WAIKANAE ESTUARY: 2020/2021 INTERTIDAL SEDIMENT MONITORING SUMMARY

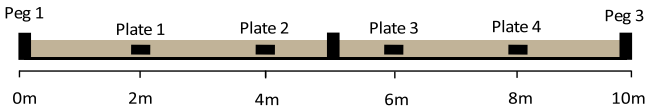
Salt Ecology Short Report 002. Prepared by Keryn Roberts for Greater Wellington Regional Council, February 2021.

OVERVIEW

Since 2010, Greater Wellington Regional Council has undertaken annual State of the Environment (SOE) monitoring in Waikanae Estuary to assess trends in the deposition rate, mud content, and oxygenation of intertidal sediments. Monitoring is conducted at three sites (A to C, Fig. 1) with the most recent results collected on 9 December 2020 reported in Tables 2 and 3 and Figure 2.

METHODS

Estuary sedimentation was measured using the 'sediment plate' method, as described in Robertson & Stevens (2010). The approach involves measuring the sediment depth from the sediment surface to the top of each of four buried concrete plates, at each of the three sites. Measurements are averaged across each plate (n=3) and used to calculate a mean annual sedimentation rate for each site. As year-to-year sedimentation changes can be highly variable, the annual mean sedimentation rate is calculated for 5 and 10 year time periods where sufficient data are available (currently Site A only).



A composite sample of the surface 20mm of sediment is simultaneously collected, and analysed for particle grain size (wet sieve, RJ Hill laboratories). This approach allows changes in sediment muddiness to be determined even where there are no changes in sediment depth. Sediment oxygenation, another key measure of biological health, is visually assessed 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) depth. Results are compared to condition bands (Table 1) developed as part of the NZ Estuary Trophic Index (ETI) to indicate ecological state.

Figure 1: Location of monitoring sites in Waikanae Estuary

RESULTS

Sedimentation rate

The mean sedimentation rate over the past 10 years (2012-2021) was +12.9mm/y (SE=5.5) at Site A, reflecting steady sediment accrual since 2010 and equating to a condition rating of 'poor' (Table 2 and Fig. 2). More recently, sediment accrual has slowed, with a period of erosion in 2017-2018, followed by accrual since 2018. The 5-year sedimentation rate was +2.3mm/y (SE=8.4) corresponding to a condition rating of 'poor'. While too early for trend assessment at Sites B and C, there has been net accrual in the past 4 years, consistent with Site A observations.

Table 2: Condition ratings for Waikanae Estuary 2021

INDICATOR (2021)	Site A	Site B[1]	Site C[1]
Sedimentation rate (5yr)[2]	POOR	NA	NA
Sedimentation rate (10yr)[2]	POOR	NA	NA
Mud content (%)	FAIR	FAIR	FAIR
aRPD (mm)	GOOD	GOOD	GOOD

NA=not applicable. [1]Plates installed Jan-2018, hence there are not enough data for trend assessment. [2]5yr and 10yr refers to trend period.

Table 1: Summary of condition ratings for sediment plate monitoring

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

Ratings derived or modified from: [1]Townsend and Lohrer (2015), [2]Robertson et al. (2016), [3]FGDC (2012).

The sediment accrual observed in the estuary is likely driven by the deposition of fine sediments from the Waikanae River (Fig. 2), with brief periods of erosion in 2017-2018 likely reflecting high flow events. Sediment accrual and erosion in the estuary will also be influenced by the position of the estuary mouth and the transport and deposition of marine sands.

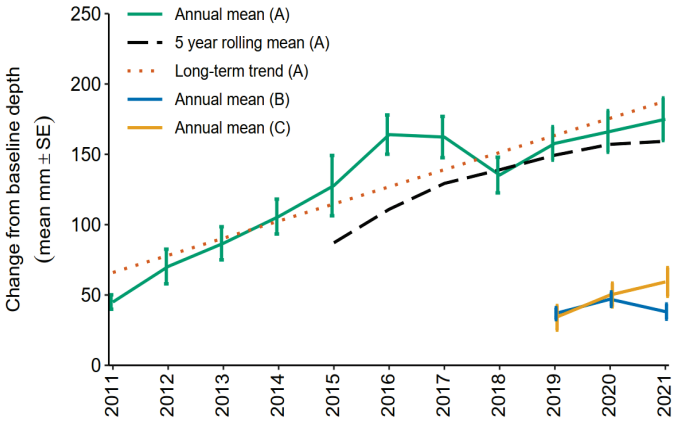


Figure 2. Change in mean sediment depth over buried plates (±SE) relative to the baseline, Waikanae Estuary.

Sediment mud content

Table 3 presents the sediment mud content for Sites A to C, with all sites rated as 'fair' in 2021. The mud content was highly variable at all sites with no apparent site scale trends observed. However, across all years, the most upstream site (Site C) has been muddier than the two downstream sites (Site A and B), indicating deposition of fine muds in the upper estuary.

Table 3: Grain size and aRPD (mm) results for the Waikanae Estuary sediment monitoring sites, 2018 - 2021.

Year	Site	aRPD	Mud (%)	Sand (%)	Gravel (%)
2018	A	30	24.9	73.8	1.3
2019	A	26	19.1	80.9	< 0.1
2020	A	30	34.3	65.1	0.6
2021	A	40	11.3	85.1	3.6
2018	B	30	24.6	73.7	1.7
2019	B	22	18.4	81.3	0.3
2020	B	11	31.6	68.1	0.3
2021	B	20	13.7	86.2	0.1
2018	C	20	32.7	65.8	1.4
2019	C	25	26.1	73.6	0.2
2020	C	8	36.0	63.5	0.5
2021	C	23	21.0	78.5	0.5

Note: Grain size results are based on a single composite sample. 2010 – 2017 data for Site A are presented in Stevens (2020).

Sediment aRPD depth

The average aRPD depth ranged from 20 to 40mm at all sites in 2021; a condition rating of 'good' (Table 2). In previous years aRPD has been variable within sites, generally higher mud contents were consistent with lower (i.e. shallower) aRPD (Table 3). This level of oxygenation is partially maintained by the presence of crabs and burrowing organisms in the surface sediments, which turn over surface sediments and create voids that allow air and water to transfer oxygen to underlying sediments.

Figure 3: Waikanae Estuary looking upstream from Site A.

CONCLUSION

The sedimentation rate over the past 10 years shows an overall trend of deposition, a relatively consistent moderately elevated sediment mud content, and moderately shallow aRPD depth. The upper estuary remains under pressure from sediment impacts, with a macrofaunal community likely dominated by mud tolerant species - a common situation in NZ tidal river estuaries. These monitoring results reinforce previous recommendations to manage fine sediment inputs to the estuary.

RECOMMENDED MONITORING

Continue annual monitoring of sediment rate, aRPD and grain size to measure sediment deposition and temporal change. Report results annually via a summary card report, with detailed reporting undertaken five yearly in conjunction with fine scale monitoring (due 2022).

REFERENCES

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