Upper Hawkesbury River Water Quality Monitoring Program 2018 - 2019

Summary Report

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Background

Hawkesbury City Council contracted the Estuaries and Catchments Team of the NSW Department of Planning, Industry and Environment (DPIE), formerly known as NSW Office of Environment and Heritage (OEH) to assist Council staff to assess the water quality in part of the upper Hawkesbury River that falls within the Hawkesbury City Council Local Government Area (LGA) over the 2018/2019 financial year. This is the first report in a proposed ongoing monitoring program. Long term monitoring programs are essential for tracking the ecological health of an estuary and to identify potential areas requiring management.

The NSW Natural Resources Monitoring, Evaluation and Reporting (MER) Program outlines standard sampling, data analysis and reporting protocols to assess estuary ecological health (OEH, 2016). The Upper Hawkesbury River monitoring program was designed by OEH to adhere to these protocols and to also address locally relevant issues.

The aims of the monitoring program are to assess the ecological health of Upper Hawkesbury River using methods that are scientifically valid and standardised, and to report the information generated in an accessible way to a number of potential users in a report card style format. This summary report presents the report card grades for the 2018 – 2019 monitoring period.

With the Hawkesbury being such a large system that runs through several Council LGA's, this program also falls within a larger overall aim, aimed at establishing a standarised report card and grades that other Council's can adopt.

Methods

Monitoring Parameters

Turbidity and chlorophyll-a are considered to be appropriate measures of estuary ecological health as they are indicators of ecosystem performance in response to catchment pressure. The concentration of chlorophyll-a in the water column is a biological indicator reflecting phytoplankton biomass, and typically reflects the nutrient load into the system. Turbidity measurements indicate water clarity, where high turbidity can result in a reduction of light available for photosynthesis, limiting algal and seagrass growth. These indicators are consistent with the NSW MER protocols.

Turbidity and chlorophyll-a data collected from NSW estuaries by OEH as part of the statewide estuarine MER program have been used to develop trigger values specific to NSW estuaries (OEH, 2016). Compliance against a guideline or trigger value is commonly used to assess the status of a condition indicator. Exceeding the trigger value frequently, or by a large extent, should 'trigger' further investigation or management action. Table 1 shows trigger values established for rivers (<10 psu) that were generated from the statewide estuarine water quality dataset (OEH, 2018) that were used in this report.

It should be noted that a trigger value for Chlorophyll-a of 7µg/l has been adopted instead of the standard trigger value of 4.8 µg/l (OEH 2016), which is generally used for Rivers Upper with a salinity of less than 10psu. The sites sampled in the Hawkesbury River as part of this monitoring program are within the tidal freshwater pool. Currently there is limited available data on tidal freshwater pools & as such a trigger value for Chlorophyll-a of 7µg/l was deemed more appropriate, based on recommendations made in 'Interim nutrient load cap assessment for the Hawkesbury Nepean River' report (Ferguson 2018), which identified that

a knowledge gab exist and that a Chlorophyll-a value of 4.8µg/l was not appropriate for the tidal freshwater pool within the Hawkesbury River. It was also noted that guideline values for the system should be reviewed and revised as more knowledge is gained about the system in the future (Ferguson 2018). DPIE is working on developing revised trigger values for freshwater tidal pools as part of the Tidal Rivers Program.

Table 1 Trigger Values for water quality indicators in NSW rivers (< 10psu).
***A trigger value for Chlorophyll-a of 7 has been adopted instead of the standard OEH trigger value of 4.8 (see explanation above)**

Indicators	Rivers Upper (<10psu)
Turbidity NTU	6
Chlorophyll-a µg/L	7*[4.8]
Ammonia µg/L	52
NOx µg/L	34
TDN µg/L	550
TN µg/L	670
Phosphate µg/L	5
TDP µg/L	6
TP µg/L	16

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Sampling and Analysis

Turbidity and other physico-chemical water quality parameters were measured using a Xylem EXO-2 multiparameter water quality sonde. The sonde logged data at approximately 0.5m depth at one second intervals for a total of 3 minutes at each site, while the vessel used for sampling freely drifted, following the method outlined in the MER protocols.

A bucket of water was filled using an integrated sampler which collects water from the top 1m of the water column. The bucket was subsampled for chlorophyll-a, and total suspended solids, in addition to subsamples of total nitrogen and total phosphorous and their respective dissolved and particulate fractions. A second bucket of water was then collected and subsampled for chlorophyll-a and total suspended solids to provide a replicate sample for each.

