

# WAIKAWA ESTUARY: SEDIMENTATION RATE MONITORING SUMMARY, FEBRUARY 2013

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Figure 1. Location of sediment rate monitoring sites in Waikawa Estuary and the position of the soft mud front in the middle estuary.

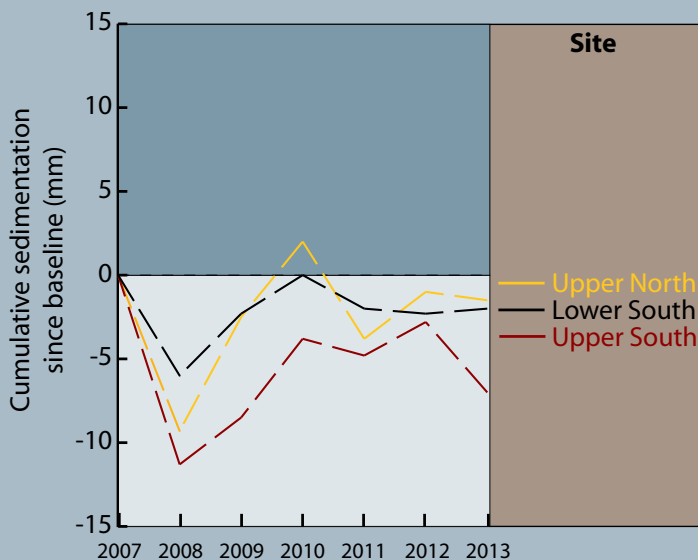


Figure 2. Cumulative change in sediment levels over buried plates in Waikawa Estuary, 2007 to 2013.

## Background

Soil erosion is a major issue in New Zealand and the resulting suspended sediment impacts are of particular concern in estuaries because they act as a sink for fine sediments or muds. If fine sediment inputs exceed the assimilative capacity of an estuary, it will infill (often rapidly), displacing high value habitat (e.g. seagrass, saltmarsh). Excess mud will also commonly result in adverse conditions including reduced sediment oxygenation, production of toxic sulphides, increased nuisance macroalgal growth, and a shift towards a degraded invertebrate and plant community. Such changes greatly reduce its value for fish, birdlife and humans.

To assess past sediment inputs to Waikawa Estuary a sediment core was collected from the Upper South site on 4 March 2007 and analysed using radio-isotopes to assess historic sedimentation rates. The results indicated mean annual sediment deposition rates of 5.1 mm/yr for the 1967-2007 period, and 1.5mm/yr for the 1878-1967 period (Robertson and Stevens 2007).

Estuaries of this type typically had deposition rates of <1mm/yr. Therefore the measured rates exceed the levels needed to maintain high value habitats, sand-dominated tidal flats, and sensitive plants and animals in the estuary.

To monitor ongoing sedimentation rates, 4 concrete plates were buried at each of 3 sites in the estuary in 2007 (Figure 1 - see Stevens and Robertson 2009 for further details) and have been monitored annually since that time. To account for spatial and temporal variation in sedimentation rates from natural processes such as wind generated waves, tidal flows, and river inputs, site averages are used to estimate mean annual sedimentation rates for the estuary.

## 2013 Sedimentation Rate

Table 1 presents the 2013 sedimentation rate results for the 12 plates buried in Waikawa Estuary, with summary data from 2007-2013 presented in Figure 2.

The mean annual rate of sedimentation indicates a slight overall loss of sediment at all sites since 2007 (-0.4mm/yr to -2.4mm/yr), a condition rating of "Very Low". This has been punctuated by variable increases and decreases within this period (Figure 2).

The greatest mean annual decline in mud has been at the Lower South site. This site was established at the leading edge of soft mud in the middle estuary in 2007. Since then, the front of overlying surface mud has progressively moved up the estuary (Figure 1). In 2013, this trend has reversed slightly with soft mud depositing back over intertidal areas that had been getting sandier over the previous couple of years.

