Christchurch City Waterway Fine Sediment Annual Report 2021

Prepared to meet the Requirements of CRC214226

Christchurch City Council

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Christchurch City Council

Report: Christchurch City Waterway Fine Sediment Annual Report 2021

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Executive Summary

The Christchurch City Council (Council) is required to monitor fine sediment cover of representative waterbodies within Christchurch and Banks Peninsula, as part of the Comprehensive Stormwater Network Discharge Consent (CSNDC; CRC214226). Fine sediment monitoring was undertaken monthly at 17 sites from waterways within the five main river catchments of Christchurch (Ōtākaro-Avon River, Opāwaho-Heathcote River, Huritini-Halswell River, Pūharakekenui- Styx River, and Ōtūkaikino River).

This was the first year that monthly deposited sediment data was available to summarise for the full calendar year. There were no obvious trends in fine sediment between sites and catchments, with similar but variable results. Overall, fine sediment cover was high and exceeded consent target levels at 12 of the 17 monitoring sites. Curlett Road Stream Upstream of Opāwaho -Heathcote River Confluence had the highest median cover across all 17 sites and Ōtākaro-Avon River at Carlton Mill corner had the lowest median cover.

There is currently insufficient data to conduct trend analysis. Further monitoring will indicate whether there are any improving or declining trends in fine sediment cover over time.

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1. Introduction

The Christchurch City Council (Council) is required to monitor fine sediment cover of representative waterbodies within Christchurch and Banks Peninsula, as part of the Comprehensive Stormwater Network Discharge Consent (CSNDC; CRC214226). In accordance with the CSNDC Environmental Monitoring Programme (EMP), monitoring was undertaken monthly at waterway sites. This report summarises the results for the monthly monitoring for the 2021 calendar year.

2. Methods

2.1. Monitoring Sites

Fine sediment monitoring was undertaken at 17 sites from waterways within the five main river catchments of Christchurch (Ōtākaro-Avon River, Opāwaho-Heathcote River, Huritini-Halswell River, Pūharakekenui-Styx River and Ōtūkaikino River) (Table 1). Non-wadeable sites were not included due to the difficulties in sampling this environment and because these sites can naturally be soft-bottomed.

2.2. Sampling and Testing Methods

Council has monitored most sites monthly since mid-2020. Fine sediment cover (< 2 mm; i.e., silt/sand) of the streambed was estimated at each site. The sampling method used was adapted from (a) methods used by ECan (Rachel Webster, ECan, personal communication, August 2015) and (b) Sediment Assessment Method 2 from Clapcott *et al* (2011). These methods have been adapted to allow a relatively semi-quantitative assessment of each reach, without having to undertake lengthy, and therefore costly, investigations. These measurements were taken by Council Laboratory staff.

The reach assessed was 30 metres in length where available, with the reach starting at the downstream coordinate for the site and continuing upstream from that point. The upstream and downstream extents of each reach were marked to ensure consistency between monitoring events. The entire reach was transversed and ten estimates were taken of fine sediment (< 2 mm) percent cover, with these estimates taken at roughly equidistant points. A bathyscope was used to assess the percent cover of fine sediments and the ten estimates encompassed all habitat types within the wetted margin of the reach (i.e., pools, runs, riffles, backwaters) and habitat types recorded.

Estimates consisted of only visible cover, not assumed cover (e.g., not assumed sediment under macrophytes). Sediment that settles thickly on macrophytes and other substrates was included in the estimate. Each estimate was rounded to the nearest 5%, with 1% recorded if a small amount of sediment is present, and 0% recorded if no sediment is present.

Where possible, observations were conducted by the same observer across each site and each month, to ensure consistency in the sometimes subjective percent cover assessments. If the visibility was not favourable at the time of the scheduled sampling, the site was not required to be revisited for that month.

No monitoring was undertaken in October 2021 due to staff shortages. In June 2021, no measurements were taken at Addington Brook, Cashmere Stream, and Ōpāwaho-Heathcote River at Ferniehurst St due to roadworks preventing site access. In August 2021, no measurement was taken at Cashmere Stream due to COVID-19 restrictions. In March, April, and May 2021, no measurements were taken at Heathcote River at

Warren Crescent due to turbid water preventing vision of the streambed, this was also the case in March 2021 at Cashmere Stream and June 2021 at Curletts Rd Stream.

The following sites were introduced to the monitoring program in July 2022: Kā Pūtahi Creek at Ouruhia Reserve, Otukaikino Creek at Groynes Inlet, and Styx River at Styx Mill Conservation Reserve. The sampling site at Kā Pūtahi Creek at Ouruhia Reserve was added to replace the site Kā Pūtahi Creek at Belfast Rd due to sampling suitability issues. The site at Ōtūkaikino Creek at Groynes Inlet was added to represent a site within the Ōtūkaikino River & Creek in the vicinity of Clearwater and Groynes subdivisions (downstream of stormwater discharge). Pūharakekenui-Styx River at Styx Mill Conservation Reserve was added to replace another site in Wilsons Drain which was not appropriate for sediment monitoring and is now an annual aquatic ecology monitoring site.