Chlorophyll-a samples were filtered through a 0.45 µm glass fibre filter paper under vacuum and the filter paper frozen until analysis. Concentrations were determined by fluorometry following extraction with 90% acetone solution, in accordance with standard methods (APHA 10200H) (APHA, 2012).

Sites and Timing

Water quality sampling was carried out at 5 zones throughout the study area (Figure 1). Sites were determined based on previous work carried out by OEH and aimed at encompasing the water quality within the main river stem and also lower Macdonald River which also falls within the Hawkesbury City Council LGA.

Water quality data and water samples were collected at 3-4 week intervals beginning in December 2018 and running through to June 2019, with the intention to continue sampling year round into the future. Sampling at this frequency allows both long and short term variability in water quality to be assessed.

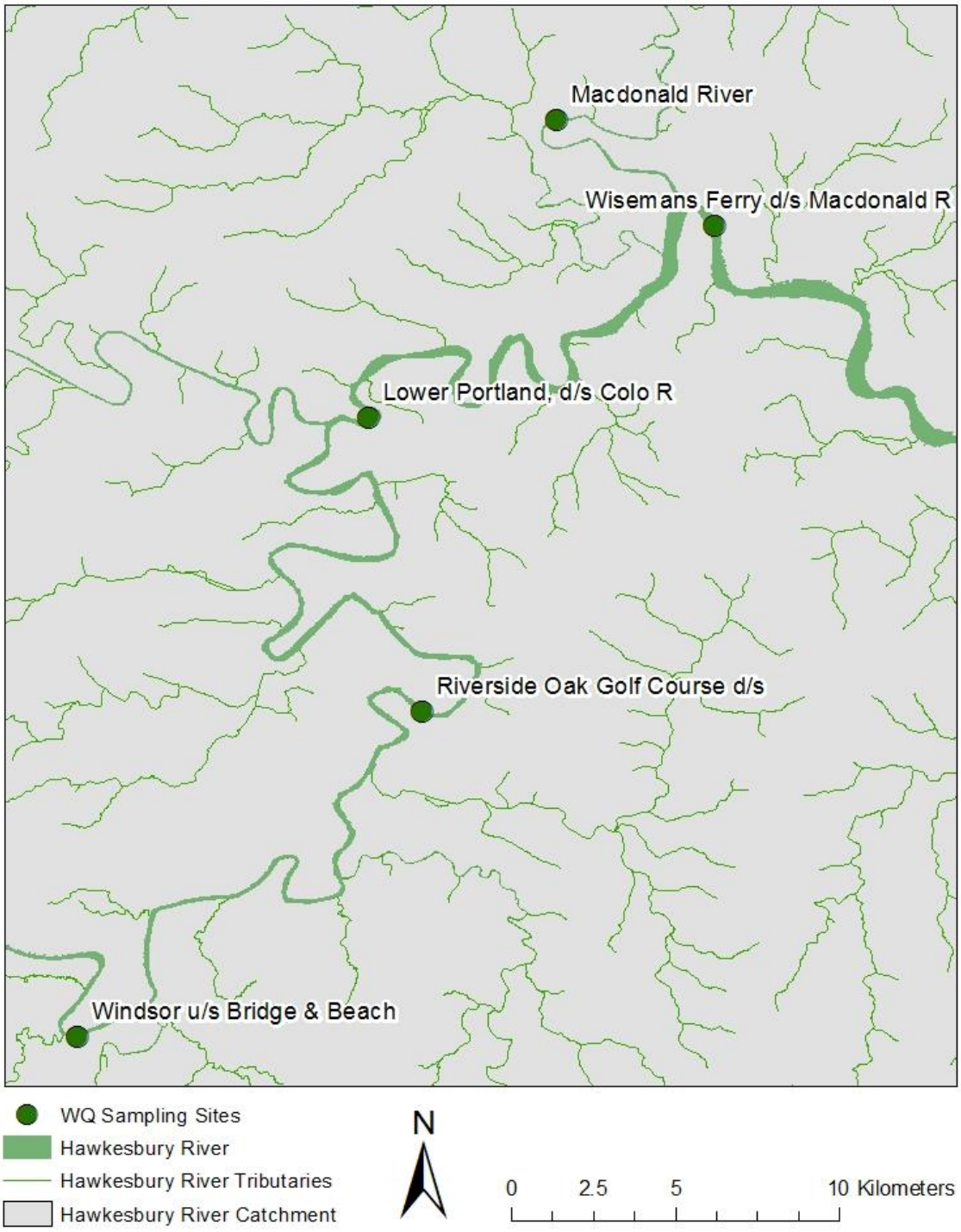


Figure 1 Sampling locations in the Upper Hawkesbury River for the 2018 – 2019 monitoring program

