment revealed that dissolved copper and zinc concentrations exceeded EMP ATLs at all sites. Dissolved zinc concentrations showed decreasing trends downstream, while dissolved copper concentrations were higher at upstream and midstream sites.

Partitioning analysis indicates that dissolved (bioavailable) copper dominated at upstream sites during storm events, while particulate copper increased downstream, in line with higher TSS. Zinc was predominantly in dissolved form across most wet weather samples, although during the highest intensity rainfall event (13/11/2025), zinc was mainly particulate. This event corresponded with the highest rainfall intensity and depth.

Dry and wet weather monitoring indicated generally acceptable water quality but demonstrated consistent exceedances of dissolved copper and zinc likely attributed to stormwater discharges. During the monitoring programme, land midway through the catchment became available, and the preliminary monitoring results confirmed this would be an appropriate location to build a stormwater treatment facility. Dissolved zinc, being the main contaminant of concern in this catchment, showed decreasing trends downstream, thought to be a result of dilution. For stormwater treatment to be effective, higher concentrations of contaminants result in greater treatment performance. Furthermore, the ecological impact at this site is less disruptive given that the waterway upstream of this site can dry up.

Dry weather zinc at Candys Road exceeded the EMP ATL, suggesting some background contamination, however, wet weather zinc concentrations were substantially higher, indicating storm-driven enrichment.

Charlesworth Drain

Instream were engaged in 2025 to undertake some targeted wet weather monitoring of the Charlesworth Drain catchment. The objective of the monitoring was to determine the impacts of industrial stormwater and legacy sediment contamination on estuarine water quality. The monitoring report is Appendix B of this report.

Land use within the Charlesworth Drain catchment is predominately characterised as pastoral, estuarine and urban and industrial. Samples were collected within a range of modified and natural waterways including estuarine

margins, shaded riparian corridors, drainage channels, culverts and shallow ponded areas. The substrate profile across all sites was predominately soft sediments with an anoxic layer observed on the surface particularly in estuarine and low flow conditions. Downstream influences from urban and industrial land uses were present on site. This included an orange precipitate observed at multiple sites, indicating iron flocculation. Other inputs observed included hydrocarbon sheen and accumulated foams.

Waterway survey information and water quality results were collected to inform the design of a stormwater treatment facility and wetland restoration project in Linwood Paddocks, and to assess whether inanga spawning was occurring within the site. This site was identified in the Ihutai – Coastal SMP.

Nine locations within the waterways of Charlesworth, Cuthberts and Lovetts Drains were sampled. The sites were sampled twice during dry conditions, but only one wet weather event was captured due to a short monitoring timeframe.

Figure 4: *Location of water quality and sediment sampling sites. Section of Charlesworth Drain sampled for inanga eggs occurred between the orange markers while the intertidal salt wedge occurred between the red markers. Credit: Instream Consulting Limited.*

Water temperature, conductivity and dissolved oxygen showed strong daily and flow-related variability across sites. Lovetts Drain sites consistently had elevated conductivity, reflecting strong saline influence and predominantly tidal conditions during baseflow. Water temperatures were higher and dissolved oxygen lower during baseflow conditions, while wet weather events improved oxygen levels and reduced temperatures due to increased flow and mixing. Under baseflow conditions, several sites experienced potentially stressful conditions for freshwater biota, particularly sensitive fish species, highlighting the risk of chronic habitat stress during low-flow periods.

Nitrogen concentrations varied widely across sites with the Lovetts Drain sites exhibiting the lowest and Cuthberts Drain consistently elevated for both inorganic (ammoniacal-N) and organic nitrogen. Nitrate-N remained below national bottom-line thresholds at all sites, but adjusted ammoniacal-N frequently exceeded guidelines at Cuthberts and Charlesworth Drain sites. Elevated ammoniacal-N at Cuthberts Drain suggests an upstream groundwater source, likely the adjacent oxidation ponds. Wet weather did not increase nitrogen concentrations and instead produced a dilution effect, indicating nitrogen inputs are primarily groundwater-derived rather than attributed to run-off.

Biochemical Oxygen Demand (BOD) was at or above relevant guidelines for all sites. BOD was elevated at one of the upstream Charlesworth Drain sites, especially during wet weather indicating increased organic loading, presumably influenced by groundwater inputs from the nearby oxidation ponds. In contrast, downstream Charlesworth Drain sites did not present similar elevations, suggesting that organic inputs upstream were diluted further along the Charlesworth Drain.

Dissolved reactive phosphorus was observed to be low across most sites apart from one of the Charlesworth Drain sites which exhibited high phosphorus concentrations during two sampling occasions. During baseflow conditions, total phosphorus was largely equal to or exceeded those during wet weather conditions. Regarding satisfying statutory guidelines, total phosphorus concentrations exceeded and aligned with the NPS-FM Attribute Band 'B', which indicates at least slight ecological impact at most sites during baseflow conditions.

Total suspended solids (TSS) presented variable results across sites and did not consistently respond to wet weather events. Every site apart from two exceeded TSS attribute target levels (ATLs). In the Charlesworth Drain network all sites except one exhibited increased TSS during wet weather events. Lovetts Drain presented a mixed picture with one site demonstrating increased TSS under wet conditions while one decreased following rain.

E. coli levels exceeded guidelines across nearly all sites, indicating significant faecal contamination. This was most pronounced in the downstream Charlesworth sites during both wet and dry conditions. This highlights the likelihood of a combination of persistent inputs arising from livestock and birds in the grazing paddocks and

wider catchment sources attributed to urban and industrial land uses.

