Lower Gordon River erosion monitoring

Update report for the period December 2016 to February 2018

Natural and Cultural Heritage Division DPIPWE
28 February 2018

Introduction

The lower Gordon River erosion monitoring program to March 2013 is comprehensively documented in the report *Lower Gordon River erosion monitoring, Tasmanian Wilderness World Heritage Area-report for the period February 2004 to March 2013* (DPIPWE 2013). This brief report is a third update since that report and contains only the most recent monitoring results and updated time-series plots. For geomorphological description, methods, previous results and discussion of their significance please refer to the earlier comprehensive report. The monitoring documented here was conducted between 29 January and 2 February 2018.

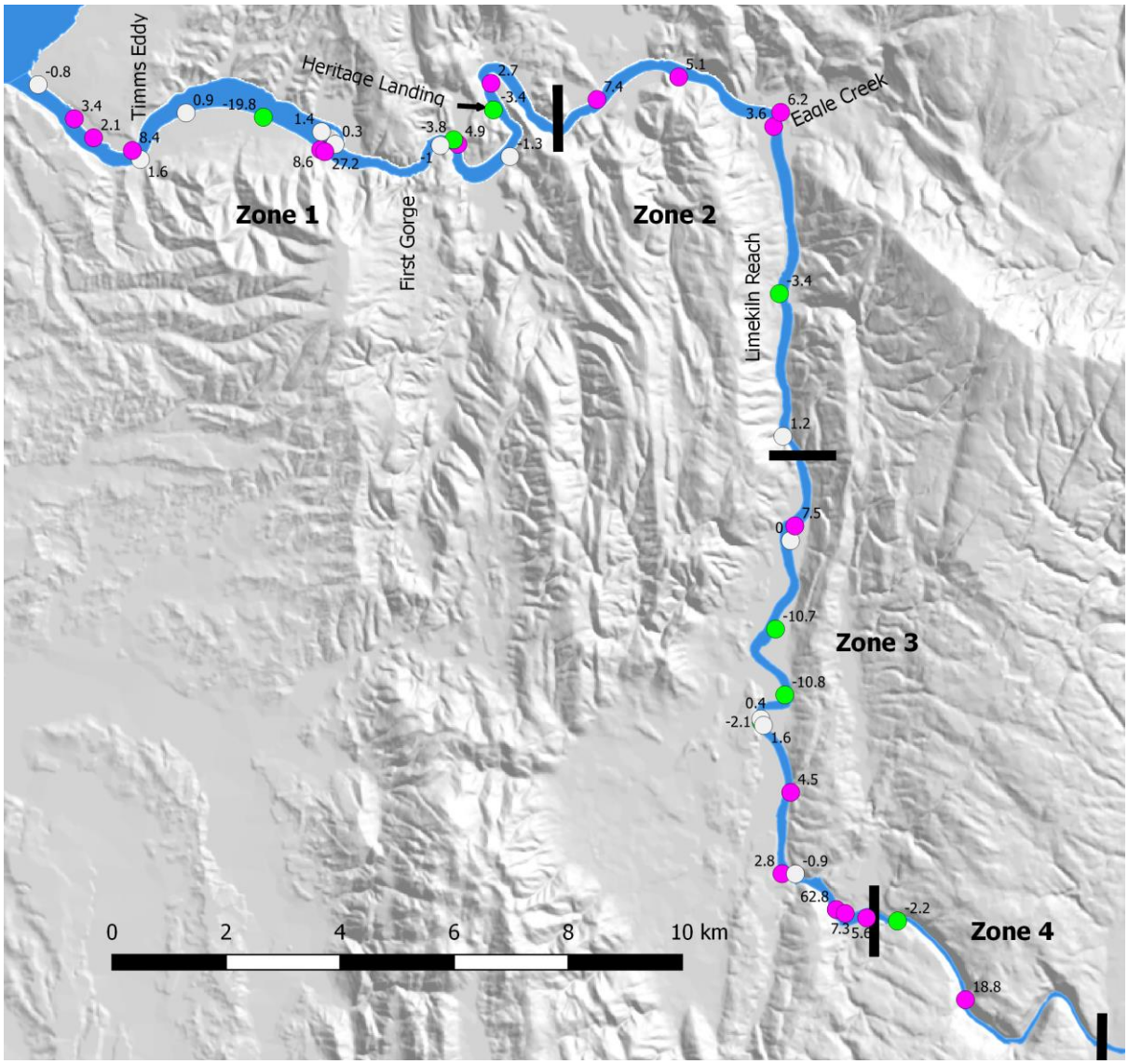

Fig 1: Map of the lower Gordon River area showing the mean rate of erosion of critical landforms (estuarine and alluvial scarps and lower levees) as recorded by multiple pins at each of 42 monitoring sites. Key: magenta = erosion, white = no change in average pin exposure exceeding measurement resolution (conservatively +/- 2 mm), green = deposition. Numbers indicate the average rate of change at each site in mm/yr, zone boundaries are shown as thick black lines.

