



Report **06.313**
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Committee **Environment Management**
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Porirua Harbour sediment quality investigation

1. Purpose

To report on the results of a second round of sediment quality and benthic ecological monitoring conducted in Porirua Harbour in October 2005.

2. Strategic context

Clean and healthy rivers, streams, and coasts are an objective of Greater Wellington's strategic plan. Urban stormwater discharges appear to represent a major impediment to the achievement of this objective.

3. Background

Stormwater investigations undertaken in the region over the past five years have provided evidence that there are a number of chemical contaminants in urban stormwater and in runoff from agricultural land which are having, or through long-term accumulation, will eventually have, significant adverse effects on receiving environments.

In May 2004, Greater Wellington Regional Council investigated the concentrations of key contaminants in marine sediments at four sub-tidal locations in the Porirua Harbour to determine the likely impacts of stormwater discharges on this important receiving environment. The investigation links to the Council's investigation of chemical contaminants in stormwater systems and urban streams.

A fifth site was sampled in October 2004, at which time benthic fauna samples were also collected adjacent to each monitoring site. The results of this additional sampling were not available at the time of reporting to the Environment Committee in February 2005 (see report 05.42).

4. Sampling sites and methodology

The 2005 survey was conducted at the same five sub-tidal sites sampled in 2004 (Figure 1). Sampling methodology remained the same as that used in

2004 although improved detection limits were employed for pesticide analysis. Analyses performed on the sediment samples (top 30 mm) included:

- Particle size distribution and total organic carbon;
- Heavy metals (9);
- Polycyclic aromatic hydrocarbons (PAHs);
- Organochlorine pesticides (23); and
- Organotin compounds (4).

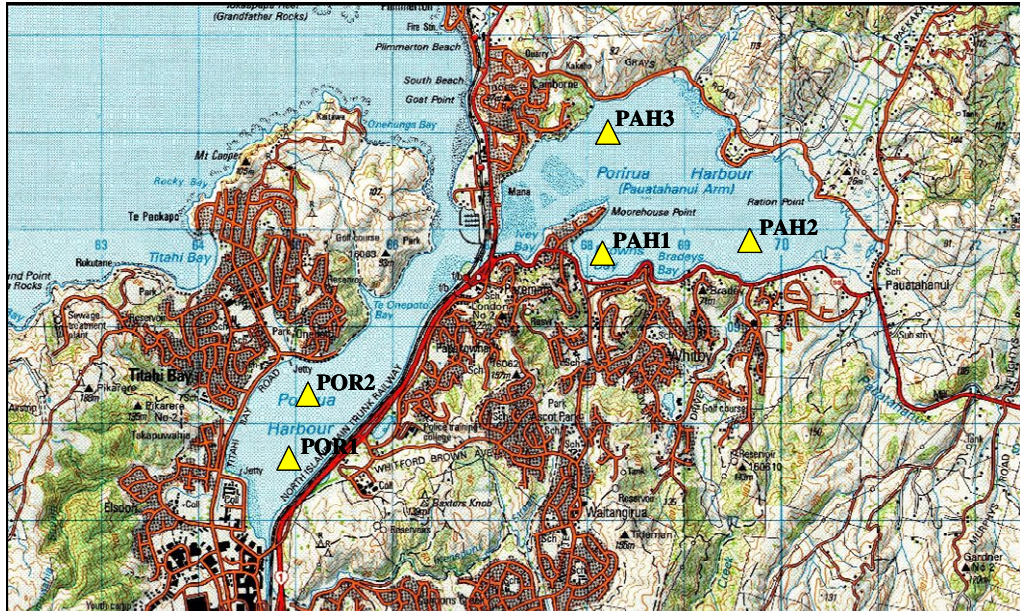


Figure 1: Map of Porirua Harbour showing the positions of the five sub-tidal monitoring sites sampled in 2004 and 2005.

5. Results and discussion

5.1 Sediment quality

The 2005 sampling results were of a similar order to the 2004 results; the heavy metals copper, lead, and zinc have accumulated in the sub-tidal sediments of the Onepoto Arm to concentrations where impacts on aquatic life may begin to occur (Figure 2). All metal concentrations are lower in the Pauatahanui Arm than the Onepoto Arm. The concentrations of copper, lead, and zinc in the mud fraction were higher at sites in the Onepoto Arm than at sites in the Pauatahanui Arm, reflecting larger inputs of urban-sourced contaminants to the Onepoto Arm and less dilution by soils with low metal content from rural catchment runoff. Inputs of heavy metals to the harbour sediments are on-going. This has been confirmed by recent studies of stream bed sediments and urban stormwater in several of the catchments draining into the Porirua Harbour.

Of the 23 organochlorine pesticides analysed, only the insecticide DDT and its derivatives were consistently detected in the sub-tidal sediments. DDT is present in both arms of the Porirua Harbour at concentrations where impacts on aquatic life may begin to occur (Figure 2). Recent studies of stream bed sediments and urban stormwater in several subcatchments confirm that inputs

of DDT to the harbour sediments are on-going. Rural soils are possibly an important source of DDT, particularly to the Pauatahanui Arm.

