Michigan Department of Environmental Quality Comments to the Contaminated Sediment Technical Advisory Group – Tittabawassee River September 23-24, 2014

General

The Michigan Department of Environmental Quality (MDEQ) appreciates the opportunity to provide these comments to the Contaminated Sediment Technical Advisory Group (CSTAG) on the remedial actions being conducted on the Tittabawassee River, Saginaw River and Saginaw Bay Site (Site).

Overall, the MDEQ believes the ongoing project is successful and wants to take advantage of the range of expertise that the CSTAG offers to improve on the results of the Tittabawassee River remedial efforts. We have grouped our comments by the Eleven Principles and have provided some discussion of each.

Principle 1 – Control Sources Early

Under its Part 111/RCRA hazardous waste management facility operating license corrective action program and other governmental controls such as the NPDES program, Dow has implemented significant control measures for primary sources. All known primary sources have been controlled and are regulated.

Focus of remedial efforts is now on control of secondary sources such as levee bank deposits, contiguous in-river sediment deposits, and non-aqueous phase liquid deposits underlying the river bed adjacent to the Dow plant site. A process is in place to identify and prioritize bank and sediment management areas for remedial actions. Secondary source control and monitoring will be necessary into the foreseeable future.

The successful removal of mobile dense non-aqueous phase liquid (DNAPL) conducted at SMAs 1-2, 1-3, 1-6A and 1-6B is a great model for other sites with free product in sediment.

Challenges:

- The MDEQ concurs with the prioritization of deposits for action. Under the adaptive management process (AMP), it will be necessary to continually evaluate those banks which were not been initially prioritized for actions to determine if additional bank stabilization work will be necessary in a particular segment of the river. Developing and implementing a monitoring program that is robust enough to determine if sufficient stabilization of secondary sources within the river (or a particular river segment) has been completed is a critical monitoring component that has yet to be developed.

- The MDEQ agrees that in-channel deposits and eroding bank deposits are important secondary sources. However, additional work needs to be conducted to quantify and document the mass of dioxin and furan contamination that is contributed back to the river system from eroding floodplain soils. Please also see the comments below related to the Conceptual Site Model (CSM).

Principle 2 – Involve the Community Early and Often

The MDEQ supports involvement of the public early and often and commends the EPA on continued enhanced public participation through EPA's local office, the Community Advisory Group and other public participation forums.

In particular, the work that the U.S. Environmental Protection Agency (EPA) is conducting in coordination with the State and local health departments has been instrumental in getting exposure control information out to segments of the public that may not be reached by more traditional public outreach methods. As an example, the First Ward Community Center River Walker Program (FCRWP) has provided fish consumption advice to well over a thousand bank anglers who may otherwise not be aware of current fish consumption advisories. While the State of Michigan and EPA have conducted extensive public outreach efforts over the years in the watershed, the FCRWP is probably one of the most effective exposure control measures that has been implemented.

Principle 3 – Coordinate with States, Local Governments, Tribes and NRDA Trustees

The EPA and the MDEQ's (the Agencies) coordination is assured by the 2010 Administrative Settlement Agreement and Order on Consent for Remedial Investigation, Feasibility Stury and/or Engineering Evaluation and Cost Analysis, and Response Design (AOC) for the Site. In addition, the MDEQ appreciates EPA's efforts to involve the Natural Resource Damage Assessment (NRDA) Trustees in the monthly technical meetings with Dow and the Agencies. This has been an effective coordination practice and is essential under the AMP.

Principle 4 – Develop and Refine a Conceptual Site Model (CSM) that Considers Sediment Stability

