

Report 09.437
Date 5 August 2009
File ENV/05/05/10

Committee Regulatory
Authors Juliet Milne, Team Leader, Environmental Science
Paul Sorensen, Environmental Scientist

Porirua Harbour environmental monitoring – 2008/09 summary

1. Purpose

To summarise the key findings of intertidal and subtidal monitoring and investigations undertaken in Porirua Harbour during 2008/09.

2. Background

Porirua Harbour has been identified as a high priority for a range of environmental monitoring and Greater Wellington is carrying this monitoring out by working closely with the Porirua City Council through its Porirua Harbour and Catchments programme. Currently, routine monitoring in the harbour incorporates both intertidal¹ and subtidal sediment quality and ecology (Figure 1), with the monitoring programmes designed primarily to assess one or more common estuary issues: sedimentation, eutrophication (nutrient enrichment), contamination and habitat loss (e.g., changes in substrate or vegetation cover). Other routine monitoring in Porirua Harbour includes microbiological water quality (five sites reported on separately under Greater Wellington's recreational water quality monitoring programme²) and contaminants in shellfish flesh (assessed at approximately five yearly intervals).

In addition to routine monitoring of the health of Porirua Harbour (and selected tributary streams³), special one-off investigations are undertaken as and when necessary; one such investigation was undertaken earlier this year and is summarised later in this report.

¹ Intertidal areas are those exposed at low-tide (in contrast, subtidal areas are permanently under water).

² See Report 09.294 for 2008/09 results.

³ Greater Wellington monitors water quality and ecological health at four sites on three streams (Porirua, Pauatahanui and Horokiri streams). Flows are also monitored on these streams.

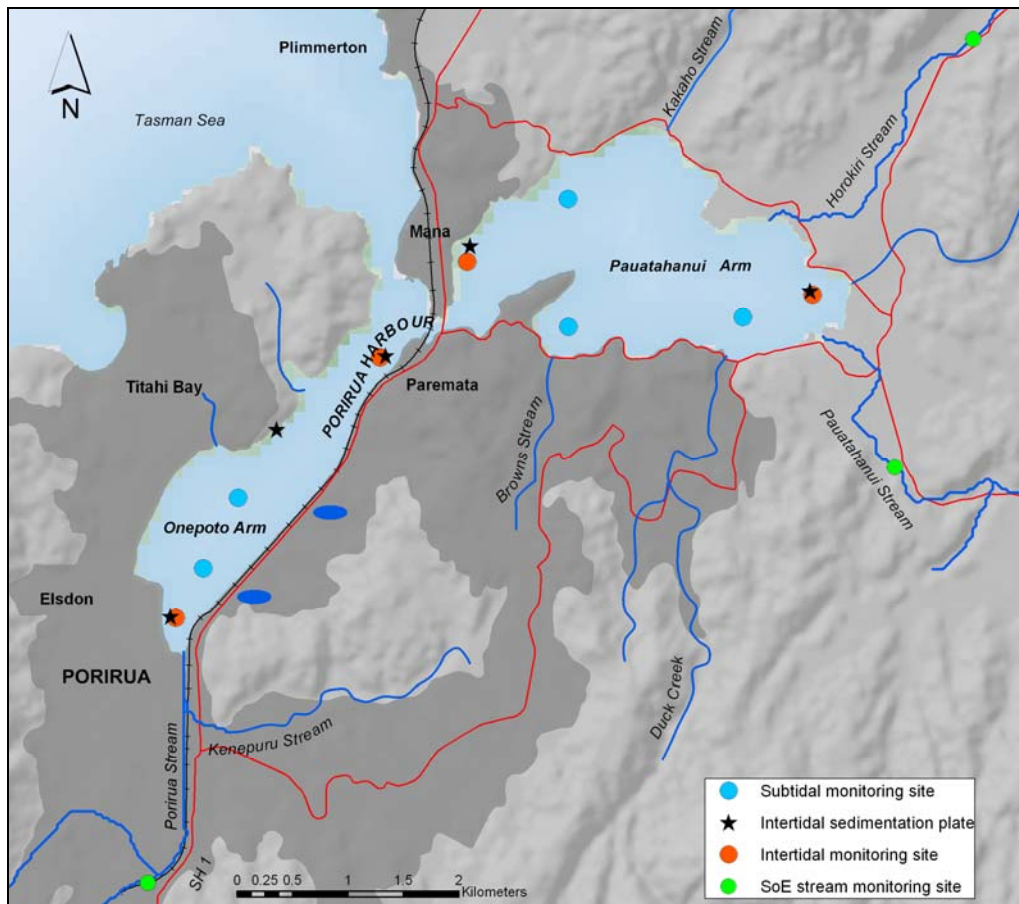


Figure 1: Intertidal and subtidal sediment quality and ecological monitoring sites in Porirua Harbour. Sedimentation plate locations and routine water quality monitoring sites on tributary streams are also shown.

