COMMENTS ON MUNICIPALITY OF FRENCH RIVER SEPTAGE REVIEW

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WATER QUALITY AND ALGAE EVENTS

Blue-green algae, also known as cyanobacteria, are photosynthetic bacteria which are a natural part of aquatic ecosystems and an important part of the food chain. However, when colonies become overgrown (bloom) they can disrupt a balanced ecosystem and adversely affect human and animal health. The World Health Organization considers this one of the biggest threats to fresh water supplies worldwide.

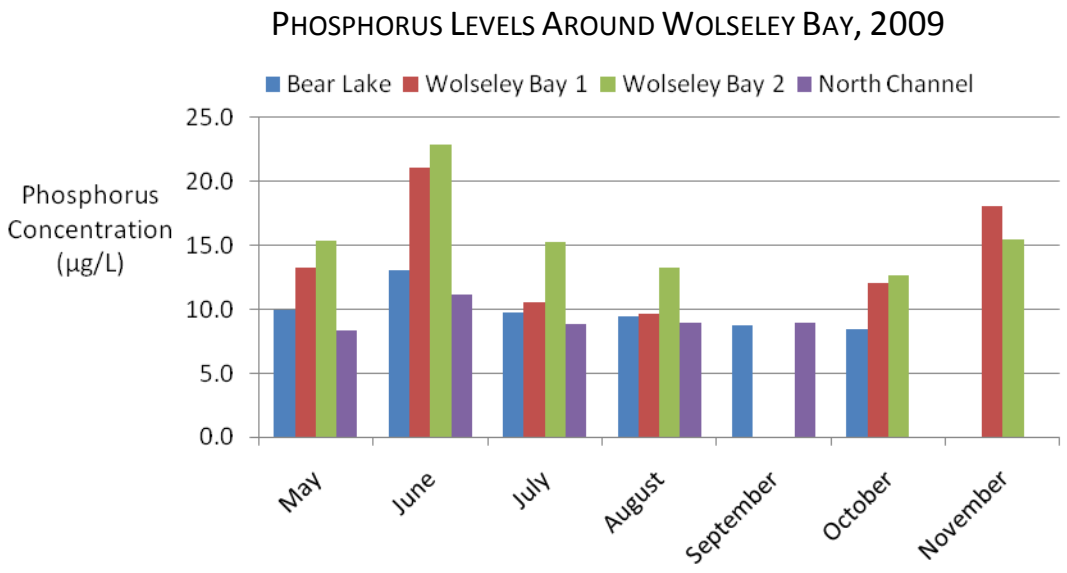
Algae blooms are now a problem on the French River. The 2007 bloom began in Wolseley Bay in early September and lasted for over 2 months. There were subsequent blooms in 2008 and 2009 that lasted for over 3 months. Bloom onset and peak algae levels in the North Channel occur after peaks in Wolseley Bay. This is consistent with the flow of the river coming out of Wolseley Bay and into the North Channel of the French River. The blooms do not occur upstream in the Wolseley River, indicating that they originate in Wolseley Bay.

WOLSELEY BAY OCTOBER ALGAE EVENTS, 2007-2009

Tests done by the Ontario Ministry of the Environment (MOE) in October of 2007 and November of 2009 confirmed the presence of blue-green algae in the French River. Samples taken by the MOE contained Anabaena, a species of blue-green algae capable of producing toxins. Toxins can irritate the skin and, if ingested, cause diarrhea and vomiting. At high enough levels, toxins can cause liver and nervous system damage. Tests for algal toxins in 2007 found microcystin-LR at 0.36 µg/L and microcystin-YR at 1.8 µg/L. It is important to note that the single sample was taken in Ranger Bay after the bloom had peaked and far from its origin. Levels of Microcystin toxins undoubtedly peaked at higher levels than those reported by the MOE. The Ontario Drinking Water Quality Standard for microcystin-LR is 1.5 µg/L, while the World Health Organization sets the limit at 1.0 µg/L. There currently are no standards for microcystin-YR. Microcystins are extremely stable in natural waters and in the dark, they may persist for months or years. Microcystins and other algal toxins remain potent even after boiling and are not removed by most home water filtration systems. Natural flushing is the only mechanism to remove toxins from the river.

Anthropogenic nutrient loading is recognized as an important contributor to algae growth. The dynamics of algae colonies is complex but research shows that phosphate availability can be limiting for algae growth and that increased levels of phosphates and other nutrients due to human activities can directly contribute to algae blooms. The blooms can appear as green clumps floating in the water or later in its development a bloom can look like a green paint spill. In addition to producing toxins algae also make the water unpleasant for recreational use, which could negatively affect home values and assessments in the area. An additional problem arises when the algae die and are decomposed by various bacteria. This can lead to the depletion of oxygen levels in the water, which stresses fish populations. Furthermore, oxygen depletion causes the release of phosphorus from sediments, thereby creating a positive feedback loop that can amplify the problem.

