TR2023/5
Summary
March 2023

Tāmaki Makaurau / Auckland Marine Sediment Contaminants

Summary of TR2023/5, covering the 2021 monitoring in the Manukau Harbour

Key points:

- **27 sites in the Manukau Harbour were sampled for concentrations of copper, lead, zinc, mercury, and arsenic.**
- **Overall, a relatively low level of metal contamination was observed.**
- **Two sites located at the head of the harbour in the Māngere Inlet have slightly elevated zinc levels (ERC-amber levels).**
- **No sites in the Manukau Harbour fell into the higher ERC-red category.**
- **Changes in the concentration of metals over time at most sites has been relatively stable.**

This document summarises the findings of Auckland Council's Regional Sediment Contaminant Monitoring Programme conducted in 2021. All sites sampled in 2021 were located in the Manukau Harbour. A comprehensive report and description of the data collected is available in TR2023/5, and for a detailed assessment of marine sediment contaminant state and changes over time across Tāmaki Makaurau up until 2019, see TR2021/10.

Overview

Contaminants such as copper, lead, and zinc, can accumulate in the sediments of our harbours, estuaries, and beaches. These metals originate from a range of different activities and land uses. They can come from vehicle tyre and brake wear, industrial activity, and some building materials. When it rains, these pollutants are washed into our stormwater networks and waterways, ending up in our marine environment. The build-up of these contaminants can affect ecological health, by reducing the number or diversity of animals living in the sediment. This can have harmful effects on the natural functioning of these ecosystems and result in degraded communities that are dominated by few species that are tolerant of higher contaminant levels. Understanding the distribution and level of chemical contaminants in marine sediments provides a useful marker of land use impacts on marine receiving environments and ecosystem health.

What we monitor

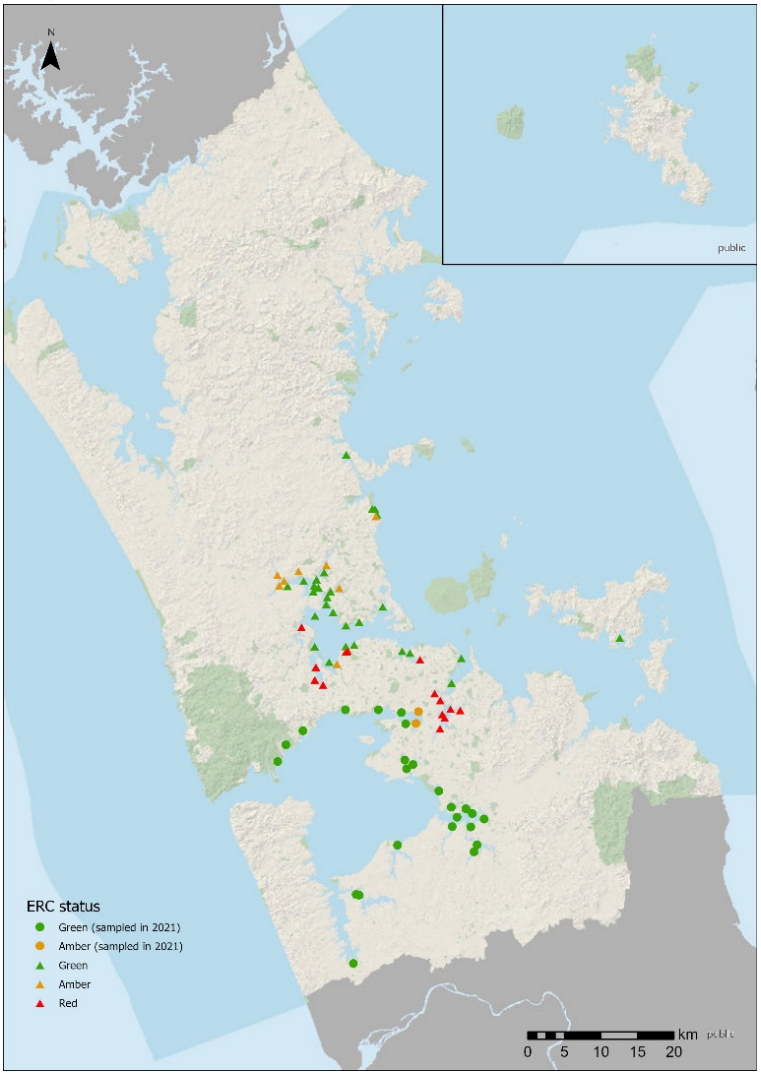
Monitoring focuses on the main heavy metals associated with urban stormwater, copper (Cu), lead (Pb) and zinc (Zn), along with mercury (Hg) and the metalloid arsenic (As).