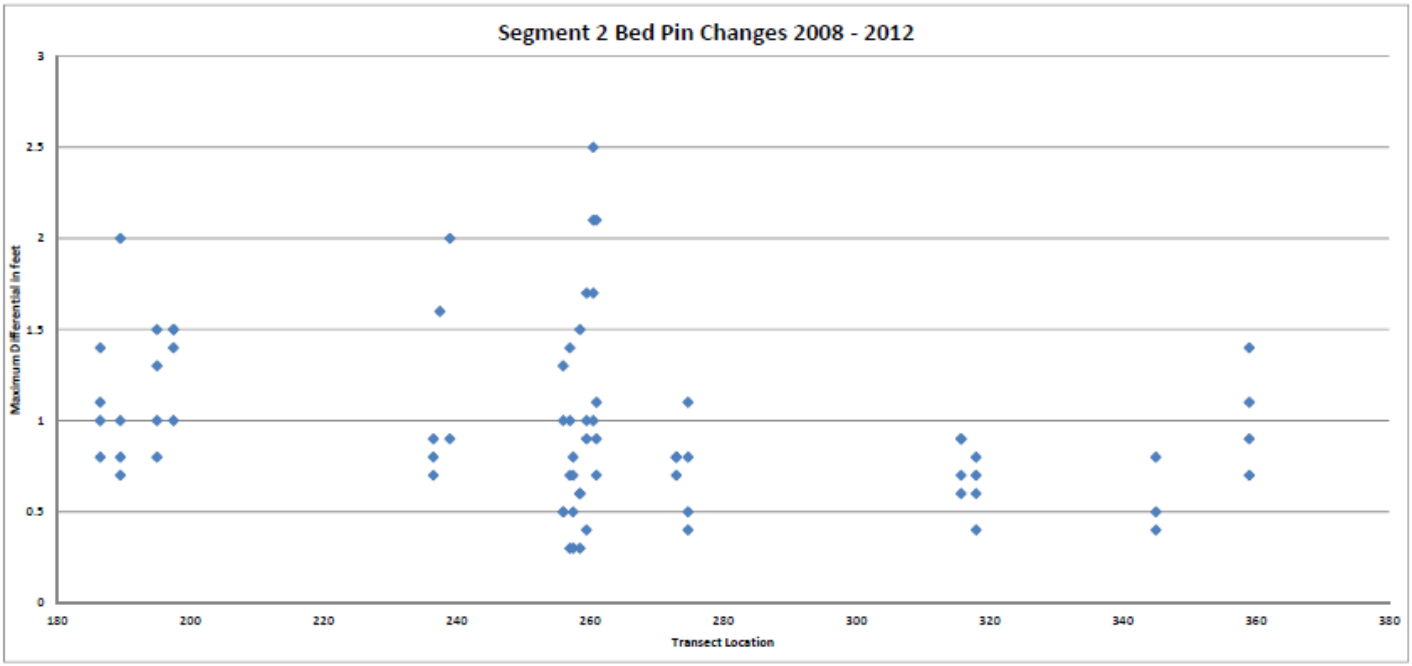
Long-term sediment stability is a critical issue in the Tittabawassee River. The river is "flashy" with discharges that range from 300 to 30,000 cubic feet per second (cfs). When in flood stage, the river inundates the floodplain and moves high volumes of both water and sediment.

Bottom sediments have been documented to be disturbed at depths of two feet or more, based on bed pin monitoring. This is also evident in the bathymetry data that clearly show the presence of significant "sand waves" that are generated on the river bed.

Smaller scale transient features such as downed trees and ice jams have the ability to cause local scouring that may be significant in their potential to uncover higher toxic equivalent concentrations of dioxins and furans (TEQ) deposits that are currently buried beneath several feet of relatively cleaner sediment.

The figure below graphs the maximum change in river sediment elevation as measured at bed pins located in transects throughout Segment 2 of the Tittabawassee River. Each blue diamond represents a bed pin monitoring location. River stationing is shown on the X axis. This data demonstrates an active bed depth well in excess of 0.5 foot in most of the monitored locations and in excess of 2.0 feet

at several transect locations. The data do not support an active bed depth of 0.5 foot as currently proposed by Dow.



