Where does all the sediment go? Modelling the Sixteen Mile Creek Sediment Plume

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A study was conducted to determine the sediment plume extent and concentration for typical events that cause high levels of turbidity within a water purification plant (WPP) intake in Oakville, Ontario. Sediment plumes within Lake Ontario at the mouths of creeks and rivers are natural occurences due to the transport of sediment from the watershed to the lake. The concentration and size of the plumes can be influenced by anthropogenic factors within the watershed. Few studies of sediment plumes have been conducted for creeks entering Lake Ontario. The need to improve or predict the suspended sediment concentration at the intake for the WPP provided an opportunity to model the sediment plume for Sixteen Mile Creek. The results were used to determine potential benefits of relocating the intake to reduce sediment concentrations.

The study consisted of 3D numerical modelling of the plume concentration and extent for various creek flows and lake conditions. Field sampling was conducted during 2 events for calibration and validation of the numerical model.

The greatest offshore plume extent at the bed was associated with: weak shore parallel currents; high creek discharge; and onshore directed surface currents, which resulted in offshore directed currents at the bed. Plumes with the smallest offshore extent were associated with: strong shore parallel currents, which turn the plume close to the shoreline; low creek discharge; and summer conditions when there is more limited vertical mixing. Relocating the intake 1 km further offshore would reduce the impacts of the more frequent flows below the 1-yr return period. However larger less frequent flows could still result in high suspended sediment concentrations at the relocated intake depending on the prevailing current. Recommedations were made for real time monitoring of turbidity, discharge and alongshore currents, which may be more cost effective than moving the intake further offshore.