

OVERVIEW

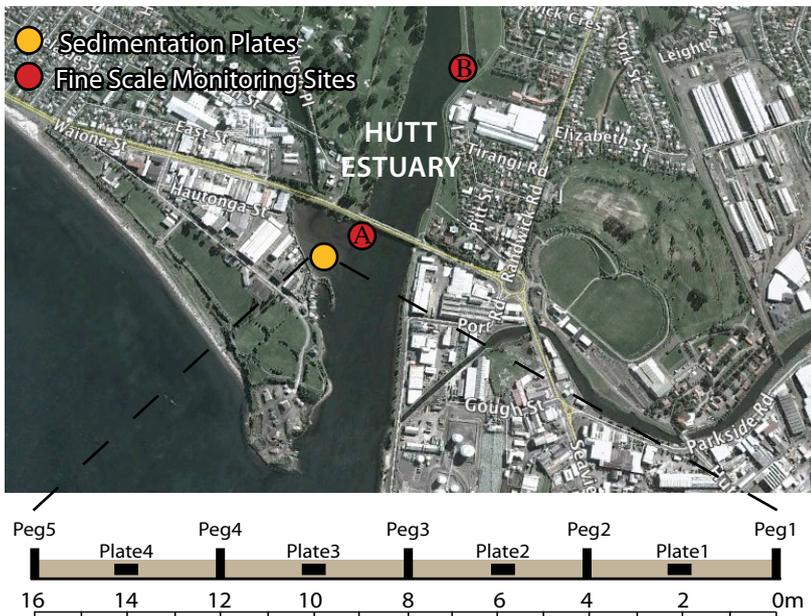
Since 2010, Greater Wellington Regional Council has undertaken annual State of the Environment (SOE) monitoring of sediment indicators in Hutt Estuary to assess trends in the deposition rate, mud content, and oxygenation of intertidal sediments. The monitoring site, comprising four buried sediment plates, is located in the only remaining intertidal flat in the lower estuary (see Fig. 1 below for site details). The results of annual monitoring undertaken on 21 January 2019 are summarised in this report card.

METHODS

The approach, described in detail previously (Robertson & Stevens 2010), measures changes in the depth of sediment overlying buried concrete plates stabilised on steel waratahs. Plates are positioned at 90° to the river channel and spaced relatively closely together (4m apart) because of the relatively narrow sediment deposition

zone. Measurements are made by vertically inserting a measuring probe in the sediment and measuring the depth to the underlying plate, with a straight edge used to average out any minor surface height irregularities. Plate measurements are averaged (n=3) and used to calculate a mean annual sediment rate for the site.

Sediment condition is further assessed by laboratory analysis of grain size (wet sieving with dispersant, 2mm and 63µm sieves, gravimetry - calculation by difference). This allows changes in sediment muddiness to be determined even where there are no changes in sediment depth. Sediment oxygenation, a key measure of biological health, is visually assessed by measuring the apparent Redox Potential Discontinuity (aRPD) depth, the depth at which sediments show a change in colour to grey/black. Results are compared to condition bands (Table 1) developed as part of the NZ Estuary Trophic Index (ETI) to indicate ecological state.



Coordinates of sedimentation pegs and plates		
Item	NZTM East	NZTM North
Plate 1	1759101	5433548
Plate 2	1759097	5433548
Plate 3	1759093	5433548
Plate 4	1759089	5433548
Peg 1	1759103	5433548
Peg 2	1759099	5433548
Peg 3	1759095	5433548
Peg 4	1759091	5433548
Peg 5	1759087	5433548

Fig. 1. Location of intertidal sediment plates and fine scale monitoring sites in the lower Hutt Estuary

Table 1. Summary of subjective condition ratings referred to in the present report.

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

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

RESULTS

2010-2019 Sedimentation Rate

Fig. 2 and Table 2 summarise changes in sediment levels since 2010. There has been an overall mean sedimentation rate of +2.7mm/yr across the nine years of monitoring, with a rolling mean over the past 5 years of 8.2mm/yr, a condition rating of 'poor'. Fig. 2 shows a consistent decrease in sedimentation from 2010 to 2016, followed by sediment accrual from 2017 to 2019.

Variation such as this is very much driven by cycles of erosion and deposition, and the timing of sampling in relation to recent flood events has a significant influence on results, with scouring of tidal flats during high river flows clearly obvious at times. The Te Mome Stream channel, which discharges across the tidal flats near the site, also has a localised influence on sediment

movement and partially explains the relatively high variance between plates within years. Dredging of the river channel in the lower estuary is also likely to exert a strong influence on the sedimentation rate recorded at the monitoring site through the removal of deposited sediment.

Consequently, rather than responding to annual measures, long-term trends should be used to guide monitoring management and decisions.

2019 Sediment Mud Content

Mean sediment mud content in 2019 was 23.8%, a rating of 'moderate', and has been relatively consistent since measurements were first taken in 2014 (Figure 3, Table 3). Although there has been no significant change over time, the lowest mud contents correlate with periods of sediment erosion in 2015 and 2016.