While acting as science officer for the French River Stewardship Council, I initiate a water quality monitoring program under the guidance of the Ontario Ministry of the Environment. Phosphorus testing for 2007 and 2008 indicated high levels in Wolseley Bay area. In 2009, the testing was expanded to include Bear Lake where Councillor Carrier collected sample throughout the year. These samples showed some of the lowest levels in our area, similar to the low levels detected in the North Channel downstream of Wolseley Bay. Phosphate levels are lower at the western (downstream) end of the North Channel than at the eastern (upstream) point where water flows into the channel. Coupled with the fact that the algae blooms appear in Wolseley Bay before entering the North Channel, the data indicates that any significant nutrient loading that is causing these events occurs in or upstream of Wolseley Bay, but downstream of Bear Lake.

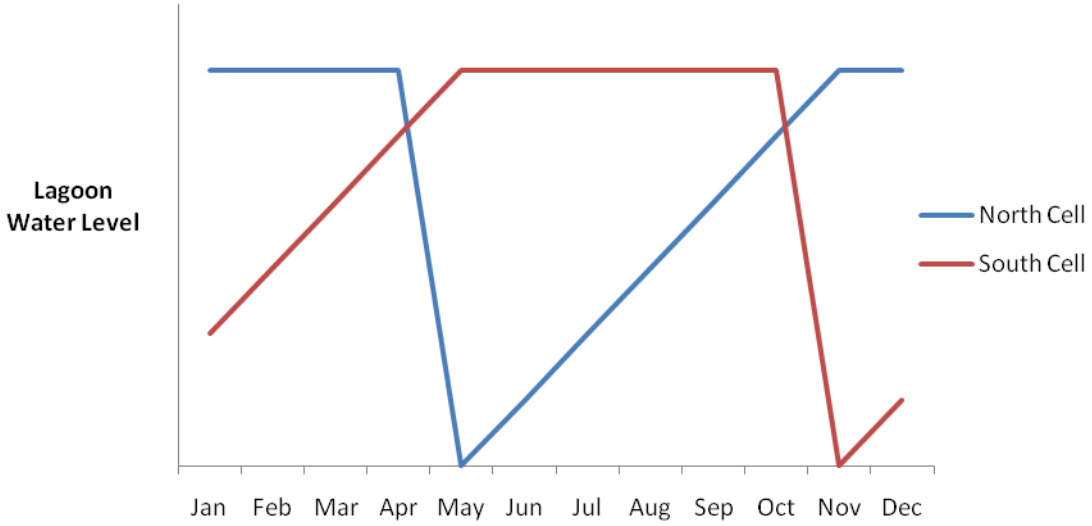


To obtain more data on the problem I hosted MOE Surface Water Specialist Rod Sein, Senior Environmental Officer Steve Moggy and a summer student as we went out to collect sediment samples from the river on June 24, 2009. Two of the four samples had total phosphorus concentrations that exceeded the Provincial Sediment Quality Severe Effects Levels by over 2X. All four samples exceeded the SEL for TKN (nitrogen) by <2X. Manganese exceeded the SELs at two stations by 2X and 3X respectively; nickel was slightly above the SEL at one station. Mr. Sein advised that, "Concentrations that exceed the SEL's are indicative of grossly contaminated sediments where one could expect only the most pollution tolerant benthic organisms to survive."

NOËLVILLE SEWAGE TREATMENT LAGOONS

The Noëlville lagoon is a two cell facultive system. These are very simple systems where waste water is held while biological activity cleans the water. Such systems can efficiently remove organics, nutrients and suspended solids from waste streams. Two lagoons are required to work opposite of each other, one fills while one sits and treats the water. Treated water is discharged into the environment prior to refilling. Lagoons are designed to be discharged during traditional high water events in the spring and fall to facilitate dilution of the effluent. The schematic below shows the water levels in an ideal lagoon that fills for six months sits for five months and has one month for analysis and discharge. The total combined capacity of the lagoons is theoretically the total amount of waste that can be properly treated in a year, however, rain water and seasonal and yearly variations mean that lagoons must operate below this theoretical maximum.