Metal concentrations displayed strong spatial and temporal variability, with multiple exceedances of ANZG guidelines. Zinc was the most elevated metal across sites, particularly at mid-catchment Charlesworth Drain sites during wet weather conditions, while nickel exceedances were limited to a small number of sites. Dissolved copper frequently exceeded guidelines, especially during baseflow, with several sites exceeding both the median and 95th percentile bioavailable copper thresholds, indicating potential chronic exposure risk. Other metals such as dissolved lead, arsenic and chromium remained below guidelines across all sites and sampling events.

Overall, the results suggest that contaminants entering the estuary originate from a combination of persistent sources, including livestock and bird activity in paddocks, as well as wider catchment inputs such as industrial stormwater, wastewater overflows, and discharges from oxidation ponds. Metals deposited within Charlesworth Drain (from upstream stormwater sources) may also become mobilised during very high flows and enter the estuary. To protect the ecological integrity of this sensitive receiving environment, targeted management of these upstream sources is recommended.

Target reductions are estimated by the Coastal catchment model for a proposed stormwater treatment wetland in Linwood Paddocks, treating 90% of the Bromley industrial area.

Styx Drain

Instream Consulting Limited were appointed to undertake TWWM in the Styx Catchment across three sampling locations in Styx Drain, Styx River upstream and downstream of new Gardiners stormwater basins. The basins discharge just south of Styx Mill Road. Monitoring occurred from August to December 2025. In addition, two EXO Data Loggers were deployed at Styx Road and upstream of Harris Drain for one month to monitor impacts of subdivision construction on turbidity.

Styx Drain was added to the monthly monitoring programme in 2025, after the 2024 monitoring results saw exceedances in ATLs. This is a rapidly urbanising catchment, and Council staff thought it would be worth building a longer-term data set specific to tracking the impact of zinc roofing on a waterway with “good” water quality.

A staged monitoring approach comprising of a dry weather walk-over, wet weather sampling and deployment of EXO loggers in Styx Drain, Styx Road and upstream of Harris Drain was applied. Wet weather sampling occurred on 19th August, 19th September and 13th November 2025. The EXO loggers remained in place until removal in December 2025 following satisfactory collection of field data.

Figure 5: *Styx Drain and Styx River sampling locations. Credit: Instream Consulting Limited.*

Comparison of wet weather and baseflow conditions from the Christchurch City Council water-quality monthly monitoring site at Styx River at Main North Road is outlined below. Figures 7, 8 & 9 compares the results against ATLs.

Dissolved zinc concentrations were consistently low under baseflow conditions across all sites. However, wet weather sampling demonstrated marked increases in zinc concentrations, with multiple exceedances of guideline values. The highest concentrations were associated with storm events, indicating that zinc inputs are predominantly driven by stormwater runoff rather than continuous sources. Spatial variability between sampling rounds indicates multiple contributing sources within the catchment, with evidence of downstream transport of inputs during high flow events.

Dissolved copper concentrations were consistently detected under baseflow conditions across all sites, indicating a continuous source within the catchment. In contrast to zinc, copper displayed a weaker and more variable response to wet weather conditions, with no consistent increase during storm events. Concentrations were generally below guideline values; however, an exceedance was recorded at Styx Drain under baseflow conditions in November 2025. This suggests that copper inputs are not solely driven by stormwater runoff but may arise from ongoing urban sources, with potential localised contributions at the Styx Drain site.

Dissolved lead concentrations were consistently low across sites and sampling events with one minor elevation observed during baseflow conditions at Styx Drain during November 2025. This remained considerably below the guideline value. No variation was observed between baseflow and wet weather conditions, indicating an absence of event-driven mobilisation or spatial variability in lead within the catchment.

Total suspended solids (TSS) and turbidity were consistently low under baseflow

conditions across all sites indicating minimal background sediment load. However, wet weather sampling demonstrated increases in both parameters, with particularly high concentrations recorded at the Styx Drain site. These elevated values significantly exceeded guideline thresholds and indicate a strong influence of stormwater-driven sediment mobilisation. A clear observed pattern between turbidity and TSS was observed, confirming turbidity provides a valuable proxy for sediment within these waterways. While downstream sites also displayed elevated TSS concentrations during wet weather, values were notably lower than at Styx Drain, suggesting dilution and/or sediment deposition processes.

Continuous turbidity monitoring undertaken using upstream and downstream EXO loggers displayed generally low background turbidity conditions punctuated by several short-duration, high-magnitude spikes, likely associated with rainfall-driven events. Peak turbidity responses exceeded 2,000 FNU at both monitoring locations, although the timing and magnitude of peaks differed between sites, suggesting localised sediment mobilisation and/or differing hydrological connectivity within the catchment. The downstream logger recorded an earlier and larger response during mid-August and aligning with the first TWWM event on the 19th August. Outside of the event conditions, turbidity remained consistently low, indicating episodic rather than chronic suspended sediment inputs. These findings are consistent with TWWM sampling results, which indicated elevated turbidity and TSS concentrations during rainfall events and supports the interpretation that storm flows are mobilising fine sediments within the system.

