Foth

April 8, 2008

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APR 10 2008

CITY OF DELAFIELD

Ms. Geri Radermacher
Wisconsin Department of Natural Resources
141 NW Barstow St, Rm 180
Waukesha WI 53188

Dear Ms. Radermacher:

RE: Response to March 17, 2008 email Regarding Flocculant Concentration for the Nagawicka Lake Restoration Project

This letter is in response to your email dated March 17, 2008 regarding concentration of flocculants used in elutriate tests for the Nagawicka Lake restoration project.

The city of Delafield, Wisconsin, is seeking a general permit for discharge of carriage water resulting from dredging of Nagawicka Lake sediments. We have previously submitted results of elutriate testing of these sediments, and have shown that concentrations of total suspended solids (TSS), as well as metals associated with TSS, can be reduced to surface water standards through the use of polymer additives (please see our letter dated November 19, 2007). We have also submitted Material Safety Data Sheets (MSDS) showing that these additives are appropriate for environmental use when used at concentrations that do not exceed those listed on the MSDS.

In this letter, we address the concerns raised by Wisconsin Department of Natural Resources (WDNR) Environmental Engineering Specialist Jerry Jarmuz and Water Resources Engineer Jackie Fratrick, as provided in the email referenced above. The WDNR staff note that environmental use of the flocculant additive at a concentration of three hundred parts per million (ppm) would require "that an individual permit may need to be issued to address whole effluent toxicity testing of the discharge because the proposed level exceeds the toxicity criteria" listed in the flocculant MSDS.

We must point out that our November 16, 2007 letter stated:

> "Final concentration of the TSS control agent was approximately 300 ppm in each elutriate test. While this concentration is appropriate for the application described here, use in the field will require a refinement of dosing strategy."

It was not our intent to recommend a particular concentration for field use of the coagulant and flocculant additives, or to recommend a specific chemical or chemicals for reduction of TSS. Rather, we responded to instructions from the WDNR stating that TSS in elutriate supernatant be brought below 40 milligrams per liter (mg/l), and that the concentrations of specific metals in the supernatant be measured to determine if these concentrations were at or below acceptable levels. As our results demonstrate, we successfully met each of these requirements.

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The need to reduce TSS concentration to 40 mg/l in effluent associated with dredging is a new and challenging requirement, and a number of vendors are actively pursuing products that will meet this goal. As described in our November 19, 2007 letter, we contacted a number of vendors before choosing Soil Net, LLC, Madison, Wisconsin (the vendor) and a combination of two of their products to reduce TSS in our elutriate tests. The vendor has several products listed on the Wisconsin Department of Transportation list of products approved for use as soil and sediment control agents. Also, the vendor, with WDNR oversight, recently used the same chemicals we chose to successfully reduce the TSS in effluent from a dredging project on the western shore of Lake Mendota, Dane County, to levels below 40 mg/l. Field application of the chemicals was done at concentrations well below those that would be of concern based on MSDS requirements. We anticipate that these chemicals would give similar successful results with the proposed Nagawicka Lake dredging project.

The use of any chemical to reduce TSS concentrations requires testing to determine the appropriate concentration necessary for a specific field application prior to use in the field. Our purpose was not to determine appropriate concentrations for field use, but rather to demonstrate through the use of elutriate tests that flocculants can reduce both TSS and metal concentrations in effluent water produced by dredging of Nagawicka Lake sediment. Initial dosing requirements for these tests were based on vendor recommendations. The vendor provided samples of proprietary coagulant and flocculant solutions, and instructions to add these chemicals at a dose of one milliliter per liter of elutriate solution. After testing was complete, the vendor informed us that at the above dose, the chemicals were present in the elutriate solution at a concentration of approximately 300 ppm.

The concentration of TSS control agents in field use is very important, for both environmental and economic reasons. However, above a certain critical minimum concentration, the concentration of coagulant and flocculant solutions in the elutriate tests has no effect on the final TSS and metal concentrations in the supernatant of these tests. Once a critical concentration of coagulant and flocculant is reached, the fine TSS particles (and associated metals) settle out of solution, and the concentration of TSS (and metals) is greatly reduced. Adding additional coagulant and flocculant solutions after the critical concentration has been reach, while unnecessary, can not affect the final TSS (and metal) concentrations, as these constituents have already been removed from solution. For this reason, our elutriate test results are valid despite the use of coagulant and flocculant solutions at a concentration greater than that which is practically necessary. As establishing appropriate field dosing was not the purpose of the elutriate tests, the use of coagulant and flocculant solutions at higher concentrations is actually the preferred methodology for performance bench testing; reported TSS and metal concentrations are as low as may be expected, and are not affected by a lack of TSS control agents.

Our experience, as well as that of the vendor, indicates that the TSS control agents used in the elutriate tests would be effective in field use at concentrations of 10 to 30 ppm, well below concentrations that would cause environmental concern, as shown on the MSDS. However, as stated, we are not recommending any specific TSS control strategy.

As part of the dredging contract for the proposed project, the selected contractor will be required to conduct additional tests with chemicals approved by the WDNR to demonstrate that acceptable TSS levels can be achieved at flocculant concentrations appropriate for use in the field. Results of these tests will be reviewed and accepted by Foth, and then forwarded to the WDNR prior to any use of the chemicals in the field. These testing requirements will be specified in the contract bid documents.

It is also important to note that flocculant dosing levels do not equate to discharge concentrations in effluent water. Flocculants bind with solids to bring them out of suspension and are removed with the solids. Therefore, a well managed chemical feed process will not only provide economic benefits, but will also minimize any excess chemicals in the sediment elutriate water after flocculation and solids removal are complete.

In addition to the above, we are expecting a dilution consideration in the return water discharge to Nagawicka Lake. As previously discussed with the WDNR, we requested a dilution factor of ten be applied to the effluent limits. To allow for this dilution factor, and as instructed by the WDNR, the discharge pipe will not be placed along the shoreline, as this would limit dispersion of the discharge. Rather, the discharge will be placed offshore to allow for the desired dispersion. Hence, in addition to lower field dosing levels and removal of flocculant chemicals with solids, there will also be a ten-fold dilution of effluent concentrations. It is, therefore, our opinion that an individual permit for surface water discharge will not be required for this project.

In summary, the elutriate tests with polymers were conducted to demonstrate that TSS at 40 mg/l can be achieved with a reduction of chemical concentrations such that surface water discharge standards can be met. Specific polymer types and dosing rates will be determined by the contractor based upon effluent discharge requirements specified in a general permit issued by the WDNR. The polymer dosing plan prepared by the contractor will then be reviewed and approved by the city's engineer and submitted to the WDNR.

If you need additional information, please contact John Starke, at Foth, at (920) 497-2500.

Sincerely,

Foth Infrastructure & Environment, LLC

John O. Starke, P.E.
Project Manager

Gerald L. Berg, P.E.
Project Director

Jon Manchester, Ph.D., P.E.
Lead Environmental Scientist

cc: Tom Hafner, City of Delafield
Kent Attwell, LWC