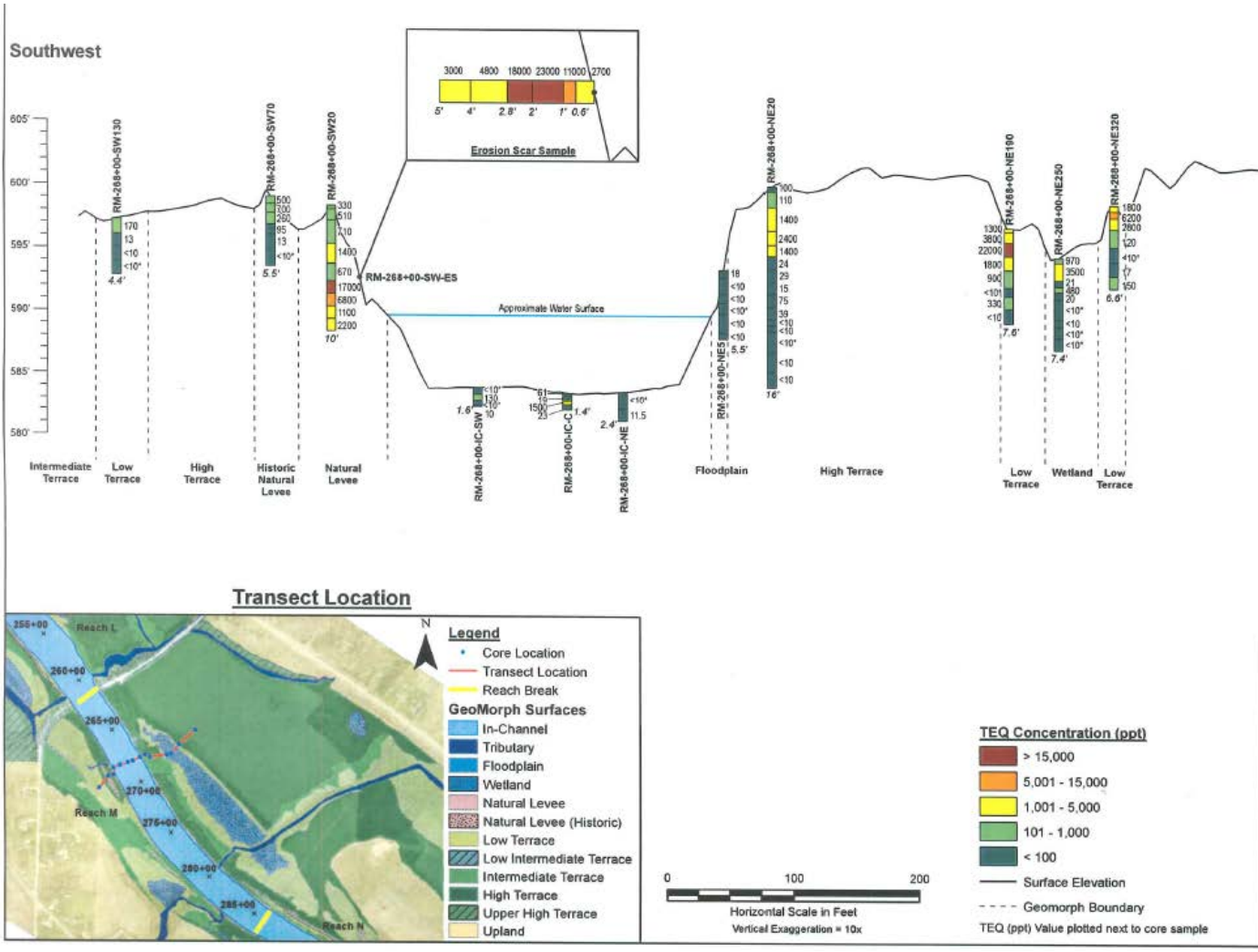
Challenges:

- The "active bed depth" of the Tittabawassee River is highly variable, dynamic, and subject to large and small scale changes. Empirical data from the river system indicate that even TEQ deposits that are covered by several feet of cleaner sand are vulnerable to scour and redisposition in the long term. Sediment TEQ deposits need to be conservatively managed to prevent future loss – regardless of the presence of a foot or two of relatively cleaner cover material that may be only temporarily present. In addition, it is not clear what the appropriate sediment depth is to use for making surface weighted area concentrations (SWAC) type calculations in situations where the active sediment bed is relatively thick.

- Previous investigations have shown that the density of the particles that contain the bulk of TEQ contamination (1.15 g/cm^3) is much less than the density of the natural sediment particles (1.7 g/cm^3) in the river. This key contaminant fate and transport issue does not appear to have been addressed in modeling or the CSM of contaminant transport that has been conducted to date by Dow.