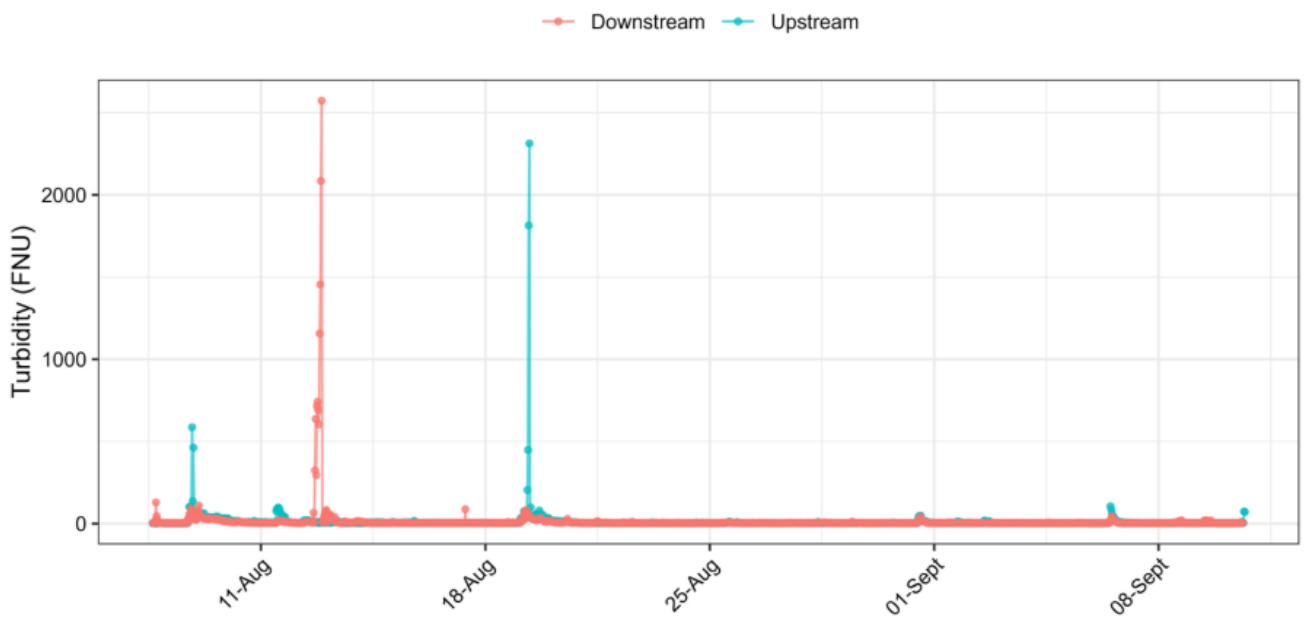
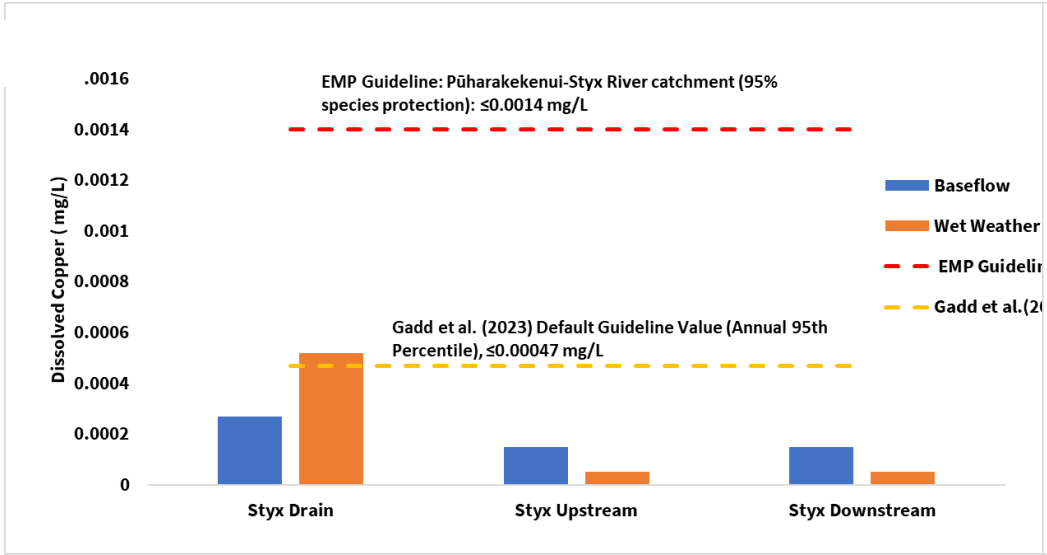
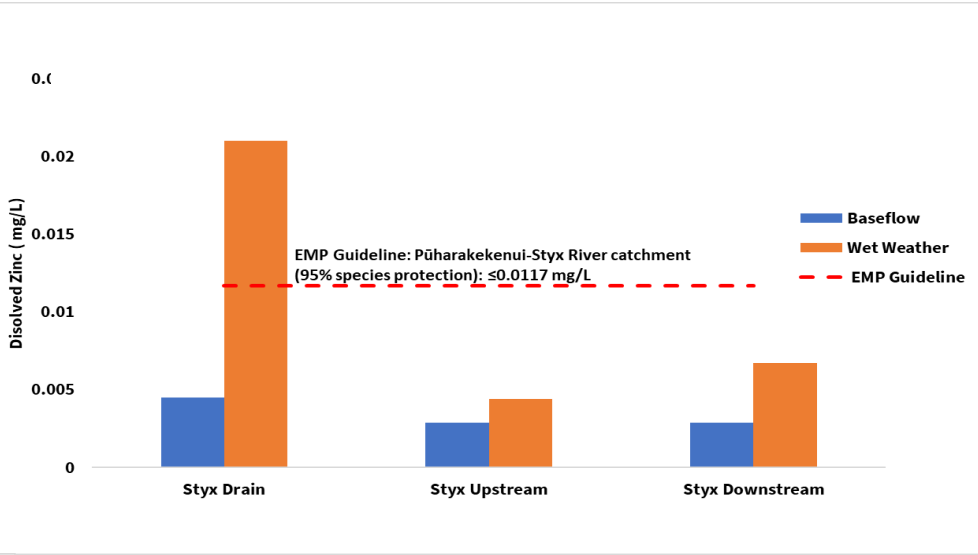


