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Committee Environment Committee
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Pauatahanui Inlet sedimentation investigation

1. Purpose

To inform the Committee of the outcomes of two inter-related research projects examining the relationship between land use change and the rate of sedimentation in Pauatahanui Inlet.

2. Strategic context

The Pauatahanui Project contributes to the healthy ecosystems goal in the Council's Long Term Council Community Plan. It also contributes to the water goal of clean and healthy rivers, streams and coasts.

Pauatahanui Inlet is identified as an "Area of Significant Conservation Value" in our Regional Coastal Plan.

3. Background

Greater Wellington has recognised the importance of the Pauatahanui Inlet by partnering a community based programme with Porirua City Council to ensure its sustainable management. In 2000 Greater Wellington and the Porirua City Council adopted the Pauatahanui Inlet Action Plan and provided resources for its implementation. A number of jointly funded projects fulfilling the objectives of the plan have been completed. The latest work to be undertaken looks at the issue of sedimentation build up in the Inlet.

One of the most significant threats to the Inlet is sediment accumulation. While all inlets receive the products of erosion in their catchments and fill up over time, human activities, such as earthworks, can accelerate this process. Accelerated sedimentation results in premature aging of an inlet with a subsequent loss of ecological and amenity values. While there has been anecdotal evidence that the rate of sedimentation in Pauatahanui Inlet is increasing, it is difficult for management agencies to develop policy responses without "hard" evidence.

In 2004 Greater Wellington and the Porirua City Council commissioned two inter-related studies to quantify and understand the impacts that land use has had, and continues to have, on sedimentation rates in the Inlet. The study has two parts:

1. An analysis of historical catchment land use and land use change in the Pauatahanui Inlet catchment over the last 150 years. This work was undertaken by the Institute of Nuclear and Geological Sciences Ltd (IGNS).
2. A reconstruction of the sedimentation of the Inlet, which was then related to the findings of the land use study. The specific objectives of this study were to:
 - quantify changes in sediment accumulation rates (SAR) due to deforestation and subsequent conversion to pasture and the effects of urban development;
 - quantify any spatial variations in SAR, particle size and heavy metal profiles between urban and rural sub-catchment outlets and the central mud basin;
 - relate observed sediment profiles to landcover history;
 - determine the rate of annual sediment accumulation; and
 - provide an assessment of potential future SAR over the next 50 years based on present day landcover and land management practices.

This work was undertaken by the National Institute of Water and Atmospheric Research Limited (NIWA).

4. Methodology

4.1 Historical land use and land use change

The landuse history and change record was constructed from a combination of historical records and sequential aerial photography. This work was undertaken at a sub-catchment level (e.g. Horokiri Stream catchment, Duck Creek catchment etc) and then combined to produce a whole catchment picture.

4.2 Sedimentation history

This study involved the extraction of sediment cores from 9 locations within the Inlet. The cores were then analysed using radio isotope and pollen dating techniques, allowing a chronology of sedimentation rates to be established. For instance, as a result of atmospheric nuclear weapon testing in the 1950s, Cesium was deposited in trace quantities over New Zealand, and was first detected in 1953. Where Cesium first occurs in the sediment columns from Pauatahanui Inlet, is known to be 1953. Similarly, the date radiata pine was

first widely planted in the catchment is known. Pollen from these trees can be identified in the sediment sample providing another benchmark date. The study then related the rates of sedimentation at these and other identifiable dates to the corresponding land use at the time.

5. Summary of results¹

The combined study has demonstrated that the rate of sedimentation accumulation in Pauatahanui Inlet has increased over time. Pre-human (“natural”) rates are estimated to have averaged 1 mm per year. As a result of the impacts of forest removal, conversion to pasture and other human activities the sediment accumulation rate has steadily increased and is estimated to be about 4.6 mm per year currently.

It is important to note that quantity of sediment entering the Inlet is likely to be higher than this figure. Two processes have worked in the Inlet’s favour to prevent the accumulation rate being higher. Firstly, as a result of the strength and frequency of winds experienced at Pauatahanui and the particular depth of the Inlet, there is considerable “stirring up” and re-suspension of sediment. Secondly, the Inlet has strong tidal flushing with the total volume of water in the Inlet changing every 4 days. The scientists suspect that the combination of these two factors results in a proportion of sediment being exported from the Inlet. This factor may be the Inlet’s “saving grace” that has prevented a more rapid accumulation of sediment. In addition, there has been a sea level rise of about 1.8 mm per year in the Wellington Harbour since 1891. It is assumed that a similar rise has taken place at Pauatahanui Inlet and this will have offset the effects of sediment build-up to some degree.

The study also shows that the rate of accumulation appears to be continuing to increase and that there may be variations between sub-catchments.

The study concludes that the fact that sediment accumulation rates have increased in recent decades suggests that the rate of sediment input now exceeds the capacity of the estuary to flush sediment.

6. What does this mean?

While the study appears to confirm the anecdotal evidence that sedimentation is increasing within the Inlet, it does not provide easy answers to the question of where the sediment is coming from. This is because:

- it may take some time (years) for sediment to travel from its source to the Inlet;
- sediment that is generated by slips, landslides and landuses does not always travel immediately to a waterway. It may be “stored” in the system and mobilised some years later as a result of an extreme weather event;

¹ Please note that the Pauatahanui Study Report is still in a final draft form and the author is currently finalising the report following feedback. Feedback has been provided by Greater Wellington and Porirua City Council officers and members of the Pauatahanui Inlet Community Trust and the Guardians of Pauatahanui Inlet.

- within the Inlet there appears to be considerable redistribution of sediments from one site to another. For instance, the scientists suspect that sediment deposited in the Inlet from Duck Creek is mobilised and moved away. Correspondingly, it appears that Browns Bay is a sediment ‘sink’ where sediment from other parts of the Inlet accumulates.

The results of the study suggest that the Inlet is approaching, or perhaps has reached, the point at which it is able to cope with the quantity of sediment it receives.

7. Next steps

This project is an important step in understanding the current state of the Inlet. It is one of a series of projects that have been undertaken over the last three to four years as part of implementing the Pauatahanui Inlet Action Plan.

It is now considered timely to review the work undertaken to date and present the Committee at a future date with an “issues and options” report to chart the Council’s future direction with the Pauatahanui Project.

The ‘issues and options’ report will be jointly prepared by Greater Wellington and Porirua City Council officers (reflecting the collaborative nature of this on-going project) and will have the following objectives:

1. To briefly review the information we have assembled as a result of the various studies undertaken and what this information tells us about the present state of the Inlet.
2. To provide comment on the adequacy of current controls on land use within the Pauatahanui catchment, and the areas in which these might be improved. It should be noted that Porirua City Council are about to commence a review of the rural zone of their District Plan.
3. To identify gaps in our understanding of the Inlet and how these might be rectified by formulating a research and monitoring strategy for the Inlet.
4. To review the various programmes and projects currently underway and how they contribute to the objectives of the Pauatahanui Inlet Action Plan and to identify any gaps.

8. Communications

Once the final report of the sediment history project is received and Porirua City Councillors have received a briefing from their officers, a press release outlining the key findings will be issued.

9. Recommendations

It is recommended that the Committee:

1. *receive the report;*
2. *note the contents; and*
3. *note that the next step for this project is the development of a joint Greater Wellington/Porirua City Council "issues and options" report on the management of Pauatahanui Inlet.*

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