



Technical Memorandum

Date: August 14, 2008
To: Denis Gourde, Eric Lamontagne, Sebastian Tolgyesi, Sylvain Doire
Cc: Larry Connell
From: Randy Baker
RE: Water Column Turbidity Interpretation – August 14 Update

The purpose of this Technical Memorandum is to update Agnico-Eagle management on the current situation regarding turbidity/TSS concentrations in Second Portage Lake. There are two main events that have prompted this update. First, we have updated the TSS-turbidity relationship by incorporating some additional data from samples that were collected within the silt curtains shortly after initiation of construction. Second, we have determined the source of anomalous readings of our turbidity meters in deeper basin areas of Second Portage Lake east of the dike.

As you know, turbidity is used as a surrogate for TSS, because turbidity can be measured in real time whereas TSS requires analysis by a lab. Prior to today, the TSS-turbidity relationship was based on data sets from 2007 and 2008, but none of the data were derived specifically from dike construction activities. When results of water samples analysed for TSS collected from within the dike construction area were incorporated into our model, the predictive relationship between field turbidity (NTU) and total suspended solids (TSS) changed slightly, and is now slightly more conservative at higher TSS levels. For example, when the new data were incorporated, turbidity (NTU) trigger levels for 24-hour and 7-day average levels that equated to 50 mg/L and 15 mg/L TSS concentrations were reduced from 244 and 53 NTU to 205 and 48 NTU respectively. This has resulted in a more rapid exceedence of the 7-day average at SE2 than forecast as reflected in the data sheet provided today. This new relationship will be carried forward from here on.

More importantly, during the last few days we began observing anomalous results during turbidity monitoring at SE3 and NE1, at deeper areas (>8 m) of the lake. Turbidity measurements went off the scale or gave us error readings at depths at or near the bottom. This phenomenon became more frequently observed and then at shallower depths (6 – 7 m) at these same stations. Suspicious that this was due to unexpectedly high turbidity, we re-calibrated our meters to read over a greater (i.e., higher) range, and we also

collected water from water depths that our meters were incapable of reaching (>10 m) and placed the water into a bucket. Turbidity water brought to surface and at depths greater than 6.5 m revealed very high levels of suspended clay sediment, in the order of 2,000 to 3,000 NTU (300 – 400 mg/L sediment).

This investigation confirmed that extremely high suspended sediment loads exist in deeper basins of Second Portage Lake east of the dike. This suspended sediment is extremely fine and appears to consist of clay particles that remain in suspension. We know from historic sediment sampling that the lake bottom consists primarily of clay (~75%) and may be quite thick in areas of the lake where dike construction transited depths greater than 5 m. We believe that this sediment was driven into suspension during rock placement and forced beneath the silt curtain where it ‘flowed’ towards the nearest deep basins of the lake east of the dike and over a few days, filled these depressions with highly turbid water.

This transition from relatively clean overlying water to very turbid water at depth happens over a narrow depth range, around 1 m between 6 and 7 m depth. This very high load of sediment in the water at this depth (350 mg/L) has formed a density barrier that appears resistant to vertical mixing. Strong winds over the last few days have not significantly eroded this layer. In fact, turbidity concentrations at the surface of SE3 have actually diminished since August 10.

The implications of this in our TSS model have been dramatic. Because our 24 hour average and weekly average TSS values are derived from the maximum turbidity levels in the water column, we have now incorporated turbidity values in excess of 2,000 NTU at station SE3, resulting in exceedence of the 24-hour maximum threshold. Exceedence of the 24-hour threshold was also observed at station NE1 (548 NTU). Exceedences of the 7-day average were also observed at stations NE2 and our high value habitat station HVH3, south-east of SE3.

Since this discovery we have dedicated our effort to determining the spatial extent of this pool of highly turbid water. Recent monitoring indicates that the area of high turbidity water extends from SE3 southeast to the south end of the large island east of the outlet streams from 2PL for a distance of 600 m. There is also a pool of less turbid water (~100 mg/L TSS) east of NE1 in a depression between the two islands (see attached figure). We have not found high turbidity levels in the 12 m basin immediately west of the dike on the impoundment side. We do not think the plume extends beyond these two areas, but further sampling will be conducted in the next two days to confirm this.

As discussed earlier, we do not believe that the observed exceedences are due to recent construction activities, but to activities that led to our initial exceedence at SE3. This was a combination of a large dump volume, disturbance of bottom sediments during dumping in deep water and unfavorable wind conditions. This is not to say that current activities are not exacerbating already poor water quality conditions in deep (>7 m) zones of Second Portage Lake east of the silt curtains. However, water quality monitoring results

of stations directly opposite construction activity (W1 and W3 and NE2 and NE3) are well below weekly thresholds. This result suggests that the majority of the suspended sediments we are currently observing resulted from events earlier on during construction.

We will continue to monitor the situation by stepping out beyond the areas of high turbidity to bound the problem and gauge its extent. In the short-term, sediment traps have been set at six locations east of the silt curtains and will be left in for the duration of the open water season. This will provide us with quantitative information on sedimentation over high value fisheries habitat.

Please do not hesitate to contact us if you require further information

Regards

Randy Baker