***Figure 6**: EXO data logger output for turbidity on Styx River. Credit: Instream Consulting Limited.*

Styx-TWWM-19.08.25





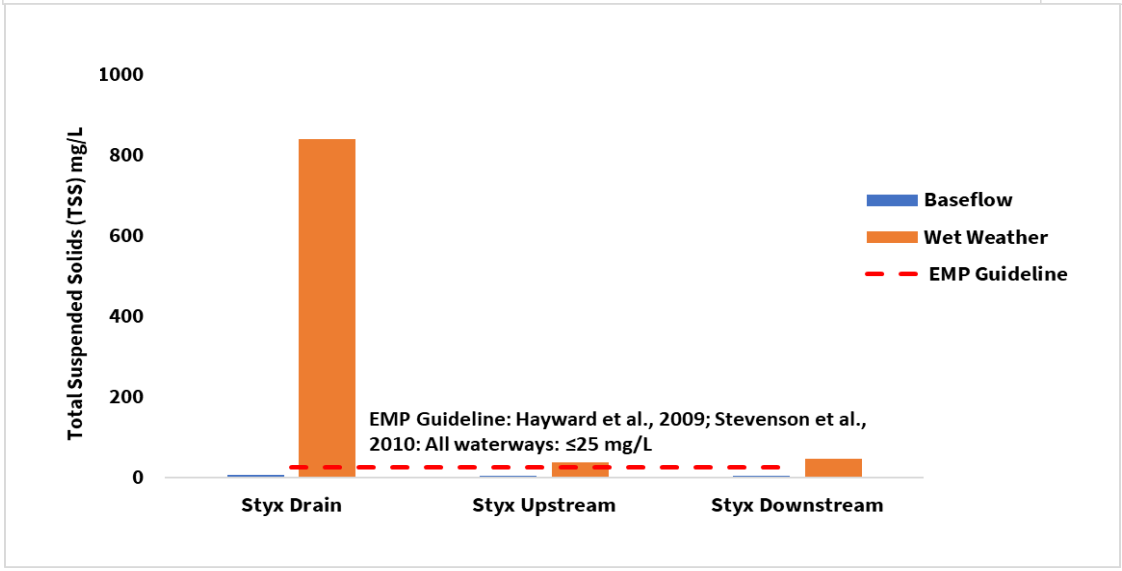


***Figure 7**: A, B & C ATL comparison of dissolved copper, dissolved zinc and total suspended solids (TSS) between baseflow and wet weather conditions.*

Samples at Styx Drain, upstream and downstream. Wet weather event on 19th August 2025