Estuarine banks

Estuarine banks are the very low lying banks comprised of organic rich mud and minor sand that occur between the mouth of the river and First Gorge. Estuarine bank erosion rates are summarised in table one and figure two. Most erosion pins are installed sub-horizontally in the eroded scarp, with a smaller number vertically in either the permanently submerged shoal below or in the occasionally inundated, vegetated surface above. It is only on those flats where deposition can occur, although a few low scarp pins also recorded deposition of very soft mud burying the scarp foot. Due to the low angle between pin and depositional surface measurements from those pins overestimate the true rate of sediment accumulation.

Table one: summary estuarine bank erosion pin measurement statistics for the reporting period. All values except n are in mm/yr. Negative values indicate deposition.

	count (n)	min.	max.	mean	median	st. dev.	n < 0	n = 0
overall	67	-41	81	**2.4**	0.9	15.5	13	19
scarp	57	-41	81	**2.9**	0.9	16.5	9	18
flat	10	-14	7	**-0.6**	0.4	7.0	4	1

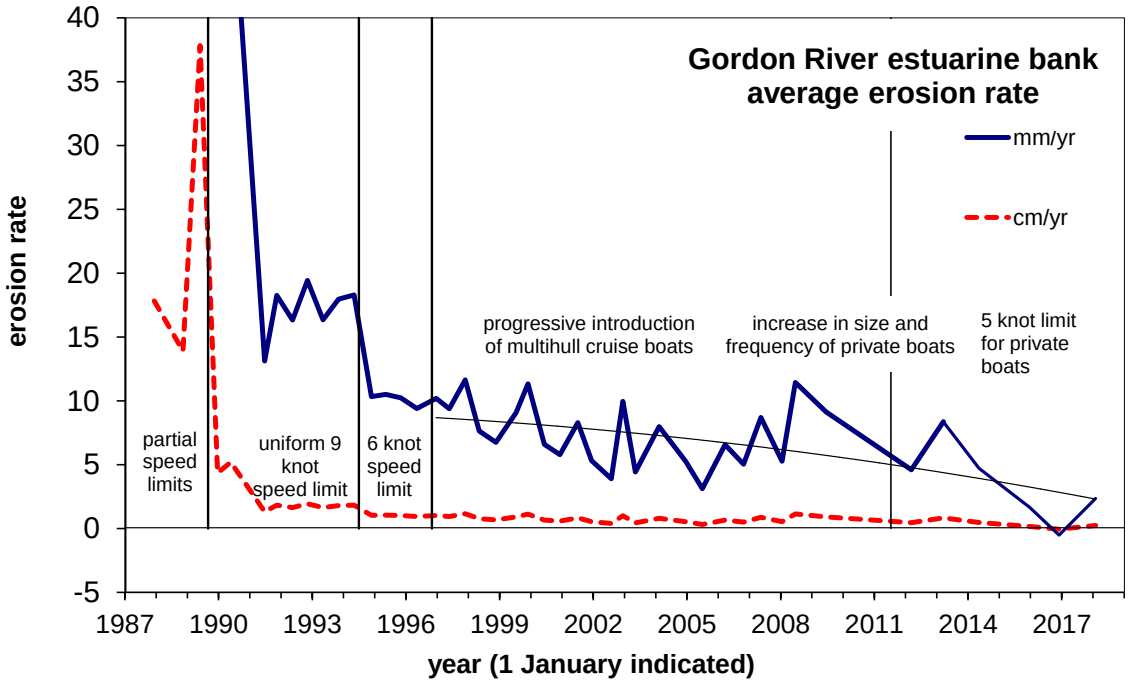

Figure 2: Mean rate of estuarine bank erosion (combined scarp and flat) through time. The fine smoothed line shows the best fit trend of the data since the first introduction of multi-hulled cruise vessels.

Alluvial banks

Alluvial banks consist of silt and fine sand and display a flat to subdued levee morphology with a crest typically about 1 m above mean water level. They occur in the floodplain areas between First Gorge and Eagle Creek, and also sporadically in Limekiln Reach. Again most pins are installed in the eroded scarp, with a smaller number in the shoal below or vegetated surface above. Alluvial bank erosion rates are summarised in table two and figure three. For reporting purposes zone 1 sites upstream of the present cruise limit at Heritage Landing are grouped with zone 2.