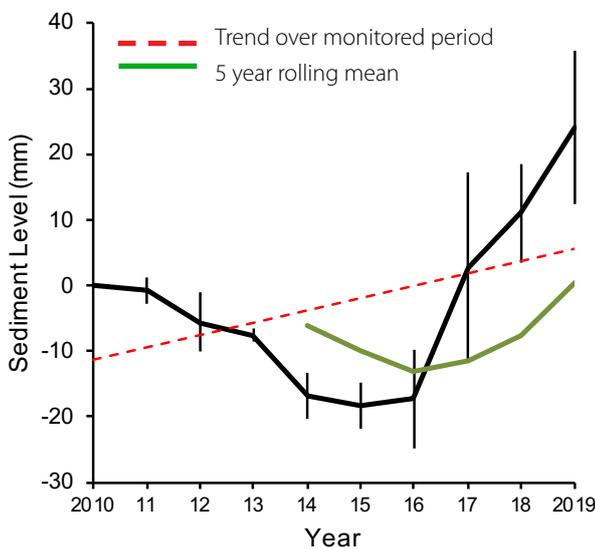


Fig. 2. Change in mean sediment level over buried plates (\pm annual range), Hutt Estuary, 2010 to 2019.

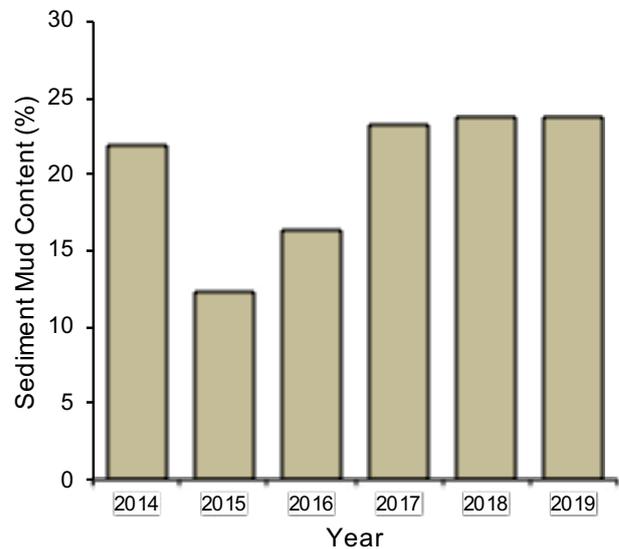


Fig. 3. Sediment mud content, Hutt Estuary, 2014-2019.

Table 2. Sediment monitoring results for Hutt Estuary, January 2010 - January 2019.

Measured Mean Depth to Sediment Plate (mm)											Change in Sediment Level Over Plate (mm)								
SITE A	20/01/10	15/01/11	21/02/12	15/01/13	21/01/14	18/01/15	23/1/16	24/1/17	21/1/18	26/1/19	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
	Plate 1	257	256	247	246	240	235	237	275	293	298	-1.0	-5.0	-3.7	-4.3	-4.4	-3.3	2.6	4.5
Plate 2	250	248	245	242	232	234	225	244	252	280	-2.0	-2.5	-2.7	-4.5	-3.2	-4.2	-0.9	0.3	3.4
Plate 3	295	297	290	289	276	273	278	292	295	306	2.0	-2.5	-2.0	-4.8	-4.4	-2.8	-0.4	0.0	1.2
Plate 4	287	285	285	282	274	274	280	289	293	301	-2.0	-1.0	-1.7	-3.3	-2.6	-1.2	0.3	0.8	1.6
Mean Change in Sediment Level (mm/yr)											-0.8	-5.5	-7.5	-16.8	-18.3	-17.3	2.8	11.0	24.1

MEAN SEDIMENTATION RATE 2010-2019: 2.7 (mm/yr) (SE=0.44)

Mean sedimentation rate over the past 5 years: 8.2 (mm/yr) (SE=0.64)

CONDITION RATING: POOR

Table 3. Mean grain size and aRPD results for the Hutt Estuary sedimentation plate sites, 2014-2019.

Year	aRPD (mm)	Mud%	Sand%	Gravel%
2014	15	21.9	74.5	3.6
2015	15	12.3	77.6	10.1
2016	8	16.4	74.8	8.8
2017	13	23.2	71.3	5.5
2018	15	23.8	68.4	7.8
2019	20	23.8	66.7	9.5

Note: Grain size results are based on a single composite sample collected adjacent to each plate e.g. 4 sub-samples/site

2019 Sediment aRPD depth

The average aRPD depth (based on replicate measurements adjacent to each plate) was 20mm which is on the threshold between the 'good' and 'moderate' condition rating bands. This level of oxygenation is partially maintained by the presence of crabs, shellfish (cockles) and macroinvertebrate worms in the surface sediments, turning over the sediment surface and creating voids that allow air and water to transfer oxygen to underlying sediments.

CONCLUSION

The sedimentation rate over the past nine years shows an overall trend of deposition, a relatively consistent moderately elevated sediment mud content, and a moderately shallow aRPD depth. Consequently the estuary flats remain under pressure from sediment related impacts related to poor water clarity and muddy intertidal substrates, with a macrofaunal community likely dominated by mud tolerant species - a common situation in NZ tidal river estuaries.

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.

REFERENCES

- FGDC. 2012. Coastal and Marine Ecological Classification Standard Catalog of Units, Federal Geographic Data Committee FGDC-STD-018-2012. 343p.
- Robertson BM, Stevens LM. 2010. Hutt Estuary: Fine Scale Monitoring 2009/10. Prepared for Greater Wellington Regional Council. 24p.
- Robertson BM, Stevens L, Robertson BP, Zeldis J, Green M, Madarasz-Smith A, Plew D, Storey R, Hume T, Oliver M. 2016b. NZ Estuary Trophic Index. Screening Tool 2. Screening Tool 2. Determining Monitoring Indicators and Assessing Estuary Trophic State. Prepared for Envirolink Tools Project: Estuarine Trophic Index MBIE/NIWA Contract No: C01X1420. 68p.
- Townsend M, Lohrer D. 2015. ANZECC Guidance for Estuary Sedimentation. NIWA client report number HAM2015-096, prepared for Ministry for the Environment. 45p.