Styx-TWWM-19.09.25

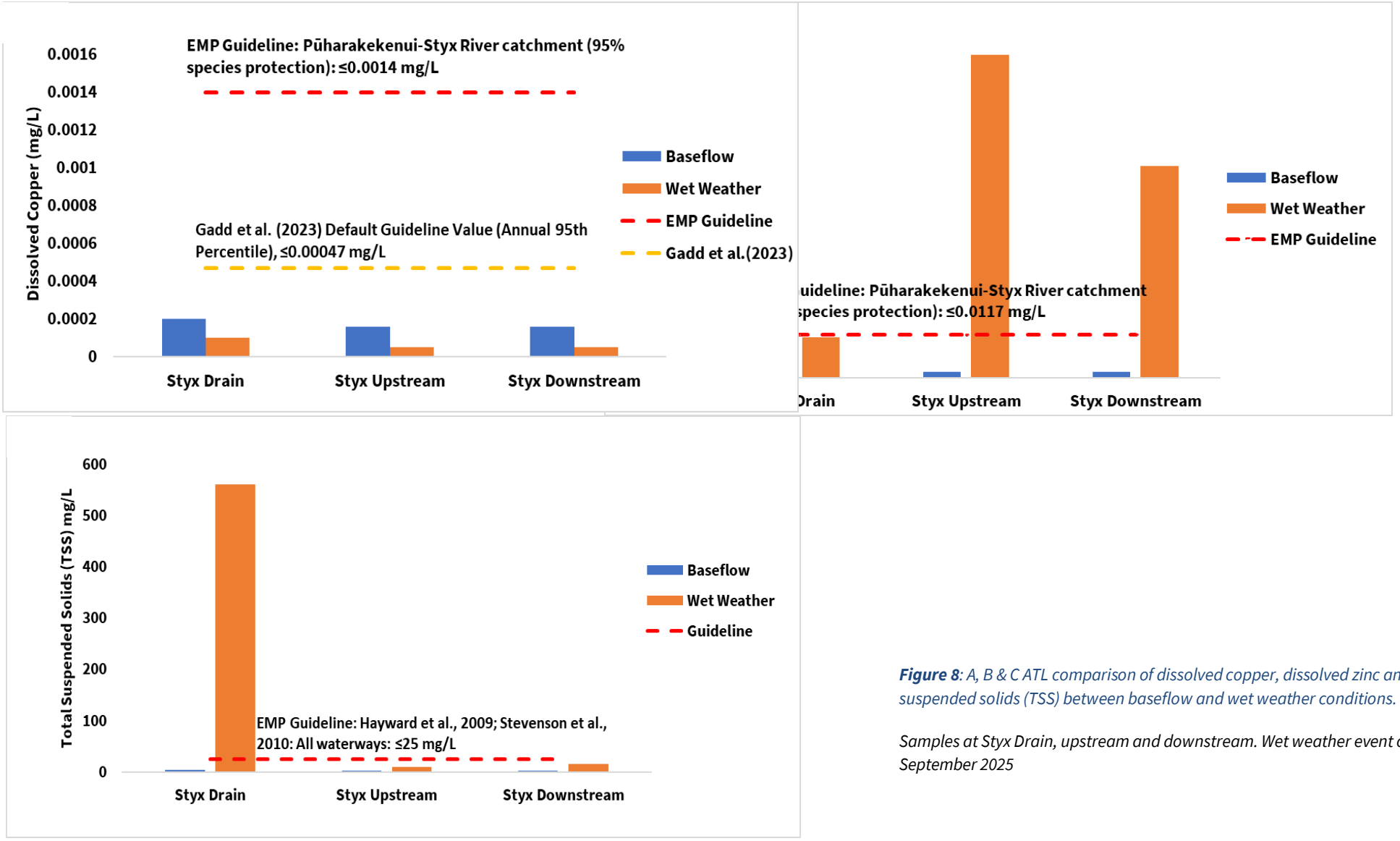
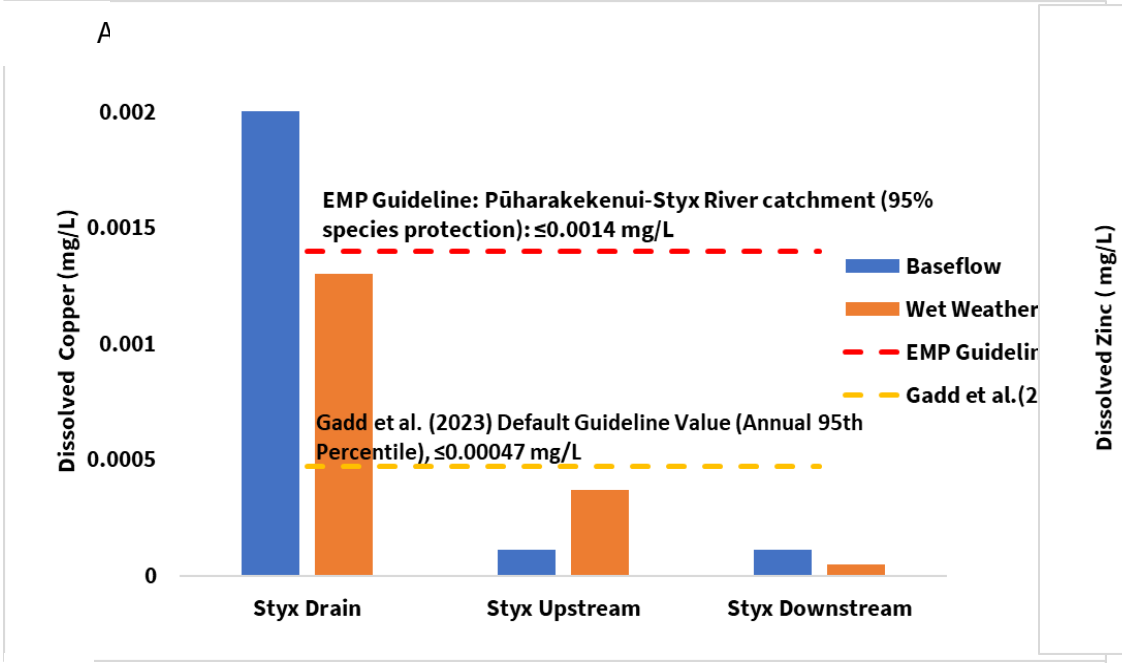
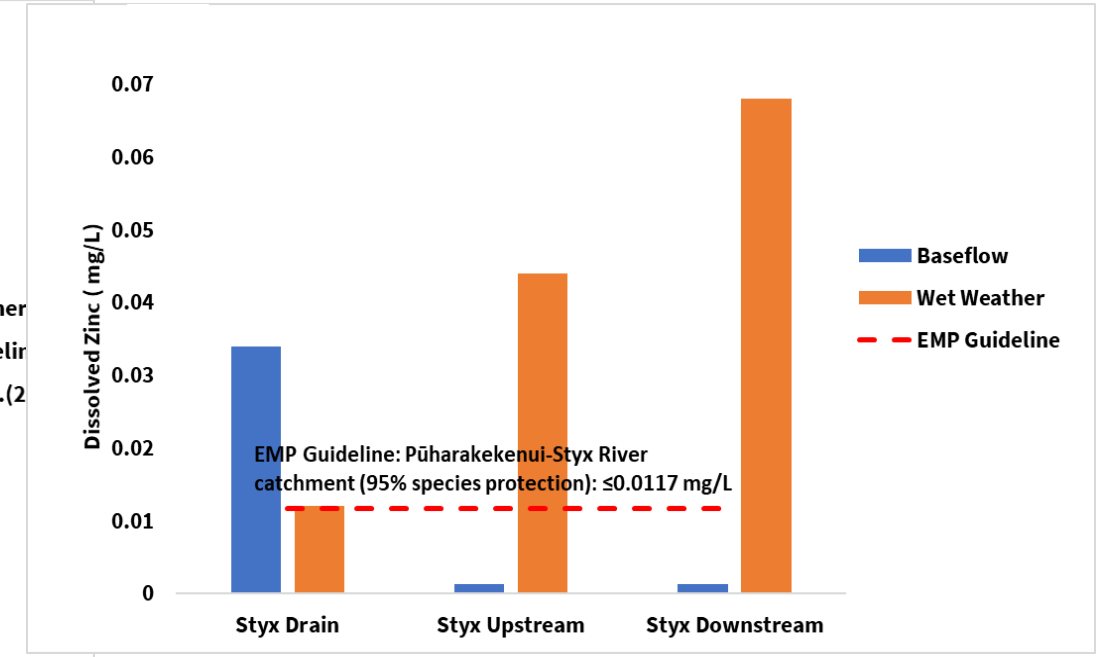