Concentrations (of Cu, Pb, and Zn) are compared with conservative thresholds developed specifically for the Auckland region, known as the *Environmental Response Criteria* (ERC). The ERC uses a traffic light system to indicate the contaminant level and associated impact on ecological health, where green indicates a low level of contaminants, amber indicates moderately elevated levels where adverse effects on ecology may be beginning to appear, and red indicates levels of contamination where ecological degradation is likely to be occurring.

Concentrations are also compared with the *Australian and New Zealand guidelines for fresh and marine water quality* (ANZG). These threshold values are higher than those used in the ERC, so fewer sites will trigger the ANZG thresholds than the ERC. Using lower contaminant thresholds (i.e., the ERC) provides an earlier warning of environmental degradation. Comparisons with the ANZG (including for mercury and arsenic which are not included in the ERC) are presented in the full annual report, TR2023/5.

Marine ecology and sediment mud content are measured at all sites in conjunction with sediment contaminant monitoring. See a synthesis report of state of the environment monitoring in the Manukau Harbour (Auckland Council, 2021) for marine ecology results.

Emerging contaminants such as those associated with pharmaceuticals, agrichemicals and microplastics, are of growing concern for the marine environment. For many of these contaminants, the accumulation, toxicity, and impact they have on the marine environment is not fully understood. Previous studies in Auckland have found concentrations largely similar to those reported internationally, with elevated concentrations observed around areas of wastewater discharge and sewage overflows. Nationwide research is underway to identify the most important emerging contaminants affecting our waterways, their source, and pathways for prevention, as well as enhancing regional and national frameworks for managing their risks. This work will help guide and determine the monitoring direction and priorities for these contaminants in the Manukau Harbour and the wider Tāmaki Makaurau region.



Environmental Response Criteria (ERC) contaminant state of sites sampled in 2021 (●), and in previous years (▲).

Where we monitor

Auckland Council's Regional Sediment Contaminant Monitoring Programme conducts regular monitoring in the intertidal sand/mud flats at around 80 sites across the region's harbours, estuaries, and coastline.

Each year a selection of sites is sampled. In 2021, sediments from 27 sites spread across the Manukau Harbour were collected, including four sites in

Māngere Inlet, five along the northern coastline, two in Mauku River, ten in Pāhurehure Inlet, three in Pukaki Inlet, one in Puhinui Inlet, one in Waiuku River and one in Te Hihi Inlet. This provided for a comprehensive assessment of the harbour.

What we found

Results showed a similar spatial pattern as reported previously for the Manukau Harbour. Overall, there is a low level of metal contamination, with 25 of the 27 sites assessed in the ERC-green category. Sites that have higher contaminant levels are located at the head of the harbour in the Māngere Inlet, where elevated zinc levels result in two sites (Harania and Anns Creek) being assessed in the ERC-amber range. No sites in the Manukau Harbour fell into the ERC-red category.

Sites in the Māngere Inlet have shown elevated levels of metals (most commonly zinc) since monitoring began in 1998. Sensitive trend analysis (statistical analysis of the monitoring data to obtain the magnitude and direction of change over time) reported in Mills and Allen (TR2021/10) indicate that concentration levels at sites in the Māngere Inlet are showing some signs of improvement (particularly for copper and lead), possibly as a result of improved site and stormwater management associated with modernising industry in the catchment.

The catchment surrounding the Māngere Inlet is intensively developed and has a long history of commercial and industrial use. The pressures associated with these land uses have cumulatively had a negative impact on sediment quality in the inlet, as seen in other areas of Tāmaki Makaurau with a similar history of catchment land use. In addition, sheltered, low energy estuarine environments (such as Māngere Inlet) tend to accumulate fine sediment and have a high proportion of mud, which are more likely to trap and accumulate contaminants, compared to sandy sites exposed to higher wave and tidal energy. The low level of metal contamination outside Māngere Inlet is likely due to a mixture of factors, including the large size and high level of tidal mixing of the Manukau Harbour, and a relatively small proportion of urban area (16% of total landcover) within the catchment.

Changes over time

In general, ERC contaminant status has remained relatively stable over time and no consistent changes in state were recorded at any sites sampled in 2021. Changes in state refer to changes in ERC threshold levels only. More sensitive trend analysis is reported in TR2021/10.