Table two: summary alluvial bank erosion pin measurement statistics for the reporting period. All values except n in mm/yr. Negative values indicate deposition.

	count (n)	min.	max.	mean	median	st. dev.	n < 0	n = 0
zone 1 alluvial banks								
overall	31	-23	10	**-1.8**	0.0	6.9	10	9
scarp	26	-23	10	**-1.0**	0.0	6.6	6	9
flat	5	-18	3	**-5.5**	-4.3	7.8	4	0
zone 2 alluvial banks								
overall	65	-30	38	**2.3**	0.9	10.5	13	19
scarp	50	-30	38	**2.2**	0.0	10.5	9	17
flat	15	-16	32	**2.7**	0.9	11.1	4	2

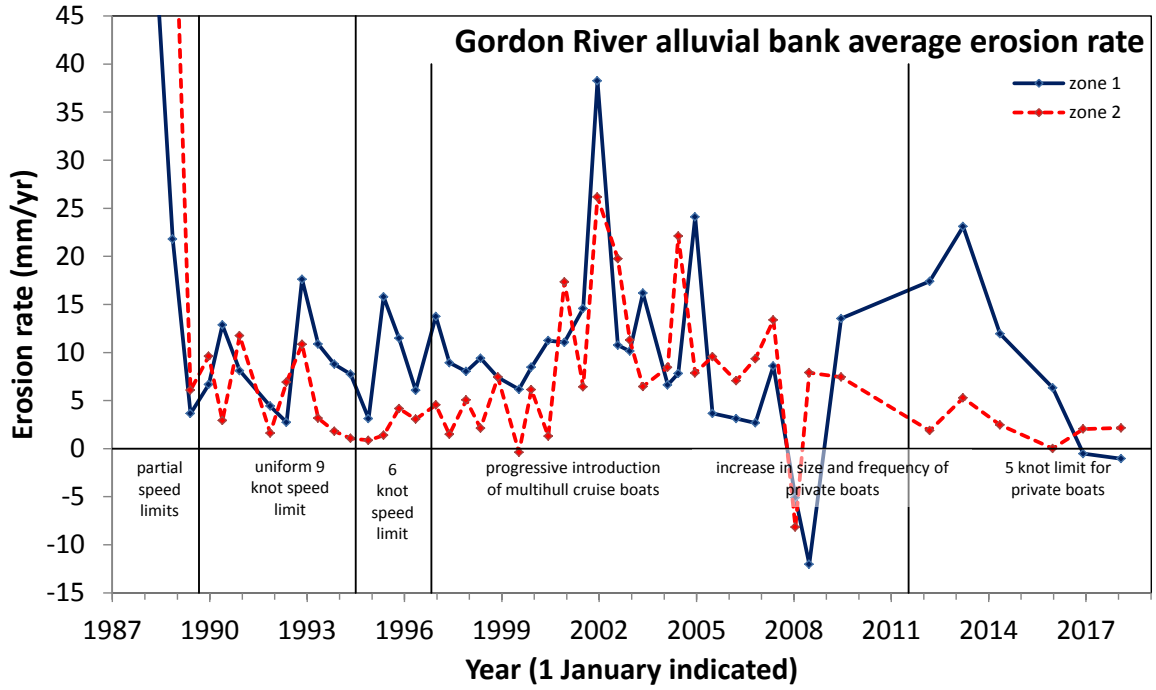

Fig. 3: Mean rate of alluvial bank (combined scarp and flat) erosion through time

Levee banks

The sandy levee banks of zone three and small areas of zone 4 are very susceptible to wake wave erosion and were rapidly eroded in the 1980s. The monitoring program recognises three discrete landforms; an upper scarp, a mid-level debris apron and low sandy bars. The latter consist of unconsolidated and largely unvegetated sand; these represent partial recovery from a catastrophic event and are a fragile buffer against renewed levee retreat. Levee bank erosion rates are summarised in table three and figure four.