Calculation of Report Card Grades

Water quality and biological data collected in the monitoring program were used to calculate a report card grade for a number of sites in the Hawkesbury River. Grades for water quality are calculated by looking at how often and to what extent the values for turbidity and chlorophyll a exceed the the statewide 80th percentile trigger value. A comprehensive outline of how the grades are calculated is available in the NSW MER protocols (OEH, 2016). As explained earlier, it should be noted that for Rivers Upper a trigger value for Chlorophyll-a of 7µg/l has been adopted instead of the standard trigger value of 4.8 µg/l (OEH 2016).

Results

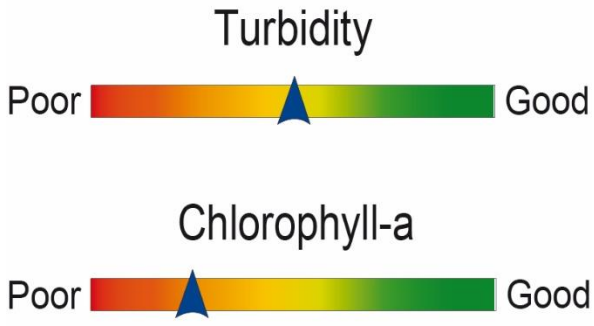
Report Card Grades

Wisemans Ferry (downstream of Macdonald River)

Overall water quality at Wisemans Ferry was only fair, with the trigger value for turbidity exceeded on all sampling trips. Chlorophyll-a was the main driver for this poor grade, with samples grossly exceeding the trigger values on all but one occasion over summer/autumn.

Table 2: Calculated grades at Wisemans Ferry during the 2018-2019 monitoring period.

Sampling Period	Turbidity	Chlorophyll-a	Overall Water Quality
2018 - 2019	C	F	D

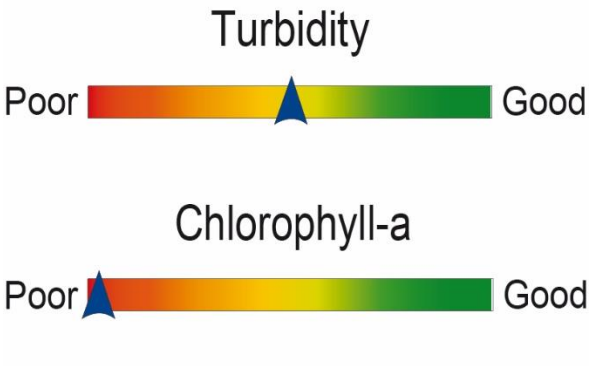


Lower Portland (downstream of Colo River)

Like Wisemans Ferry, overall water quality at Lower Portland was only fair with the trigger value for turbidity exceeded on all sampling trips and chlorophyll-a results were largely responsible for this poor grade. Chlorophyll-a grossly exceeded the trigger values on all but one occasion over the summer/autumn, with turbidity often more than double the trigger value.

Table 3: Calculated grades at Lower Portland during the 2018-2019 monitoring period.

Sampling Period	Turbidity	Chlorophyll-a	Overall Water Quality
2018 - 2019	C	F	D

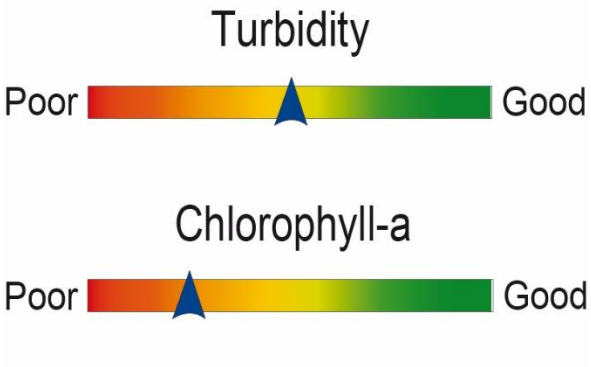


Riverside Oaks (downstream of golf course)

Overall water quality at Riverside Oaks was only fair throughout 2018 – 2019 sampling period. This grade is not surprising, given that trigger value for both turbidity and chlorophyll-a were exceeded on all but one occasions over summer/autumn.