Table 1. Christchurch City Council waterway fine sediment monitoring sites and associated waterway classifications under the Comprehensive Stormwater Network Discharge Consent Environmental Monitoring Programme to allow comparison to Attribute Target Levels.

Catchment	Site ID	Site	Easting (NZTM)	Northing (NZTM)	Waterway Classification	% Cover Attribute Target Level	Monitoring instigated
Ōtākaro-Avon	AVON08	Riccarton Main Drain	1568683	5180019	Spring-fed – plains – urban	30	June 2020
	AVON09	Addington Brook	1569427	5179826	Spring-fed – plains – urban	30	June 2020
	AVON10	Dudley Creek	1572574	5182150	Spring-fed – plains – urban	30	June 2020
	AVON12	Avon River at Carlton Mill Corner[1]	1569737	5181259	Spring-fed – plains – urban	30	June 2020
Ōpāwaho-Heathcote	HEATH06	Heathcote River at Rose Street	1568701	5175918	Spring-fed – plains – urban	30	June 2020
	HEATH07	Heathcote River at Ferniehurst Street	1569157	5175612	Spring-fed – plains – urban	30	June 2020
	HEATH10	Curlett Road Stream Upstream of Heathcote River Confluence	1566928	5177711	Spring-fed – plains – urban	30	June 2020
	HEATH27	Cashmere Stream, Behind 406 Cashmere Road (downstream of stormwater discharge)	2477452	5736476	Banks Peninsula	20	June 2020
	HEATH31	Heathcote River at Warren Crescent	2476033	5738970	Spring-fed – plains – urban	30	June 2020
Pūharakekenui-Styx	STYX03	Styx River at Main North Road	1569066	5187219	Spring-fed – plains	20	June 2020
	STYX04	Kā Pūtahi Creek at Blakes Road	1570401	5188030	Spring-fed – plains	20	June 2020
	STYX09	Kā Pūtahi Creek at Ouruhia Reserve	2481755	5751732	Spring-fed – plains	20	July 2021
	STYX12	Styx River at Styx Mill Conservation Reserve	2478252	5749370	Spring-fed – plains	20	July 2021

1 This site are specifically located in proximity to stormwater outfalls.

Catchment	Site ID	Site	Easting (NZTM)	Northing (NZTM)	Waterway Classification	% Cover Attribute Target Level	Monitoring instigated
Huritini-Halswell	HALS03	Nottingham Stream at Candys Road	1564532	5173080	Spring-fed – plains	20	June 2020
	HALS05	Knights Stream at Sabys Road	1563723	5172852	Spring-fed – plains	20	June 2020
Ōtūkaikino	OTUKAI01	Ōtūkaikino River at Groynes Inlet	1567878	5188869	Spring-fed – plains	20	July 2021
	OTUKAI03	Ōtūkaikino Creek at Omaka Scout Camp	1565664	5188038	Spring-fed – plains	20	June 2020

2.3. Data Analysis

2.3.1. Summary Statistics and Graphs

Monthly fine sediment monitoring data was summarised using box plots in the program RStudio (Version 4.1.3). The dark lines in the boxes of the boxplots represent the medians, and the bottom and top lines of the boxes represent the 25th and 75th percentiles (the interquartile range), respectively. The T-bars that extend from the boxes approximate the location of 90% of the data (i.e., the 5th and 95th percentiles). These percentiles were calculated using HAZEN methodology (Ministry for the Environment, 2003). There is currently insufficient data to conduct trend analysis, as three years of data is required for Time Trends analysis (NIWA, 2020).

2.3.1. Attribute Target Levels

The medians of the fine sediment boxplots were compared to the Attribute Target Levels (ATLs) in Schedule 7 of the consent (Table 1). These ATLs are based on the Canterbury Land and Water Regional Plan (LWRP) Table 1a (Freshwater Outcomes for Canterbury Rivers; Environment Canterbury, 2019). The LWRP waterway classification determines which ATL is appropriate. All of the sites within the Ōtākaro-Avon and Ōpāwaho Heathcote River catchments are classified as 'Spring-fed plains – urban', with an ATL of 30% fine sediment cover. The exception to this is Cashmere Stream which is classified as 'Banks Peninsula' and has an ATL of 20% fine sediment cover. All sites within the Pūharakekenui-Styx, Huritini-Halswell, and Ōtūkaikino River catchments are classified as 'Spring-fed – plains', with an ATL of 20% fine sediment cover.