***Figure 8**: A, B & C ATL comparison of dissolved copper, dissolved zinc and total suspended solids (TSS) between baseflow and wet weather conditions.*

Samples at Styx Drain, upstream and downstream. Wet weather event on 19th September 2025

Styx -TWWM-13.11.25





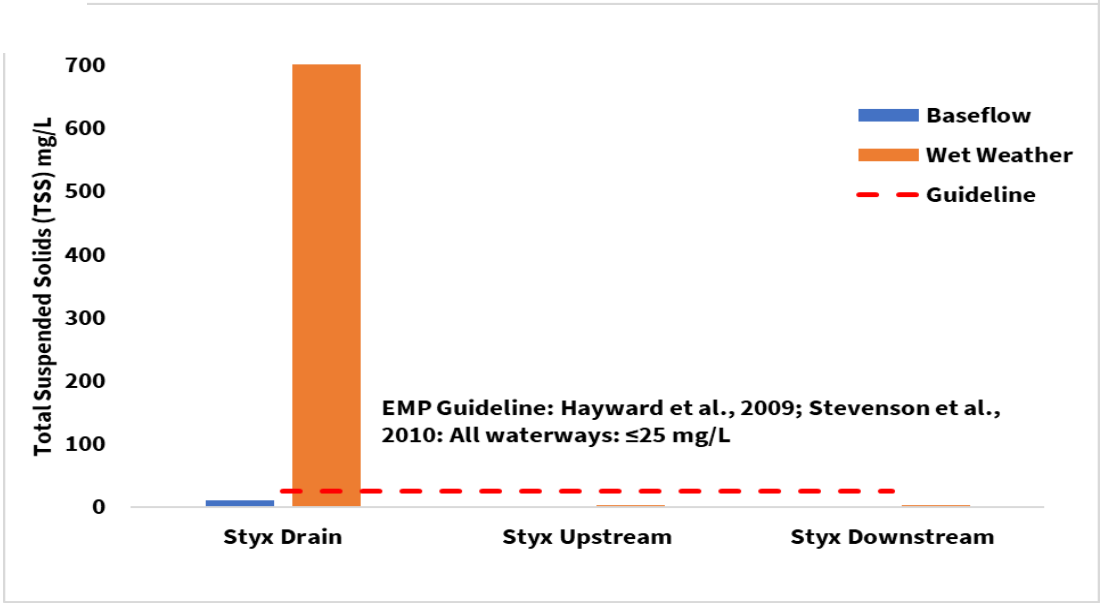


***Figure 9**: A, B & C ATL comparison of dissolved copper, dissolved zinc and total suspended solids (TSS) between baseflow and wet weather conditions.*

Samples at Styx Drain, upstream and downstream. Wet weather event on 13th November 2025

Richardson Terrace Stormfilter™ sub-catchments

To investigate the wider context of stormwater runoff entering the Richardson Terrace StormfilterTM in conjunction with the treatment performance monitoring, Council decided to take grab samples of the three contributing sub-catchments: Bells Creek, Arran Drain, and Ferry Road (captured at SW Access 8168). This sub-catchment monitoring was on the suggestion of the Land Drainage Operations Team to help them investigate any potential retrofit pre-treatment upstream of the StormfilterTM. Council were able to capture first flush samples across two events over 2025.

***Table 3**: First flush samples collected at Arran Drain, Bells Creek and SW Access 8168*

	Arran Drain	Bells Creek	Ferry Road (SW Access 8168)	ATL (95th perc)
Rainfall Event 12.03.2025				
Total Copper (mg/L)	0.0035	0.004	0.0061	
Copper dissolved (mg/L)	0.0005	0.0013	0.0017	0.0013
Total Suspended Solids (mg/L)	17	21	20	17.7
Total Zinc (mg/L)	0.065	0.072	0.12	
Zinc dissolved (mg/L)	0.019	0.044	0.1	0.008
Rainfall Event 30.07.2025				
Total Copper (mg/L)	0.0014	0.007	0.015	
Copper dissolved (mg/L)	0.00093	0.0044	0.0073	0.0013
Total Suspended Solids (mg/L)	3.5	16	27	17.7
Total Zinc (mg/L)	0.024	0.12	0.46	
Zinc dissolved (mg/L)	0.015	0.077	0.34	0.008

The results were compared to downstream baseflow conditions collected from the Christchurch City Council water quality monitoring point near Catherine Street with wet weather sampling at Arran Drain, Bells Creek and Ferry Road (captured at SW Access 8168).

Sample results show that dissolved zinc and dissolved copper concentrations were elevated across the monitored sub-catchments of Arran Drain, Bells Creek and Ferry Road compared with adjacent Heathcote River baseflow conditions, indicating that rainfall runoff is mobilising contaminants within the stormwater network.

Baseflow concentrations in the Heathcote River were consistently low, whereas wet weather samples from all sub-catchments showed increases in metal concentrations. Arran Drain recorded the lowest wet weather results and remained generally below guideline levels. Bells Creek displayed moderate elevations, with some concentrations meeting or exceeding guideline levels. Ferry Road consistently returned the highest concentrations for both zinc and copper, with zinc substantially above the guideline level and copper elevated, identifying this area as the most significant potential source of metal contamination. Overall, the results are reflective of industrial/commercial runoff, traffic related wear, and large areas of hardstand surfaces, and that first flush stormwater effects are contributing to episodic metal spikes.

