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MEMO

To: Ralph Dollhopf, Incident Commander, Region 5, U.S. Environmental Protection Agency, Emergency Response Branch

From: Karl Gustavson, Earl Hayter, and Paul Schroeder, US Army Engineer Research and Development Center (ERDC)

Date: December 7, 2012

Subject: Site Visit Report. Talmadge Creek and Kalamazoo River, Enbridge Oil Spill, November 29-30, 2012.

At the request of the U.S. Environmental Protection Agency Emergency Response Branch, this memo summarizes ERDC's preliminary comments on the Enbridge Oil Spill response, based on observations made during a November 29-30, 2012 site visit and meetings, briefing materials, and conference calls. Based on our review, it is clear that significant progress has been made at the site, removing a vast amount of oil impacting the study area. Ongoing characterization and removal efforts indicate that residual materials remain that warrant additional management. Below, we provide comments on several aspects relating to the materials and response.

Removal, Recovery, and Containment Strategies. In 2012, there was no active removal of oil-impacted sediment, but collection of fugitive oil via skimming, booms, and curtains took place. In 2013, removal of sediments will occur in areas where poling indicates the ongoing presence of fugitive oil.

While there are some uncertainties regarding the physical characteristics of residual oil, the information presented to ERDC suggests that, in many respects, it behaves similar to sediment. In particular, the material forms deposits on or in the sediment bed, the material transports and redeposits in deltas and impoundments where sediment accumulation is expected, and previous excavations have re-accumulated residual oil indicating its propensity to deposit in areas with suitable conditions. As such, it appears that the remaining materials have or have begun to behave similar to lighter sediment fractions.

Based on this information, we considered potential containment and removal/recovery strategies that are either proposed or could be used to augment operations. Currently, the areas of primary concern are the delta and impoundment areas where the materials have come to be located. These areas have served as traps for sediment moving downstream and more recently for oil and

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oil-impacted sediments. However, they currently appear at or near capacity, limiting their ability to retain materials of concern under high flow/shear conditions, which effectively permits downstream transport. As such, it would be useful to enhance the depositional characteristics of these areas by removing sediments with residual oil. As expected, these areas exist where the river widens and material drops out of suspension. Current conditions suggest that the surface area is sufficient for sediment trapping, but the depth is insufficient to provide storage and prevent scour. If materials were removed, the areas could effectively serve as a sediment/oil trap and provide the dual benefit of eliminating further transport of oily materials and sequestering oil in known locations.

Environmental conditions within the impoundments and delta appear quite conducive to removal operations via dredging, for example, using a plain suction or other hydraulic dredge. The beds of fine grained material with low amounts of debris and obstructions are good candidates for removal. Because dredging operations can cause soluble and sediment-associated releases of contaminants, operational and engineering management strategies should be included to lessen the impact. With regard to oil releases, one strategy would be to conduct removal operations in colder temperatures to lessen oil dissolution and dispersion. Oleophilic booms and curtains can also be very effective in impoundments with low velocities. If unacceptable levels of legacy contaminants are encountered, a standard practice is to place clean materials in the dredge footprint to provide isolation and dilution of residual contaminated sediments, if they exist. As the vertical extend of the oil is determined through ongoing efforts, it would also be useful to evaluate the vertical distribution of legacy contaminants, such as PCBs and metals. Determining the concentrations of other contaminants over the depth of oil impact from a few cores in proposed dredge areas would facilitate predictions of whether dredging will expose, resuspend, or release other contaminants of concern.

The ERDC team also briefly reviewed the layout and design of the short-term containment strategies, such as the low-profile screens, coir logs, and mats. It appears that the presented strategy would function to lessen transport of deposited materials and likely retain other materials undergoing transport. The ERDC team is not aware of other applications of the proposed approaches; however, the oil situation in the Kalamazoo River is quite different than typical sediment cleanup projects targeting legacy contaminants that have remained in situ for decades. Where containment does occur between field seasons at contaminated sediment remediation sites, it is often done so by placing a thin residual cap on remaining sediments and removing the remaining sediments and cap the following season. Such an approach could also be implemented at the Kalamazoo River, if needed, including the placement of organoclays to adsorb and contain oil between removal operations. Suggestions for improving the design of the structures relate to ensuring placement of the containment structures such that they would not funnel water and increase erosion in areas of residual oil. It is our understanding that the issues of backwater effects and susceptibility to ice are also being examined. Finally, we note that in terms of contaminant transport, barring structure-induced scouring of residual oil, adverse effects from the containment structures are not anticipated and they should function to retain materials and lessen their transport.

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Future Characterization of Oil and Oil-impacted Sediment. Characteristics of the oil have changed markedly from the initial spill to those present today and, depending on their environmental fate and transport, will likely continue to change. As site actions proceed, it would be helpful to generate a greater understanding of remaining material by defining its form and physical characteristics, including density, size, shape, and associations in the sediment. This information will assist in documenting changes in its nature and extent, modeling transport (described further below), assessing future management strategies, and site closeout.

Modeling. The ERDC team agreed with concerns from the EPA team regarding the capability of the current hydrodynamic model and limited sediment transport effort to predict future transport of oil impacted materials. As the site proceeds through cleanup and towards closure, a robust hydrodynamic and sediment transport model will be needed to assess the transport and disposition of the submerged oil and evaluate management strategies. If possible, it is recommended that a single model framework be developed by the Government and responsible parties for developing future simulations. A collaborative approach will hasten decision making by lessening iterative comment periods critiquing model structure and output. Based on experience at many other sites in several EPA Regions, we recommend using EFDC-SEDZLJ as the hydrodynamic and sediment transport framework.

Two initiatives are recommended to develop a model framework capable of simulating the transport of submerged oil and oil-impacted materials:

1. To most appropriately parameterize the model, physical characterization of the residual oil (as discussed above) will be needed. Additional testing to better represent the properties of the oil and oil-impacted materials in modeling would include
    a. Defining the shear stress required to erode residual oil from the sediment bed.
    b. Defining the physical state of the oil after erosion.
    c. Estimating bedload transport of sediment in the system and whether residual oil is transported as bedload.
    d. Estimating the settling speed of negatively buoyant oil ‘particles’.

2. From this information, new transport modules in EFDC and SEDZLJ will likely need to be developed to simulate oil and sediment transport. Earl Hayter has substantial experience in developing and modifying mixed (i.e., cohesive and noncohesive) sediment transport models, including EFDC and SEDZLJ, and would be available to perform this task.

If there are any additional questions or further detail is needed, ERDC would be pleased to provide additional support as needed. POC: Karl Gustavson, karl.e.gustavson@usace.army.mil, [redacted].

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