3. Results

3.1.1. Spatial differences

There were no obvious trends in fine sediment between sites and catchments, with similar but variable results (Figure 1). Curlett Road Stream Upstream of Ōpāwaho-Heathcote River Confluence had the highest median cover of 100% across all 17 sites and Ōtākaro-Avon River at Carlton Mill corner had the lowest median cover (Figure 1: Monthly fine sediment percent cover at 17 sites in Christchurch City from January - December 2021. The red lines are the consent Attribute Target Levels.Figure 1). High sediment cover was also recorded in the Ōpāwaho-Heathcote River at Warren Cres and Ferniehurst Street, and in Nottingham Stream. Low sediment cover was also recorded at Ōtūkaikino at Omaka Scout Camp and Pūharakekenui-Styx River at Main North Road.

3.1.2. Comparison to Attribute Target Levels

ATLs for fine sediment cover were complied with at five of the 17 monitoring sites (Figure 1). None of the sites in the Huritini-Halswell catchment complied with the ATL. One out of five sites met the ATL in the Ōpāwaho-Heathcote River Catchment. Two out of four sites met the ATL in the Ōtākaro-Avon River Catchment, and only one site in the Pūharakekenui-Styx and Ōtūkaikino Rivers met the ATL.

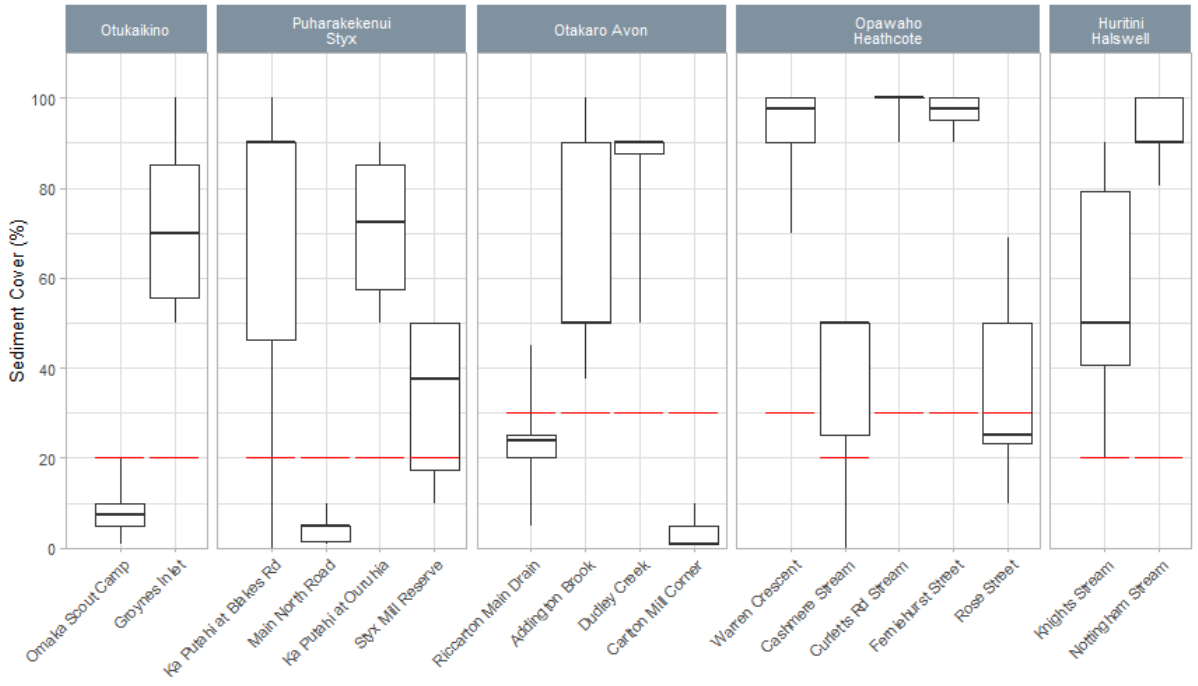

Figure 1: Monthly fine sediment percent cover at 17 sites in Christchurch City from January - December 2021. The red lines are the consent Attribute Target Levels.

4. Discussion

Monitoring data from 2021 shows no obvious patterns in fine sediment between sites and catchments, with similar but variable results. Fine sediment cover was high and exceeded consent target levels at 12 of the 17 monitoring sites. This partly reflects the naturally high fine sediment cover present in some of the spring-fed streams sampled across Christchurch, but mostly reflects the negative impacts of rural and urban land use on sediment erosion and fine sediment deposition.

Sites in the Ōpāwaho-Heathcote River generally had the highest fine sediment cover which is likely reflective of the current and historical catchment sediment inputs. Ōpāwaho-Heathcote River at Rose St was the only site within the Ōpāwaho-Heathcote catchment to meet the ATL.