3. Intertidal sediment quality and ecological monitoring⁴

As with the initial 2008 survey, the second intertidal survey completed in January 2009 was undertaken at two sites in each arm of the Porirua Harbour (Figure 1). This monitoring included assessments of sediment texture, nutrient and organic content, heavy metal concentrations and benthic (sediment-dwelling) fauna and flora richness. The depths to 15 sedimentation monitoring plates buried in various locations in December 2007 were also measured (with four additional plates buried near the Paremata boatsheds) and macroalgae (e.g., sea lettuce) cover mapped.

In terms of the key estuary issues the monitoring addresses, the January 2009 survey showed:

- *Sedimentation*: After one year, sedimentation rates at most sites are low. The exception is one site in the upper Onepoto Arm (average of 7mm in 13 months); further plates need to be put in place at this site as the variability across the two sedimentation plates was high (0-14 mm).

⁴ This section is a brief summary of two technical reports:
Robertson, B.; Stevens, L. 2009. *Porirua Harbour: Intertidal fine scale monitoring 2008/09*.
Stevens, L. 2009. *Porirua Harbour: Intertidal macroalgal monitoring 2008/09*.

- *Eutrophication*: Similar to last year's findings, sediment nutrient concentrations and the depth of the oxygenated surface sediment layer indicate that both arms of the harbour are moderately eutrophic or enriched. This conclusion is supported by the presence of elevated numbers of benthic fauna that tolerate moderate levels of mud and/or organic enrichment, and the widespread coverage of macroalgae. More than 10% of the intertidal habitat in the Pauatahanui Arm, and more than 30% of the intertidal habitat in the Onepoto Arm had greater than 50% coverage of macroalgae, resulting in localised nuisance conditions (rotting macroalgae and poorly oxygenated and sulphide-rich sediments). At this stage, enrichment is not a major problem, but there is a need for caution in relation to factors that could increase nutrient concentrations and fine sediment in the harbour.
- *Toxicants*: Total heavy metal concentrations in the sediments of all sites (measured as an indicator of potential toxicants) are well within national sediment quality guidelines. The situation is different in the mud-dominated subtidal basins, particularly in the Onepoto Arm (*see* Section 4).

4. Subtidal sediment quality and ecological monitoring⁵

Greater Wellington's Porirua Harbour subtidal sediment quality monitoring programme primarily focuses on heavy metals and several classes of organic contaminants which tend to be bound to the mud fraction of sediments. The subtidal basins in each arm of the harbour are dominated by fine muds and thus form a "sink" in which contaminants accumulate. The third survey of subtidal sediment quality and benthic community health was undertaken at five sites in November 2008. This survey was narrower in scope than the first two surveys (May 2004 and October 2005), with the sediment chemistry component restricted to assessing concentrations of just one group of contaminants, the heavy metals.

Consistent with the results of the previous surveys, concentrations of total copper, lead and zinc (Figure 2) are above 'early warning' sediment quality guidelines in the subtidal sediments of the Onepoto Arm of Porirua Harbour. Concentrations of the other metals analysed are currently below guideline levels in the Onepoto Arm, as are the concentrations of all metals in the subtidal sediments of the Pauatahanui Arm. The benthic fauna monitoring data indicate that some of the environmental variables being measured are influencing lower-order benthic community structure. However, at this stage, any effects of metal contamination cannot be separated from the effects of differences in sediment texture and organic carbon content.

Although statistically significant trends in the biologically available concentrations of copper, lead and zinc have been detected since 2004, it is still too early to tell whether these trends are ecologically significant and whether they will continue into the future.

⁵This section is a brief summary of the technical report: Milne, J.R.; Sorensen, P.G.; Kelly, S. 2009. *Porirua Harbour subtidal sediment quality monitoring: Results from the November 2008 survey*.

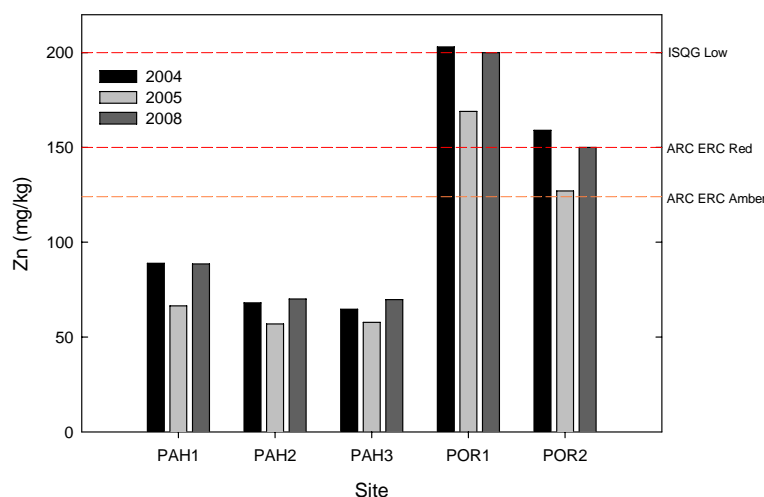


Figure 2: Concentrations of total zinc in sediments of five sites sampled in Porirua Harbour in 2004, 2005 and 2008, based on the <500 µm fraction of a single composite sample from each site