Wet weather sampling indicates that total suspended solids (TSS) concentrations increase across all monitored sub-catchments when compared with adjacent Heathcote River baseflow conditions. Under baseflow, TSS concentrations at the Heathcote monitoring site are relatively low and consistent whereas wet weather samples from the sub-catchment are elevated indicating mobilisation of sediments during rainfall events.

Across the sites, Bells Creek and Ferry Road consistently record the highest wet weather TSS concentrations, with values generally remaining below the guideline threshold. Arran Drain shows lower wet weather TSS concentrations relative to other sub-catchments, although still elevated compared to baseflow.

Temporal variation is evident between sampling events. In one event, wet weather TSS at Arran Drain was notably lower than baseflow, suggesting potential dilution effects or variability in rainfall intensity and sediment mobilisation. In contrast, Ferry Road shows consistently elevated wet weather TSS, including one event where concentrations are close to the guideline, indicating it is likely the most significant contributor of suspended sediments during storm events.

Overall, the results demonstrate that stormwater runoff is a key driver of suspended sediment transport within these sub-catchments, with Ferry Road and Bells Creek representing priority areas for further investigation and potential mitigation to reduce sediment inputs to the receiving environment.

While two rainfall events are insufficient for the purposes of significant investment, Council will continue to investigate further in conjunction with a strengthened maintenance programme to ensure optimal treatment performance at the Richardson Terrace Stormfilter™.

Richardson Terrace Stormwater Pump Station lifts stormwater from Arran Drain, Bells Creek and Ferry Road (captured at SW Access 8168) catchments into the Ōpāwaho-Heathcote River. Investigation into the hydraulic and water quality performance of the Stormfilter™ at Richardson Terrace with WSP commenced in 2025. The aim of this monitoring is to help Council understand the contributing sub-catchments and management of this device to ensure optimal performance and

design considerations for proposed pumped devices. The Stormfilter™ cartridges were out of service during replacement mid-2025 and so only one rainfall event was monitored in the 2024-2025 monitoring period. Treatment performance results will be available in the next annual report.

4. Industrial Audits

High-Risk Sites Investigation

In 2022, AECOM produced a desktop assessment identifying high-risk sites across four catchments: Heathcote, Curletts, Addington and Nottingham. A high-risk site was defined as a site that has potential to discharge contaminants to stormwater at concentrations that could result in exceedance of the Attribute Target Levels (ATL). Their review included consideration of HAIL sites, CSNDC Schedule 1 sites, and sites with an ECan discharge consent.

Table 4: *Number of catchment sites identified as high-risk, high-risk sites covered by CSNDC and audited by CCC.*

Catchment	Number of high-risk sites identified	Number of high-risk sites covered by the CSNDC	Number of high-risk sites audited by CCC
Heathcote	8	6	3
Curletts	25	25	16
Addington	16	14	4
Nottingham	1	1	0

For further investigation, AECOM recommended passive site inspections, mapping the high-risk sites within each catchment, and identification of galvanised roofing on high-risk sites.

All sites deemed as high-risk that are covered by the CSNDC had a desktop assessment for audit suitability undertaken by the Industrial Site Audit team. Businesses that were still active and qualified for an Industrial Stormwater Discharge Licence (ISDL, the Council's new stormwater quality management tool) were audited and actions to reduce risk are being monitored by Council staff. All AECOM recommendations will be covered by the ongoing ISDL process.

Industrial Site Audits 2024 and 2025 in Priority Catchments

In 2024, two industrial sites within the Curletts Stream catchment were audited. These included sites operating in the waste management and resource recovery industries, and the food and beverage industry, all of which are listed in the Council's Register of Industrial and Trade Activities.

In 2025, five industrial sites in the Heathcote catchment were audited. These sites

represented a range of industrial activities, including food and beverage, rubber manufacturing, animal transfer and processing, waste management and resource recovery, and chemical industries.

All sites selected under the CSNDC programme undergo a thorough audit and risk assessment. Site-specific actions are then recommended, including the development of a Stormwater Management Plan for each site, with defined timeframes for implementation. The quality of stormwater runoff from each audited site is assessed against the target values set for each catchment under the Council's Environmental Management Plan (EMP). Where target values are not met, further recommendations are provided, which may include the installation of stormwater treatment devices.

Actions identified for each audited site under the CSNDC are shared with Environment Canterbury (ECan) for review and feedback, ensuring a coordinated approach and improved environmental outcomes.

Since the establishment of this programme, the focus has been on building strong relationships with businesses. Efforts have included supporting improvements to trade waste connections, promoting updated approaches to stormwater runoff treatment, and undertaking regular discharge sampling to assess the effectiveness of implemented actions.

5. Improvements, Stormwater Treatment Facilities and Timelines

Curletts Stream

After some repairs to Curletts Basin in 2024, the wetland and planting are still in the establishment phase. In the previous Condition 59 report (2024), an issue with sediment discharge from the wetland was noted, considered likely to be due to highly dispersive soils in the wetland base being disturbed. This is likely to reduce over time as the system matures, due to plant growth and consolidation of site soils. Treatment performance investigations will look into whether improvements of the system can be retrofitted.

Nottingham Stream

Nottingham Stream is located within the Huritini-Halswell catchment. The SMP proposes a first flush basin, wetland and detention basin to provide stormwater treatment and flood mitigation for approximately 19 hectares of residential development. However, in the surface water quality monitoring this sub-catchment was identified for intervention due to ongoing elevated levels of dissolved zinc and copper.