Changes in state did occur at two sites, Anns Creek in the Māngere Inlet, and Waimāhia Central in the Pāhurehure Inlet. This saw the state for zinc concentrations dropping from levels in the ERC-red

Regional Sediment Contaminant Monitoring Programme sites Hillsborough (left) and Waiuku (right) in the Manukau Harbour.

status to the ERC-amber status at Anns Creek (between 2019 and 2021), and from the ERC-amber status to the ERC-green status at Waimāhia Central (also between 2019 and 2021). It is possible that the change in state at these sites is attributable to issues with zinc analysis during the last sampling events at these sites, resulting in slightly higher concentrations being recorded in 2019, rather than actual decreasing concentrations over this time.

Overall, changes in the concentrations of metals over time at most sites in the Manukau have been relatively small, with slight changes above and below threshold levels.

Site	Location	Status Cu Pb Zn only	Mud Content % <63 um	Total Recoverable metals, mg/kg <500 mm				
				Cu	Pb	Zn	As	Hg
Anns Creek	Māngere Inlet	Zn	93.6	14.69	19.8	140.41	10.86	0.05
Harania	Māngere Inlet	Zn	90.4	13.35	18.12	123.71	10.7	0.05
Māngere Cemetery	Māngere Inlet		86.1	11.8	17.3	112.11	11.24	0.04
Tararata	Māngere Inlet		59.4	12.13	16.42	117.92	9.83	0.04
Blockhouse Bay	Northern Coastline		30.6	3.93	9.87	57.2	7.29	<0.02
Big Muddy	Northern Coastline		80.9	8.52	9.57	61.29	12.38	0.03
Hillsborough	Northern Coastline		17.5	6.13	10.55	64.35	9.41	0.02
Little Muddy	Northern Coastline		27.7	9.58	12.55	71.03	16.73	0.04
Mill Bay	Northern Coastline		10.7	3.65	7.93	50.82	13.08	<0.02
Mauku/Taihiki River A	Mauku River		40.2	2.86	5.49	34.02	7.69	<0.02
Mauku/Taihiki River B	Mauku River		23.1	2.28	4.61	29.05	6.52	<0.02
Whangamaire	Pāhurehure Inlet		90.5	3.24	6.22	31.28	8.24	<0.02
Whangapouri	Pāhurehure Inlet		37.9	5.07	9.23	53.89	10.09	0.03
Bottle Top Bay	Pāhurehure Inlet		73.0	7.62	11.68	73.64	11.79	0.04
Doc Island Mud	Pāhurehure Inlet		30.5	3.35	6.73	49.28	8.86	0.02
Drury Inner	Pāhurehure Inlet		44.3	5.99	9.56	65.59	10.55	0.04
Pāhurehure Middle	Pāhurehure Inlet		31.7	3.46	7.68	49.19	12.47	<0.02
Pāhurehure Papakura	Pāhurehure Inlet		66.2	7.51	13	85.16	11.56	0.04
Pāhurehure Upper	Pāhurehure Inlet		83.4	7.96	12.39	88.93	13.71	0.04
Papakura Lower	Pāhurehure Inlet		95.0	7.62	11.79	75.18	10.1	0.04
Waimāhia Central	Pāhurehure Inlet		90.1	7.62	11.6	82.48	13.4	0.04
Puhinui Upper	Puhinui		92.0	8.68	12.68	109.12	14.25	0.04
Pukaki Airport	Pukaki Inlet		83.4	7.17	10.97	69.75	13.21	0.03
Pukaki Upper	Pukaki Inlet		40.1	4.03	6.62	45.12	7.78	<0.02
Pukaki Waokauri	Pukaki Inlet		49.6	4.67	7.87	53.55	8.73	0.02
Karaka/ Te Hihi Estuary	Te Hihi Inlet		39.1	2.95	5.29	34.71	8.12	<0.02
Waiuku	Waiuku Inlet		77.9	8.52	14.84	90.54	14.55	0.05

Environmental Response Criteria (ERC) contaminant state for copper (Cu), lead (Pb), and zinc (Zn), and concentrations of arsenic (As), mercury (Hg), and mud content at sites sampled in 2021. Metals' concentrations are medians of five replicates.

Find out more:

Allen, H. (2023). *Tāmaki Makaurau / Auckland marine sediment contaminant monitoring: data report for 2021.* Auckland Council technical report, TR2023/5

Mills, G N and H Allen (2021). *Marine sediment contaminant state and trends in Tāmaki Makaurau / Auckland 2004-2019. State of the environment reporting.* Auckland Council technical report, TR2021/10

Auckland Council (2021). *A synthesis of state of the environment monitoring in the Manukau Harbour.*

For more information or to request data, email environmentaldata@aklc.govt.nz
Technical reports are available on Knowledge Auckland, www.knowledgeauckland.org.nz