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**Table 1. Sediment monitoring results for Waikawa Estuary, February 2007 - February 2013.**

SITE	Sediment Depth (mm)							Change (mm)						Overall Rate (mm/yr)	2007-2013 SEDIMENTATION RATE CONDITION RATING
	3-2-07	10-2-08	14-2-09	18-2-10	11-2-11	20-1-12	14-2-13	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2007-2013	
Upper North	253	237	250	251	246	243	248	-16	13	1	-5	-3	5	<b>-0.4</b>	<b>VERY LOW</b>
Upper North	210	207	212	211	209	217	210	-3	5	-1	-2	8	-7		
Upper North	270	259	265	273	265	267	266	-11	6	8	-8	2	-1		
Upper North	257	250	253	263	255	259	260	-7	3	10	-8	4	1		
Site Mean (mm/yr)							-9.3	+6.8	+4.5	-5.8	+2.8	-0.5			
Upper South	212	203	205	212	210	210	208	-9	2	7	-2	0	-2	<b>-1.8</b>	<b>VERY LOW</b>
Upper South	223	206	215	218	218	220	212	-17	9	3	0	2	-8		
Upper South	215	210	212	218	210	216	215	-5	2	6	-8	6	-1		
Upper South	230	216	214	217	223	223	217	-14	-2	3	6	0	-6		
Site Mean (mm/yr)							-11.3	+2.8	+4.8	-1.0	+2.0	-4.3			
Lower South	255	250	242	244	243	243	248	-5	-8	2	-1	0	5	<b>-2.4</b>	<b>VERY LOW</b>
Lower South	248	238	235	237	235	238	234	-10	-3	2	-2	3	-4		
Lower South	225	213	214	213	212	214	213	-12	1	-1	-1	2	-1		
Lower South	250	253	248	254	250	244	245	3	-5	6	-4	-6	1		
Site Mean (mm/yr)							-6.0	-3.8	+2.3	-2.0	-0.3	+0.3			

## SEDIMENTATION RATE CONDITION RATING

RATING	DEFINITION
Very Low	<1mm/yr
Low	1-2mm/yr
Moderate	2-5mm/yr
High	5-10mm/yr
Very High	>10mm/yr
Early Warning Trigger	Rate increasing



While surface mud deposits are currently being flushed from the middle part of the estuary, the underlying sediments are still relatively muddy. This is reflected in a shallow RPD (1-3cm), infilling of interstitial spaces with fine muds (10% mud in 2007), and rapid re-suspension of muds by wave action making estuary waters turbid.

Despite the low mean annual deposition evident over the past 5 years, Waikawa Estuary remains excessively muddy (42% soft and very soft mud - Stevens and Robertson 2009), with the vast majority of the mud located in the extensive intertidal flats in the upper and middle estuary (see photo).

As such, ongoing management is needed to restrict future inputs to a level that the estuary can assimilate (i.e. mean areal sedimentation rate <1mm/yr). If this can be achieved, then the recently observed reduction of surface mud from the lower estuary is expected to continue.

### Conclusion

Sedimentation rates over the past 5 years fall within the "Very Low" condition rating. The decrease in surface mud over a relatively extensive part of the middle estuary, has resulted in a small but important improvement in estuary condition.

### Recommended Monitoring

Continue to measure all sediment plate depths annually.

### Recommended Management

- Develop and assign catchment nutrient and sediment load guideline criteria to Waikawa Estuary based on available catchment load/estuary response information from other relevant estuaries.
- Estimate catchment nutrient and suspended sediment loads using available catchment models and stream monitoring data.
- Determine the extent to which the estuary meets guideline catchment load criteria.
- Develop management and restoration plans for the estuary as appropriate.

### References

- Robertson, B., and Stevens, L. 2007. *Waikawa Estuary 2007 Fine Scale Monitoring and Historical Sediment Coring. Report prepared by Wriggle Coastal Management for Environment Southland.* 29p.
- Stevens, L.M. and Robertson, B.M. 2009. *Waikawa Estuary. Broad Scale Habitat Mapping 2008/09. Report prepared by Wriggle Coastal Management for Environment Southland.* 29p.