Table 4: Calculated grades at Riverside Oaks during the 2018-2019 monitoring period.

Sampling Period	Turbidity	Chlorophyll-a	Overall Water Quality
2018 - 2019	C	D	C

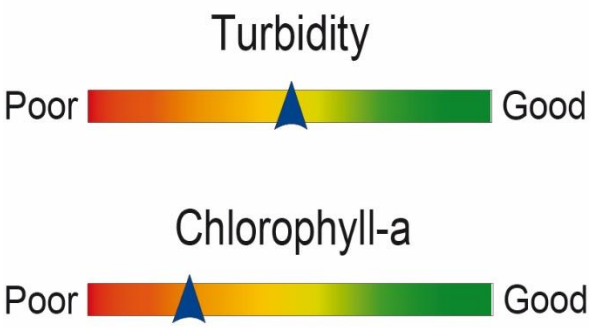


Windsor (upstream of Windsor Bridge)

The overall water quality at Windsor was only fair. The trigger value for turbidity were exceeded for all sampling trips, with chlorophyll-a more than double the trigger value on all but two sampling occasions.

Table 5: Calculated grades at Windsor during the 2018-2019 monitoring period.

Sampling Period	Turbidity	Chlorophyll-a	Overall Water Quality
2018 - 2019	C	D	D

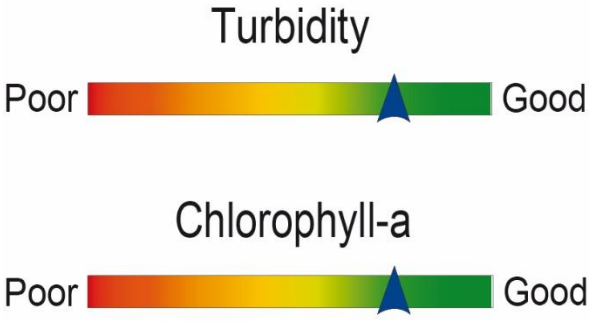


Macdonald River

The overall water quality in the Macdonald River was good. While trigger value exceedances for turbidity were common, exceedances were only relatively minor. Chlorophyll-a exceedances were less common with chlorophyll-a trigger value only exceeded on two occasions.

Table 6: Calculated grades in the Macdonald River during the 2018-2019 monitoring period.

Sampling Period	Turbidity	Chlorophyll-a	Overall Water Quality
2018 - 2019	B	B	B



Summary

The overall water quality grades recorded for all sites within the main stem (i.e. all site excluding Macdonald River) of the upper Hawkesbury River were poor. Overall the chlorophyll-a grades were poor within the main river stem, with a decline in chlorophyll-a grades observed further downstream. Furthermore, the trigger values for chlorophyll-a in the main river stem were exceeded at all sites, for every sampling event apart from sampling in April. This would suggest that the river is constantly in a eutrophic state. Turbidity within the main river stem was considered fair at all sites, with the trigger value for turbidity also exceeded frequently at all sites.

Overall water quality within the Macdonald River fared much better than the main river stem and was classified as good. Observed turbidity and chlorophyll-a were generally lower than that observed in the main river stem. It is not surprising that Macdonald River scored better considering its catchment is much less disturbed when compared to the highly developed catchment of the main river stem and the tributaries feeding into it.

While monthly rainfalls (as measured at Richmond RAFF base) were well below the long-term monthly rainfall figures for the region in February, April and May, rainfall for December January and March were above average.

Relatively low turbidity was recorded at all sites during sampling in early March, following a period of dry weather (prior to higher than average rainfall observed towards the second half of the month). During sampling in March, we observed very high values for chlorophyll-a (several times the trigger value) at all site, except for the Macdonald River where a much smaller increase was observed. This suggests that light availability is limiting algal growth and that there is potential for chlorophyll-a to have been significantly higher on other sampling occasions if turbidity in the river was lower.

With no previous data, continuous, long term monitoring is required to gain a better understanding of what is driving water quality and overall ecological health in The Upper Hawkesbury River and the Macdonald River

References

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