



## Memo

**Date:** 5 Aug 2015

**To:** Chairman, Healthy Rivers Collaborative Stakeholder Group

**From:** Healthy Rivers Technical Leaders Group

**Subject:** **TLG recommendation on the use of Dissolved Oxygen (DO) as an Attribute for Waikato-Waipā catchment under WRC Plan Change 1**

Dissolved oxygen is fundamental to life in freshwater ecosystems. The National Policy Statement for Freshwater Management (NPS-FM; 2014) recognises the importance of dissolved oxygen and has included it as an attribute for assessing Ecosystem Health. However, the Attribute has been recommended as applying only below point source discharges.

Dissolved oxygen is added to water through interactions with the atmosphere and from photosynthesis by aquatic plants and algae. It is depleted through chemical oxidation processes and respiration by organisms (animals, microbes, plants and algae), especially during the decomposition of organic material.

Point source discharges (e.g. industrial and municipal wastes, farm wastes) often contain compounds that exert an oxygen demand on receiving water bodies (i.e. oxygen is needed to break down those compounds). Management of point source discharges has long included limits on the Biochemical Oxygen Demand (BOD) exerted by organic contaminants.

Dissolved oxygen in rivers is also strongly affected by flow conditions, temperature and the biomass of aquatic plants and algae. The processes of addition and depletion of dissolved oxygen in water bodies varies throughout the day (e.g. plants produce oxygen during the day and deplete oxygen during the night). In general, the time of minimum dissolved oxygen will be prior to dawn.

### **Monitoring of dissolved oxygen**

The NPS-defined Attribute states for dissolved oxygen require intensive continuous monitoring during the summer period to calculate required compliance statistics. The sampling statistics used to assess Attribute State are either the 7-day mean minimum or the 1-day minimum (both restricted to summer sampling 1 Nov-30 Apr).

The 7-day mean minimum is the mean value of 7 consecutive daily minimum values from continuous monitoring. The 1-day minimum is the lowest daily minimum across the whole summer period, again based on continuous monitoring.

So, the Attribute requires continuous dissolved oxygen monitoring at a site for at least a 7-day period in summer. This would usually be achieved by deploying a dissolved oxygen sensor attached to an electronic logger that measures concentrations every 15 minutes. This level of monitoring is not realistic across the regional State of the Environment monitoring network.

### **Current Waikato Regional Council approaches**

The State of the Environment data that the TLG has received from WRC includes “spot” measures of dissolved oxygen only. That is, dissolved oxygen is measured at the time of water quality sampling during business hours. Hence there is no SoE monitoring data available with which to strictly assess current state or trends relative to NPS-proposed dissolved oxygen Attribute states.

I have spoken with Brent Sinclair (WRC’s Industry and Infrastructure Manager). He advises that WRC often sees dissolved oxygen modelling information as part of consent applications for point source applications. However, consent compliance monitoring does not involve dissolved oxygen monitoring in the Waikato-Waipā catchment. The council generally requires sampling to show compliance with BOD and or Suspended Sediment (SS) limits in the discharge itself. The reason for this is the difficulty in undertaking compliance monitoring in the receiving water body. Issues such as dilution, mixing, assimilative capacity and changes with distance downstream make this difficult.

### **Recommendation:**

As mentioned in the Attributes report presented to CSG #12, dissolved oxygen performs relatively poorly against the five criteria for inclusion in Healthy Rivers. Of particular note are the indirect effects of the four contaminants on dissolved oxygen, the paucity of current state data and difficulty with modelling implications of changes in dissolved oxygen.

Given the poor performance of the Attribute relative to selection criteria, we recommend that dissolved oxygen be excluded as an Attribute in rivers for the purposes of the HRWO process.

Healthy Rivers TLG