Table three: summary levee bank erosion pin measurement statistics for the reporting period. All values except n in mm/yr. Negative values indicate deposition.

	count (n)	min.	max.	mean	median	st. dev.	n < 0	n = 0
upper	32	-15	3	**-0.4**	0.0	3.2	3	24
middle	31	-105	5	**-5.4**	0.0	21.9	8	11
lower	84	-134	106	**9.4**	3.4	38.0	27	5

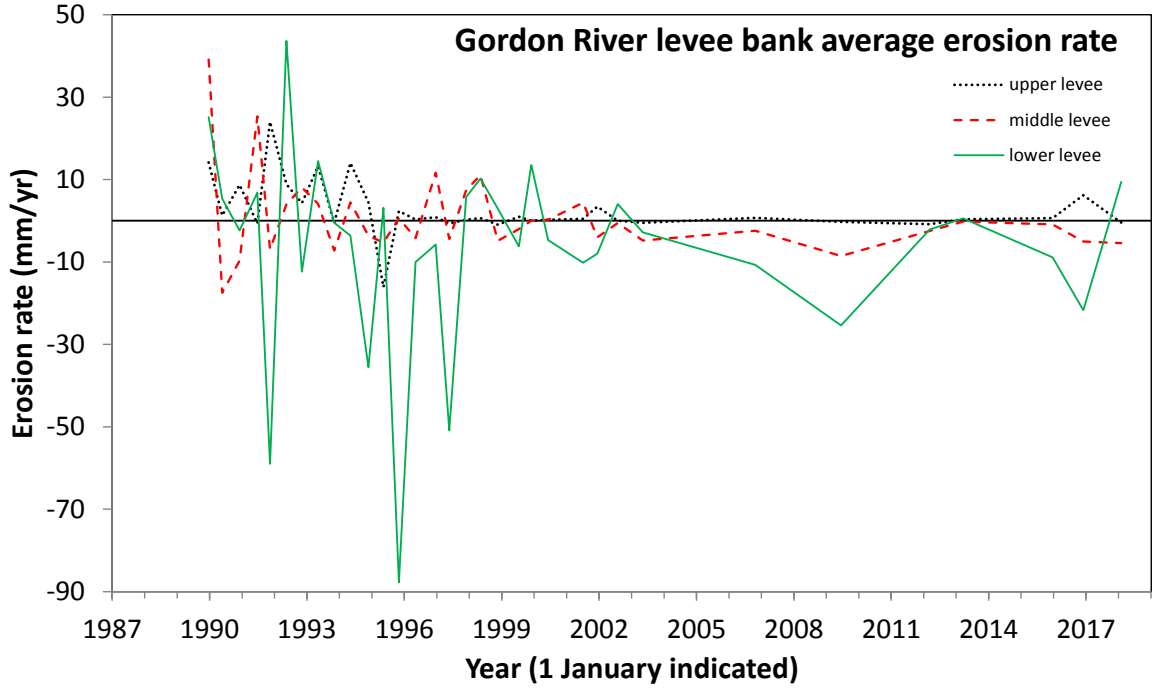

Fig. 4: Mean rate of levee bank erosion through time. Note that prior to 1989, when the erosion rate was much greater before cruise vessels were excluded from these reaches, no distinction was made between upper, middle and lower levee.

Turbidity monitoring

Instrumental monitoring of near bank turbidity at 15 second intervals has been reinstated at two sites, one above and one below Heritage Landing. Greenspan TS 100 instruments have replaced the original Analite sensors, otherwise the installations and data analysis remain as described in detail in DPIPWE (2013). The installations essentially act as boat counters, providing a record of each vessel pass that causes geomorphic activity. They do not however record vessel passage that does not cause geomorphic effect. Battery power and memory capacity constraints limit data collection to a maximum of 180 days between services. No mid-year service was conducted. The full 180 days of data was acquired from the downstream site however memory card issues meant that the upstream site collected only 89 days of data.

At the downstream site a total of 924 turbidity events characteristic of wave wake impact were recorded, for an average of 5.13 per day. For the baseline period of 2003 – 2009, when considering only the same days of the year (30 Nov – 28 May), the corresponding figure was 4.79 events per day. The slight increase in private vessel traffic implied is likely to be underestimated, since afternoon cruises now cease in January rather than continuing through March, as they did during the baseline period.

From the timing of turbidity events (figure 5) it is clear that near bank geomorphic activity at the downstream site is still dominated by scheduled cruises, which pass the site shortly after 10:00 am (upstream), noon (upstream and downstream) and about 2:00 pm (downstream). Peak season afternoon cruises were also recorded between about 27 December and 20 January, at approximately 4:20, 5:15, 6:00 and 7:30pm. A much smaller cluster of events between 8:30 and 9:00 am may represent downstream passage of *Stormbreaker* after collection of Franklin River rafters.

In contrast the upstream site, which is beyond the range of cruise activity, recorded only 135 turbidity events, for an average of 1.51 per day. That is slightly less than the average of 1.92 events per day recorded by a previous site located further upstream. However very shallow water at the

former site made it overly sensitive; many of those events were recorded during the hours of darkness and could not reasonably be attributed to vessel passage. This report documents the first data returned from the relocated site. While of little use in itself it does provide a benchmark against which future levels of vessel activity in this reach may be gauged.