No sites in the Hurutini-Halswell catchment met the ATL. In the most recent surface water quality monitoring report for the city, Margetts and Poudyal (2022) found that Nottingham Stream had amongst the worst water quality of all 51 sites monitored. They noted that there is currently no stormwater treatment in the Nottingham Stream catchment, and they recommended that the addition of stormwater treatment in the catchment should be a priority.

Two out of four sites met the ATL in the Ōtākaro-Avon River catchment with Carlton Mill having the lowest fine sediment cover across all catchments. This is expected as the substrate at this site is largely cobbles and gravels with fast flowing riffle habitat that flushes out fine sediments and prevents settling on the stream bed. The other site that met the ATL was Riccarton Main Drain (a tributary of the Ōtākaro-Avon River), despite having a highly urbanised catchment. Dudley Creek had the highest fine sediment cover within the catchment. Dudley Creek is also a highly urbanised catchment with substrates predominantly soft bottomed.

Fine sediment cover in the Pūharakekenui-Styx River catchment varied between sites. The two Kā Pūtahi (a tributary of the Pūharakekenui-Styx River) sites had higher fine sediment cover than the two Pūharakekenui-Styx River mainstem sites, with the Pūharakekenui Styx River at Main North Road site being the only site to meet the ATL. Kā Pūtahi at Blakes Rd had the highest median fine sediment cover in the catchment; however, sediment was highly variable during the year. The two Ōtūkaikino River sites were considerably different to each other, with only the Ōtūkaikino at Omaka Scout camp meeting the ATL.

5. Recommendations

Based on the results of the monitoring above, the below is recommended:

- Continuation of long term monitoring to establish if sediment cover changes over time;
- Stormwater treatment in catchments that are predominantly urban that do not have stormwater treatment in place (e.g., Nottingham Stream and Riccarton Main Drain);
- Working with industry to prevent sediment runoff from individual sites from getting into the stormwater system and then into waterways;
- Implementation of tasks under the CSNDC to reduce sediment discharges, such as:
    - Implementing the Risk Matrix and Transition Plan for Excluded Sites (Condition 3);
    - Ensuring site-specific Erosion and Sediment Control Plans (Condition 41);
    - Instigating the Sediment Discharge Management Plan (Conditions 43-46);
    - Embedding a Building Consent approval and inspection process with respect to erosion and sediment control (Schedule 4i); and
    - Implementing the sustainable behaviour change programme (Schedule 4m).
- Implementation of the tasks in the Healthy Water Bodies Action plan relating to reducing sediment discharge, such as:
    - Reducing sediment discharges, in conjunction with other stakeholders, such as Environment Canterbury (e.g., by instigating the CSNDC, Stormwater and Land Drainage Bylaw, Building Act, Community Waterways Partnership, and Surface Water Implementation Plan);
    - Carrying out education/behaviour change campaigns via the Community Water Partnership to reduce sediment inputs to waterways;
    - Removing excessive fine bed sediment where appropriate; and
    - Reviewing Council maintenance practices to ensure effects on water quality are mitigated as far as possible (e.g., preventing sediment discharge due to macrophyte removal).

6. Acknowledgements

Council laboratory staff collected the monthly monitoring samples. Instream Consulting Limited provided advice on graphing.

7. References

Environment Canterbury, 2019. Canterbury Land and Water Regional Plan. September 2017. Environment Canterbury, Christchurch. Accessed from: https://eplan.ecan.govt.nz/eplan/#Rules/0/55/1/25081.

Clapcott, J.E., Young, R.G., Harding, J.S., Matthaei, C.D., Quinn, J.M. and Death, R.G. (2011) Sediment Assessment Methods: Protocols and guidelines for assessing the effects of deposited fine sediment on in-stream values. Cawthron Institute, Nelson, New Zealand.

Margetts, B. I., and Poudyal, S. (2022). Christchurch City water quality annual report 2021. Christchurch City Council Report, Christchurch, New Zealand.

Ministry for the Environment, 2003. Microbiological water quality guidelines for marine and freshwater recreational areas. Ministry for the Environment, Wellington.

NIWA, 2020. Trend and equivalence analysis. Software Version 6. NIWA. http://www.jowettconsulting.co.nz/home/time-1

Ryan, P.A., 1991. Environmental effects of sediment on New Zealand streams: a review. New Zealand Journal of Marine and Freshwater Research 25: 207-221.

Stevenson, M., Wilks, T. & Hayward, S. 2010. An overview of the state and trends in water quality of Canterbury's rivers and streams. Environment Canterbury Report R10/117, Christchurch.

Walsh C.J., Roy A.H., Feminella J.W., Cottingham P.D., Groffman P.M. & Morgan R.P., 2005. The urban stream syndrome: current knowledge and the search for a cure. Journal of the North American Benthological Society 24: 706-723.