Note: assessment of this sediment fraction is appropriate for comparison against sediment quality guidelines but a different – and more ‘precise’ – assessment is used to determine trends in zinc concentrations over time

5. Targeted assessment of sediment contamination⁶

In February this year, in association with Porirua City Council, Greater Wellington staff undertook a targeted investigation of contaminants in surface sediments at selected intertidal locations in Porirua Harbour. The southern-most end of the Onepoto Arm adjacent to Porirua City was the primary focus of the study; this area has been ear-marked for possible future development yet the sediments are known to contain elevated concentrations of contaminants. Sediment sampling was also undertaken at a few other potential contaminant “hotspots”: the mouth of a stream entering the Onepoto Arm adjacent to the Porirua Rowing Club (‘Onepoto’ Stream), and adjacent to the mouths of Browns Stream and Duck Creek in the Pauatahanui Arm. In addition, sediment samples were collected from the lower reaches of several streams discharging into the harbour that receive urban stormwater inputs, including the Porirua Stream.

The results of the targeted assessment confirm that there is clear evidence of stormwater-derived contamination in Porirua Harbour. Zinc is present above sediment quality guidelines at all 10 intertidal sites sampled between the Semple Street stormwater outfall and the Porirua Stream channel at the southern end of the Onepoto Arm (Figure 3). Copper, lead and total high molecular weight polycyclic aromatic hydrocarbon (HMW PAH) concentrations are also present above guideline values at some sites in this area, and total DDT is present above guidelines at all sites. Although only two sediment core samples were taken, zinc was present in one at a concentration equal to the ANZECC (2000) ‘high’ guideline value. This suggests that contamination may exist to some depth, at least in the vicinity of the Semple Street stormwater outfall.

⁶This section is a summary of the technical report: Sorensen, P.G.; Milne, J.R. 2009. *Porirua Harbour targeted intertidal quality assessment*.