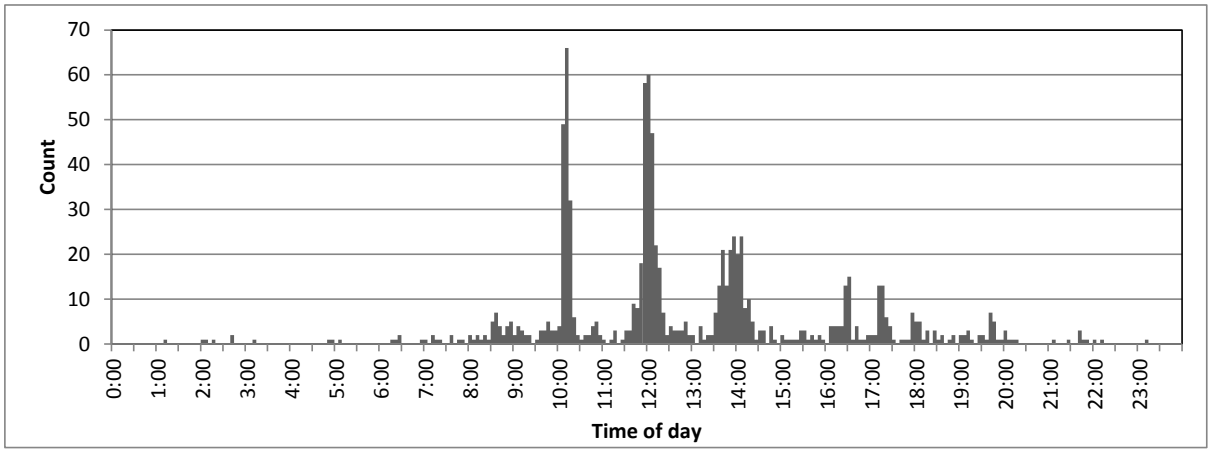

Fig. 5: Histogram showing timing of near bank turbidity events and geomorphic activity at the downstream monitoring site during the period 30 November 2016 to 28 May 2017.

Summary and conclusions

Due to inappropriate weather conditions in December, when fieldwork was first scheduled, the most recent monitoring period was longer than ideal at 14 months. While that does not affect analysis, since data is reported as rates in mm/yr, it does have some bearing on how seasonal factors influenced the results. The most recent monitoring period included two seasons of peak summer (non-angler) visitation but only one season of winter – spring high flow and potential deposition.

The recent uptick in the rate of estuarine bank erosion should not at this stage be regarded cause for concern. It is in accord with both established interannual variability and overall trends.

For the second consecutive period zone one alluvial banks recorded minor deposition overall, while zone 2 alluvial banks recorded minor erosion. However the difference remains less than the variability within the historic record. The scarped alluvial banks in both zones remain very susceptible to wave erosion.

Levee bank scarps and debris slopes showed little activity, mostly as minor slope adjustments and accumulation of organic debris. The scarp foot recovery bars recorded erosion overall however that may be due to the inequality of seasonal influences during the extended monitoring period.

Turbidity monitoring data suggests that little has changed with regard to the impact of cruise operations since 2013. The majority of geomorphic activity at the site downstream of Heritage Landing still occurs at the times of scheduled cruises.

When erosion pin and turbidity monitoring data are considered together no new erosion problems are revealed. However some erosion remains attributable to cruise vessels. That is counter to the Lower Gordon River Recreation Zone Plan (PWS 1998) management target of zero wash induced erosion. Theoretical considerations, centered on an energy threshold that must be exceeded before erosion can occur, suggest that continued erosion by cruise vessel wave wake could be avoided by a slight (0.5 kt) reduction in speed. It is anticipated that this issue will be addressed in more detail in upcoming review of the Recreation Zone Plan.

It is recommended that erosion pin and turbidity monitoring be continued at the present frequency. Continuity of turbidity data requires a mid-year equipment service to be conducted by PWS.

References

DPIPWE 2013 *Lower Gordon River erosion monitoring, Tasmanian Wilderness World Heritage Area- report for the period February 2004 to March 2013.*
http://dpipwe.tas.gov.au/Documents/LGR%20Monitoring-2013-14.pdf

PWS 1998 *Lower Gordon River Recreation Zone Plan*. Parks and Wildlife Service, Hobart.
http://www.parks.tas.gov.au/file.aspx?id=6604