A stormwater treatment device is proposed for Nottingham Stream, with a focus on copper and zinc prior to discharge to the Huritini-Halswell River (CMPS#69267). The project site is located at 46 Nicholls Road and 67 Wales Street, which are now owned

by Council. The preferred solution under development is a Bioscape treatment system supported by pre-treatment gross pollutant trap (GPT) and a pump station.

Stormwater passes through the GPT for initial treatment then pumped into Filterra® Bioscape® system for further filtration/treatment before being discharged back into Nottingham Stream. The system will operate as an offline facility avoiding significant modification of the stream channel and minimising disturbance to the existing stream habitat. The system is expected to service approximately 79 hectares of contributing catchment, upstream of the Nicholls Road culvert.

Current estimated delivery timeline is 2028. The project is still in the early stages of design and subject to refinement as the project develops.

Overall, the project is expected to deliver improved water quality and enhance ecological health of the stream. Once delivered, this project will be a good example of how adaptative management under the CSNDC has enabled additional treatment to be prioritised.

Addington Brook and Riccarton Stream

Addington Brook and Riccarton Stream are two tributaries in the Ōtākaro–Avon catchment. Although Addington Brook does not feature as a priority site according to the latest water quality results, it has been a "contaminant hot spot" for many years.

This project under the SMP Capital Programme delivers stormwater filtration infrastructure across two independent sites, Addington Brook and Riccarton Stream, to improve waterway health (CPMS#41987). The project targets areas most affected by urban runoff and legacy contaminants, with the design developed to achieve approximately 80% treatment of flows within the watercourses. Facility locations have been optimised to maximise treatment performance while minimising cost, focusing on high-impact catchments and strategic treatment points.

The proposed solution uses centralised biofiltration systems (Filterra® Bioscape®) to treat runoff from large catchments, generally greater than 10,000m^2. These systems apply engineered media and filtration processes to remove contaminants within a relatively compact footprint, making them suitable for urban environments where space is limited such as predominantly developed areas of Christchurch.

The programme supports compliance with the CSNDC and broader stormwater management objectives. Implementation will occur over several years, with completion expected around 2027/28, supported by an overall investment of $30 million.

To ensure protection of the enhanced waterways and to prevent the proposed treatment devices being compromised, Council intend to undertake targeted wet weather monitoring and industrial site audits with ECan.

Figure 10: Locations (green dots) of stormwater treatment devices being designed in Addington Brook and Riccarton Main Drain catchments.

6. Conclusions

This report has continued to build upon the previous investigations into the source and treatment of copper, zinc, and TSS issues at priority sites for investigation. This includes three sites previously identified as issues (Curletts Stream at Motorway, Curletts Stream upstream of the Heathcote confluence, and Nottingham Stream at Candys Road), as well as identifying two new priority sites (Cashmere Stream at Sutherlands Road and Stream Reserve Drain in Governors Bay). The Curletts and Nottingham Stream investigations revealed a clear impact of stormwater discharges on receiving water quality. Investigations into the cause of degraded water quality in Cashmere Stream and Stream Reserve Drain will commence over the next two years.

To address impacts from stormwater, stormwater treatment facilities are planned in both Addington Brook and Nottingham Stream. Within the Curletts Stream catchment, we propose continuing targeted wet weather monitoring source control investigations and investigating potential improvements to Curletts Basin. We propose targeted wet weather monitoring, continuing to work with ECan to identify sources of industrial stormwater discharges and illicit discharges into Addington Brook.

Over the next two years, we propose further work on linking the surface water

quality monitoring data and our ICCM so we can more closely ascertain how water quality is responding to treatment.

Collectively, these efforts will contribute to reducing contaminant loads and improving stormwater quality across the targeted catchments and enable us to shift priorities as these are addressed.

7. References

AECOM New Zealand (2022). CSNDC Condition 59: Assessment of High Risk Sites. Report prepared for Christchurch City Council by AECOM New Zealand Limited, November 2022.

ANZG 2022. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT, Australia. https://www.waterquality.gov.au/anz-guidelines. Accessed May 2026.

Borne & Gadd (2022). Targeted wet weather monitoring of Curlett and Haytons Streams 2021. Report prepared for Christchurch City Council by National Institute of Water & Atmospheric Research Ltd, July 2022.

Gadd J, Hickey C, van Damm R, Milne J, Wood D (2023). Implementing bioavailability-based toxicity guideline values for copper and zinc in Aotearoa New Zealand. Interim technical guidance for scientists and practitioners, focusing on freshwater applications. Report prepared by NIWA for MBIE Envirolink and Horizons Regional Council, September 2023. NIWA Client Report 2023249AK.

Instream Consulting (2026). Christchurch City Surface Water Quality Report 2025. Report prepared for Christchurch City Council by Instream Consulting, May 2026.

Noakes & Marshall (2024). Christchurch City Surface Water Quality Annual Report 2023. Prepared to meet the Requirements of CRC231955. Christchurch City Council. CSNDC-Annual-Surface-Water-Quality-Report-2023-final.PDF. Accessed May 2026.

Noakes & Tredinnick (2023). Condition 59 - Response to Monitoring (2023). Prepared to meet the requirements of Requirements of CRC231955. Christchurch City Council. CSNDC-Cond-59-report-2023.pdf. Accessed May 2026.

Pattle Delamore Partners (2026). Te Tauawa-a-Maka-Nottingham Stream Wet Weather Monitoring 2025. Report prepared for Christchurch City Council by AECOM New Zealand Limited, February 2026.

Appendix A: Te Tauawa-a-Maka - Nottingham Stream Wet Weather Monitoring (PDP)

Appendix B: Charlesworth Drain - Water and Sediment Quality and Īnanga Spawning (Instream)