

Salt Ecology Short Report 027. Prepared by Barrie Forrest for Otago Regional Council, March 2023

**OVERVIEW**

In November 2021, Otago Regional Council started annual State of the Environment monitoring in Pleasant River Estuary to assess trends in the deposition rate, mud content, and oxygenation of intertidal sediments. Sediment monitoring is undertaken at two sites (Fig. 1), with the latest survey carried out on 27 Nov 2022.



Fig. 1. Location of Pleasant River Estuary sites.

**METHODS**

Estuary sedimentation is measured using the ‘sediment plate’ method (e.g. Forrest et al. 2022). The approach involves measuring sediment depth from the sediment surface to the top of each of four buried concrete pavers. Measurements are averaged across each plate (n=3) and used to calculate a mean annual sedimentation rate for each site.

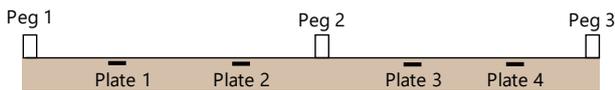


Table 1. Summary of condition ratings for sediment plate monitoring.

Indicator	Unit	Very Good	Good	Fair	Poor
Sedimentation rate <sup>1</sup>	mm/yr	< 0.5	≥0.5 to < 1	≥1 to < 2	≥ 2
Mud content <sup>2</sup>	%	< 5	5 to < 10	10 to < 25	≥ 25
aRPD <sup>3</sup>	mm	≥ 50	20 to < 50	10 to < 20	< 10

Condition ratings derived or modified from: <sup>1</sup>Townsend and Lohrer (2015), <sup>2</sup>Robertson et al. (2016), <sup>3</sup>FGDC (2012).

A composite sample of the surface 20mm of sediment is collected adjacent to the plates and analysed for particle grain size (wet sieve, RJ Hill laboratories), enabling assessment of sediment muddiness.

Sediment oxygenation is visually assessed in the field by measuring the depth at which sediments show a change in colour to grey/black, commonly referred to as the apparent Redox Potential Discontinuity (aRPD). Results for all indicators are compared to condition ratings of ecological state shown in Table 1.

**RESULTS**

Table 2 shows a summary of results and the respective condition ratings where applicable.

Table 2. Indicator summary and condition ratings (no ratings available for gravel and sand). Five years of data are required to establish a meaningful trend in sedimentation rate.

Site	Year	Sed rate mm/yr	Gravel %	Sand %	Mud %	aRPD mm
A	Nov-2021	na	< 0.1	57.4	42.6	4
	Nov-2022	-1.7	< 0.1	57.4	40.5	12
B	Nov-2021	na	2.3	51.6	46.1	2
	Nov-2022	2.7	2.3	51.6	45.9	3

< All values below lab detection limit

**Sedimentation rate**

In the first year of measurement, there was minor sediment erosion at Site A and sediment accrual at Site B of 2.7mm/yr, which exceeds the 2mm/yr national guideline value (Table 2, Fig. 2). While this level of fine sediment deposition is of concern a time series of at least 5 years is required before a meaningful trend can be established.

**Sediment mud content and oxygenation**

Sediments at both sites are classified as muddy-sand with a moderately-high mud content of ~40-46%

(rated 'poor'). This result reflects the relatively modified nature of the catchment, with land uses dominated by pasture (61.9%) and exotic forestry (31.1%; Forrest et al. 2022).

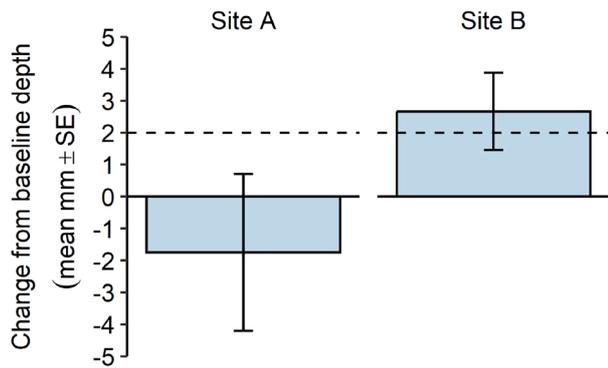


Fig. 2. Change in mean sediment depth over buried plates ( $\pm$ SE) in November 2022 relative to the November 2021 baseline. The dashed line represents the national guideline value of 2mm/yr.

Sediment oxygenation was generally low (2-12mm aRPD depth), and shallower at Site B. For both sites, this result reflects the muddy surface sediment, which reduces oxygen penetration into the sediment matrix. However, the sediment did not show any of the typical symptoms of strong enrichment (e.g. black colour, strong sulfide odour, extensive cover of opportunistic macroalgae).



Soft, muddy-sand sediments at Site A, November 2022

## CONCLUSIONS

Fine sediment deposition was observed at site B at levels exceeding the national guideline value of 2mm/yr. While this is a concern, due to the variable nature of erosion and accretion in estuaries, a time

series of at least 5 years is required before a meaningful sedimentation trend can be established. Both sites are excessively muddy (>25% mud), which is also reflected in the wider estuary (Roberts et al. 2022) and is likely owing to inputs from the highly modified catchment.



Sediment oxygenation (aRPD transition from brown to dark grey sediment) at Site B in November 2022.

## RECOMMENDED MONITORING

Continue annual monitoring of sedimentation rate, sediment grain size and aRPD depth, and report results annually via a summary report. Comprehensive reporting should be undertaken in 2023/24 as part of the completion of the 'fine scale' ecological and sediment monitoring three-year baseline.

## REFERENCES

- FGDC. 2012. Coastal and Marine Ecological Classification Standard Catalog of Units, Federal Geographic Data Committee FGDC-STD-018-2012. 343p.
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