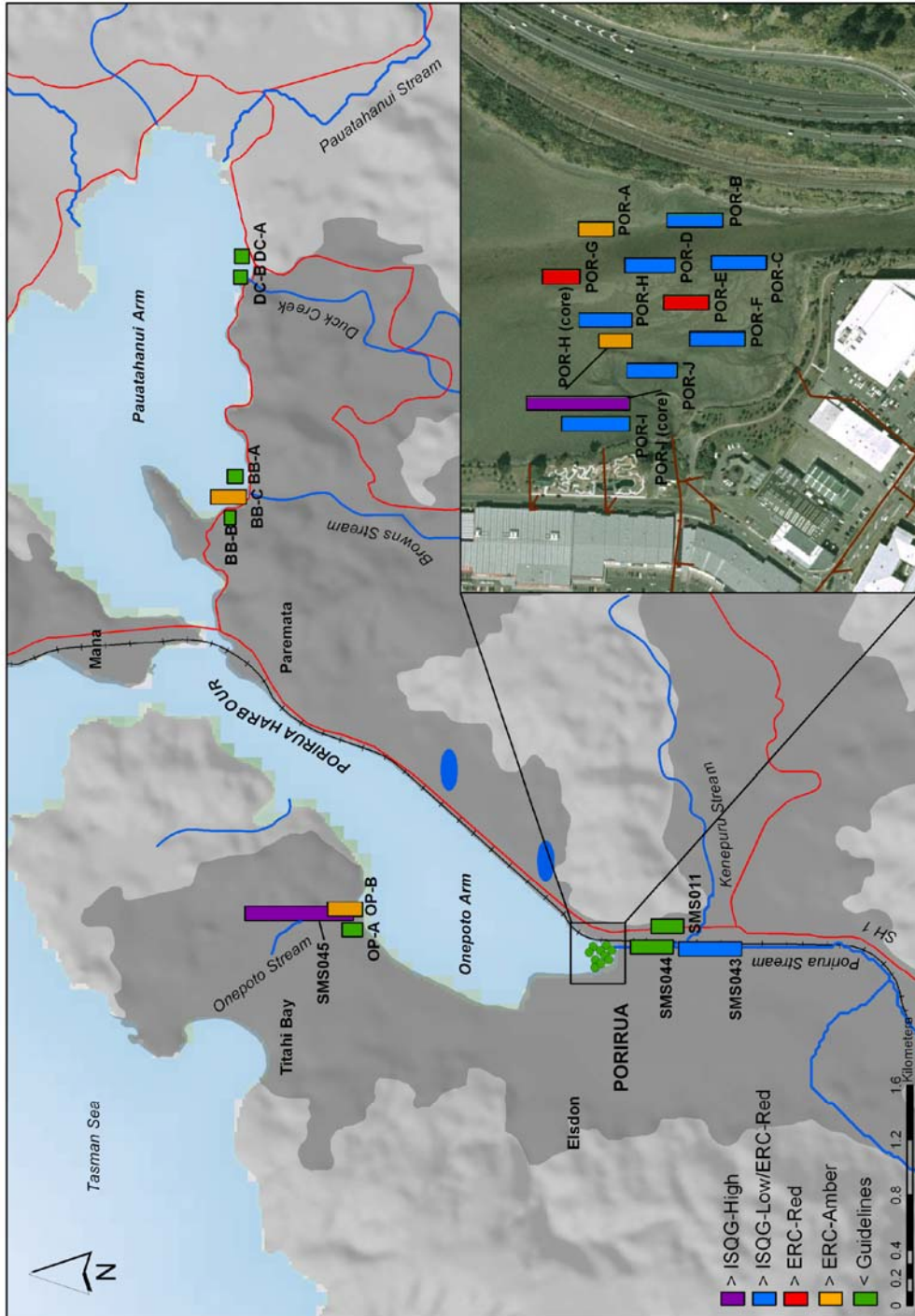


Figure 3: Concentration of total zinc in sediments of sites sampled as part of the Porirua Harbour targeted intertidal sediment quality assessment in February 2009, based on the <2 mm fraction of a single composite sample from each site. The concentrations present are coloured in accordance with sediment quality guidelines exceeded.

Intertidal sediments at the mouth of the 'Onepoto' Stream beside the Porirua Rowing Club contain concentrations of lead, zinc, total DDT and various PAH compounds above sediment quality guidelines. Sediments adjacent to the mouths of Browns Stream and Duck Creek have total DDT concentrations above guideline values, with lead and total HMW PAH concentrations also above guidelines in the sediments adjacent to the mouth of Browns Stream.

Stormwater-derived contaminants are also present in the sediments from the beds of streams that discharge into the Porirua Harbour. Concentrations of total DDT, and to a lesser extent zinc, exceed sediment quality guidelines in Porirua, Kenepuru and 'Onepoto' streams. Sediments in the 'Onepoto' Stream also contain concentrations of several HMW PAH compounds and dieldrin above guideline values.

In most cases, existing sediment contaminant concentrations only exceed 'alert level' or 'early warning' guidelines. This indicates that there is an opportunity for management intervention to limit the extent of degradation and prevent adverse environmental effects from occurring. Zinc and DDT are the contaminants of greatest concern; these are persistent contaminants and stormwater and stream investigations⁷ to date confirm inputs of both are ongoing.

6. Porirua Harbour and catchment programme

Greater Wellington is a key player in Porirua City Council's Harbour and Catchment programme which aims to have a comprehensive strategy and action plan to address environmental issues in place by June 2011. Relevant Greater Wellington staff are involved with representatives of a range of other agencies both on the Strategy Reference Group and the Science Reference Group. The latter is intended to assist decisions about what additional "science" is required to guide the strategy. One significant project the group has advised on this year is the development of a hydrodynamic model of the harbour to improve our understanding of water and sediment circulation into, around and out of the harbour. Earlier this year Porirua City Council commissioned a bathymetric survey that will assist with the development of this model. Greater Wellington contributed to this by installing one permanent and three temporary tide gauges.

Greater Wellington will continue with its scheduled environmental monitoring programme. This includes a third intertidal survey in early 2010.

7. Communication

Copies of this report and the various technical reports will be sent to Porirua City Council, Wellington City Council, the Department of Conservation, Ngati Toa and local interest groups. The technical reports will also be available on Greater Wellington's website.

⁷ Key technical report: Milne, J.R.; Watts, L. 2008. Stormwater contaminants in urban streams in the Wellington region.

8. Recommendations

That the Committee:

1. ***Receives the report.***
2. ***Notes the content of the report.***

Report prepared by:

Report prepared by:

Report approved by:

Juliet Milne
Team Leader Environmental
Science, Environmental
Monitoring & Investigations

Paul Sorensen
Environmental Scientist,
Environmental Monitoring &
Investigations

Ted Taylor
Manager, Environmental
Monitoring & Investigations

Report approved by:

Nigel Corry
Divisional Manager,
Environmental Management