HYPOTHETICAL LAGOON OPERATION



The Noelville facility is two 220 m^2 lagoons with a capacity of about 72 600 m^3 each at a depth of about 150 cm (5 feet). If they were operated as described above the lagoons would therefore be able to handle 2 X 72 600 / 365 = 398 m^3/day. This is well below the 477 m^3/day cited by the MOE, which would fill the lagoons in 300 days. Why the difference? Aparently, there was an error caused by confusion between *holding time in a batch treatment* lagoon system such as ours and *retention time in a continuous flow* system. According to the C of A, a lagoon with a 300 day *retention time* was approved. Each year we should be holding waste in the lagoons for a total of 300 days (150 each), as described above. The error was made when the 300 day holding time was used to calculate the capacity of a 143 200 m^3 continuous flow filtration system, which would be able to handle 477 m^3/day, but is not the kind of system we have in Noelville. That is why nobody has been able to explain how our lagoons could handle 477 m^3/day over a full year, they can't. The true capacity is 398 m^3/day, well below the 437 m^3/day that it is currently receiving!

As noted above, the operation of facultive lagoons requires that the waste is held for 150 days before the waste can safely be released into the environment. This time is required for biological processing of the sewage. Due to the errors noted above, this has not been happening at the Noelville lagoons. In each year from 2007-2009, a least one lagoon was discharged without adequate treatment time, resulting in approximately 4,000,000 gallons of untreated and undertreated sewage leaving the lagoon. This represents a major threat to the health of downstream water bodies, the French River.

Rain water, hauled sewage and sewage from the municipal system all enter the lagoons. The council is considering purchasing a flow meter to monitor waste pumped into the lagoons from the municipal sewer system. This will allow the performance of the check valve to be monitored but as a cheaper alternative, a ruler in the lagoons themselves could also be monitored to

determine the net input to the system from all sources. A rain meter could be attached to the ruler or placed nearby.

Rainfall data are available from Public Works and Government Services Canada, which operates the Chaudiere dams, or from Environment Canada's National Climate Data and Information Archive for Sudbury. The 49 yr average from the PWGSC data is 97.3 cm/year, which is about 65% of the lagoon depth. The following table shows a snippet of the rainfall data. The numbers in brackets are the percentages relative to the 49 year average.

FRENCH RIVER ANNUAL RAINFALL (cm)

	2006	2007	2008	2009
Public Works	104.5 (107%)	-	103.4 (106%)	80.7 (83%)
Environment Canada	96.8 (99%)	75.8 (80%)	101.7 (105%)	-

It does not appear that the last few years have been particularly wet. Evaporation rates are unknown and are probably significant, but the year to year variation in rainfall should not be affected very much by evaporation because evaporation rates are probably not tightly linked to annual precipitation amounts. Evaporation could be affected by temperature, but that is not considered here. Variation in rainfall levels can be expected to result in a *maximum* year to year *variation* of about 25 cm, about 17% of lagoon capacity (more than three times the amount added by Noelville Sanitation).

The purpose of any waste water treatment is to minimize the effects of the effluent on downstream ecosystems. Acceptable discharge levels depend on characteristics of the receiving waters and can vary greatly between sites. The MOE sets the maximum allowable concentration of nutrients and contaminants for discharge from any sewage lagoon. This does not mean that levels lower than the limit are insignificant or even 'acceptable' from an ecosystem perspective, just that discharges above these levels are illegal. Although some people are reassured by the fact that discharges don't *usually* exceed regulated levels, this is a mistake. The amount of rainwater entering the system can dilute the effluent in the ponds so that the levels appear acceptable even though there has been little to no significant treatment. Imagine you have a glass of water that tests above some limit. Dilute it with excess rainwater and the numbers may be OK and now you can dump it in the river even though the amount of contamination has not changed. Dilution is still pollution and it bypasses the purpose of the lagoons. For facultive lagoons to properly serve the environment the waste must be held for 150 days of treatment time AND contaminants must be at acceptable levels before discharge.

SUMMARY

There is a serious problem with algae on the river, which is the backbone of our local economy. The factors that led to this situation have occurred over a long time and it will take time to remedy the situation. It is important to take immediate actions to minimize future nutrient loading. Only then will remediation efforts make sense. The Noelville Sewage Treatment Lagoons are probably not the only source of nutrient loading into Wolseley Bay, but they do appear to be the largest. Based upon these considerations, the following suggestions are offered to outline a responsible course of action.

No expansion of the inputs to the lagoon should be contemplated until the capacity issue is resolved and proper reserve capacity is available. This includes new lots on septic systems and the proposed 25% extension of the municipal sewer line. On approved lots, septic systems are preferable to direct sewer connections since they contribute much less effluent to the lagoons. A sludge determination and a re-evaluation of the lagoon capacity should be carried out to determine if sludge removal is necessary.

Diversion of infiltrating sources is a worthwhile effort and should be pursued. However, although this could potentially bring us within the proper operational lagoon capacity, there would still not be enough to expand the system. Even if extra capacity is found, we are still very near the edge. To address this problem, expansion of the lagoons is one option but probably not the best. I urge council to explore options for lagoon aeration and a secondary treatment facility.