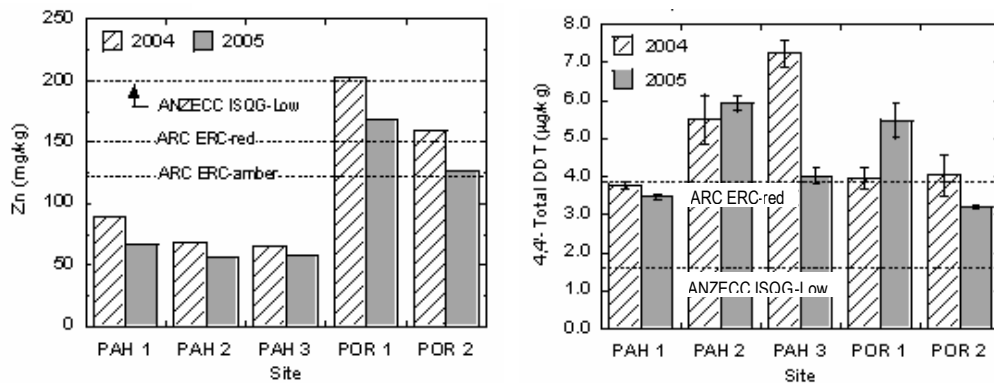


Figure 2: Total zinc (left) and 4,4'-Total DDT concentrations¹ recorded at sub-tidal sediment sampling sites in 2004 and 2005. Guidelines presented are the ANZECC (2000) Interim Sediment Quality Guidelines (ISQG) and the Auckland Regional Council's Environmental Response Criteria (ARC ERC 2004) for estuarine environments. These guidelines are not "pass" or "fail" values; they are set at the concentrations which experimental and/or field evidence suggests are likely to result in impacts on aquatic life.

At the present time adverse effects on aquatic life are unlikely to occur as a result of PAH or organotin contamination of sub-tidal sediments, with many of the organotin compounds below or close to analytical detection limits. Ongoing organotin inputs are unlikely given that the use of butyltins as an antifoulant on small boats was banned in 1989. However, recent studies of stream bed sediments and urban stormwater confirm that inputs of PAHs continue to be an issue.

Some statistically significant differences were present in the 2004 and 2005 sediment quality results, demonstrating the capability of the existing monitoring programme to detect small changes in contaminant concentrations over time. However, there was no *ecologically* significant change in sediment contaminant concentrations between the two investigations.

5.2 Benthic ecology

A total of 62 species were identified from the benthic fauna samples collected in 2004 and 2005, the fauna being composed predominantly of polychaetes, gastropod and bivalve molluscs, and crustaceans. Fifty one of these species were found in the 2004 investigation, with 48 of the 51 species found at one or more of the sub-tidal sites in the Pauatahanui Arm. In contrast, taxonomic richness was significantly lower in the Onepoto Arm; only 34 of the 51 species were found in this arm.

¹ Normalised to 1% total organic carbon content as required by the ANZECC (2000) sediment quality guidelines.

The two sampling sites in the Onepoto Arm were located in deeper waters than the sites in the Pauatahanui Arm. To rule out the possibility that the different sampling depths were responsible for the differences in taxonomic richness, two additional sites were sampled in the Onepoto Arm in 2005. The results from these samples confirmed taxonomic richness is lower in this arm. The lower taxonomic richness is most likely to be related to different characteristics of the physical habitat (e.g., sediment texture) at the sampling sites in the Onepoto Arm rather than sediment contaminant concentrations. Statistical analyses examining the relationship between mean species abundance and concentrations of selected sediment contaminants, suggest that contaminant concentrations are not adversely affecting the benthic fauna at this time.

6. Conclusions

The marine sediments in both arms of the Porirua Harbour have been contaminated with toxic compounds derived from the surrounding catchments. Some of these compounds, including total copper, lead and zinc in the Onepoto Arm, and Total DDT in both the Onepoto Arm and the Pauatahanui Arm, are present at concentrations above sediment quality guidelines.

Although there is no clear evidence that existing sediment contaminant concentrations have resulted in significant adverse effects on the benthic ecology of the sub-tidal monitoring sites, the thresholds for such effects are still not known for this environment, and continued monitoring will be necessary to try and ascertain when any thresholds for effects have been reached. The results of recent stormwater investigations have shown that contaminants in some stormwater discharges to the Porirua Harbour catchment clearly have the potential to cause significant adverse effects on the benthic ecology of the harbour. Subsequently, urban stormwater discharges to water in the Porirua Harbour catchment may not comply with the permitted activity rules in Greater Wellington's Regional Freshwater Plan and Regional Coastal Plan.

7. Next steps

The investigations to date have not only provided a measure of the level of contamination in the marine sediments in the Porirua Harbour, but also the ability, with further monitoring, to determine the direction and rate of change in contaminant concentrations. If an increasing trend is identified over time, it should be possible to estimate when critical levels will be reached (i.e., when contaminants will result in significant ecosystem effects).

The Resource Investigations Department also proposes to repeat a select amount of sediment chemistry sampling in May 2007, focusing on key metals for the purpose of continuing trend detection. The more comprehensive sampling conducted in 2004 and 2005 should ideally be repeated in October 2008. The ongoing development of the Regional Action Plan for Stormwater Management will be another tool to allow us to progress this work.

8. Communications

Copies of this report and the technical report presenting the results of the 2005 Porirua Harbour sediment quality investigation will be sent to Porirua City Council, Wellington City Council, Regional Public Health and Ngati Toa.

9. Recommendations

It is recommended that the Committee:

1. **Receive** the report; and
2. **Note** the contents.

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