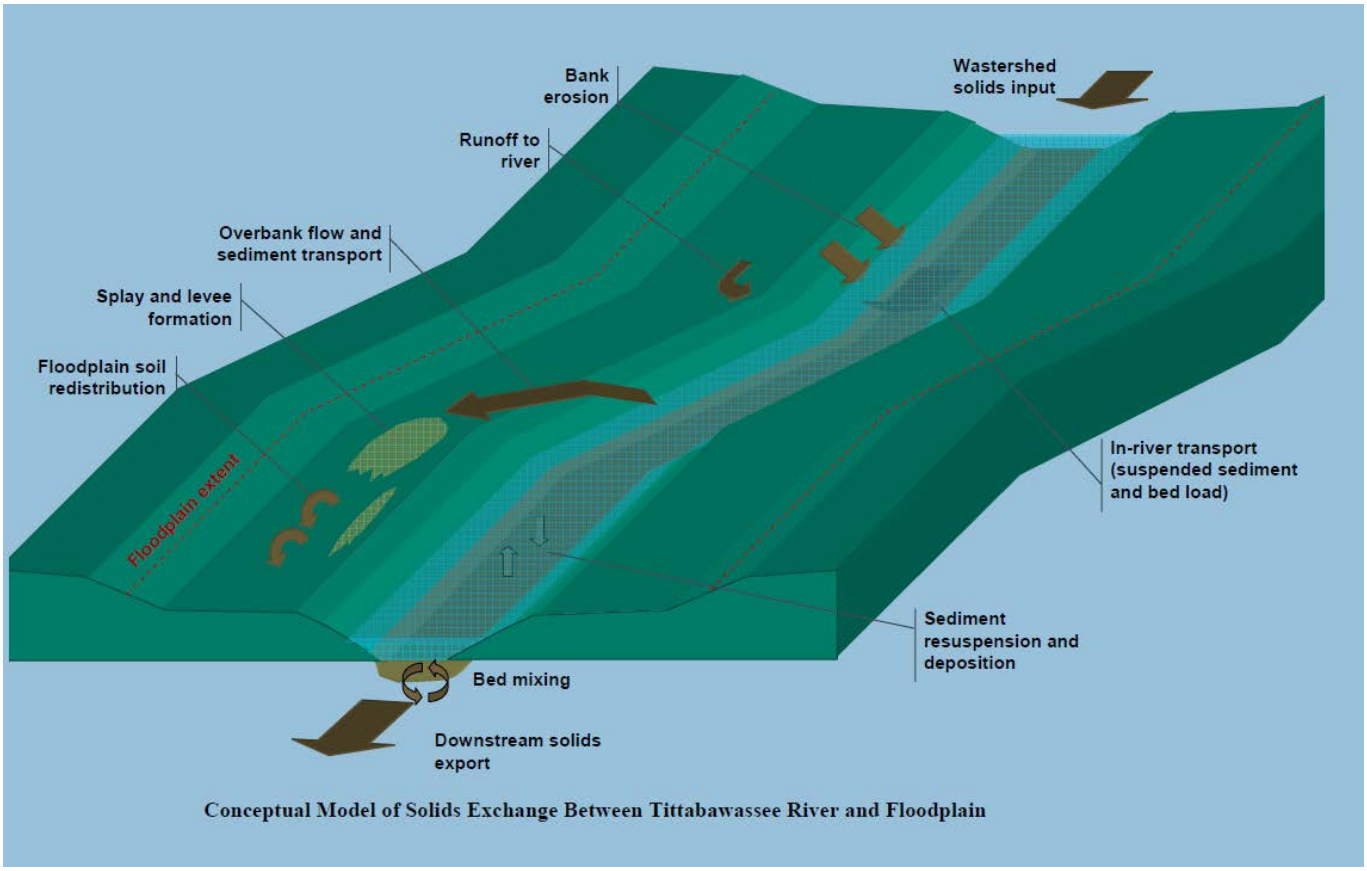
- Stabilization of bank deposits is currently being prioritized based on TEQs, size of deposits and bank stability. The MDEQ supports this approach. However, given the dynamic nature of the river system, banks currently identified as stable with high concentrations of TEQs may become

unstable in the future. In addition, a part of the methodology used for the identification of stable banks includes a modeled erosion rate of less than 2.5 inches per year. In certain circumstances, especially when the high TEQ levels are present near the bank surface, it may be necessary to conduct additional work to carefully monitor and, if necessary, further stabilize banks with high TEQ deposits that are currently classified as "high to moderately stable." As shown in the figure below, several years of erosion, even at a rate below 2.5 inches per year (over 2 feet in 10 years), could result in the exposure of high TEQ bank soils for erosion and direct contact. In this context, the position of the TEQ deposit in the bank may be an important modifying factor in determining what banks should be prioritized for stabilization.



- The MDEQ agrees that the floodplain is a sink for TEQ contaminated media. However, Dow's current CSM neglects the potential for floodplain soils to erode back into the river during flooding events. The MDEQ supports a CSM that recognizes the potential for TEQ to return to

the river via floodplain runoff. The figure below is taken from Dow's 2007 GeoMorph Pilot Site Characterization Report, Upper Tittabawassee River and Floodplain Soils, Midland, Michigan - Appendix K, Conceptual Model of Solids Movement - Tittabawassee River and Floodplain, and provides a more complete CSM. Currently, the presence and magnitude of the potential contribution of TEQ back into the river system from floodplain runoff is not well understood and is a significant source of uncertainty that needs to be addressed by the collection of empirical data. The magnitude of floodplain runoff contribution may be significant in comparison to sediment and bank deposits due to the large size of the floodplain where elevated TEQ levels are present (4500 acres in the 8-year flood plain).



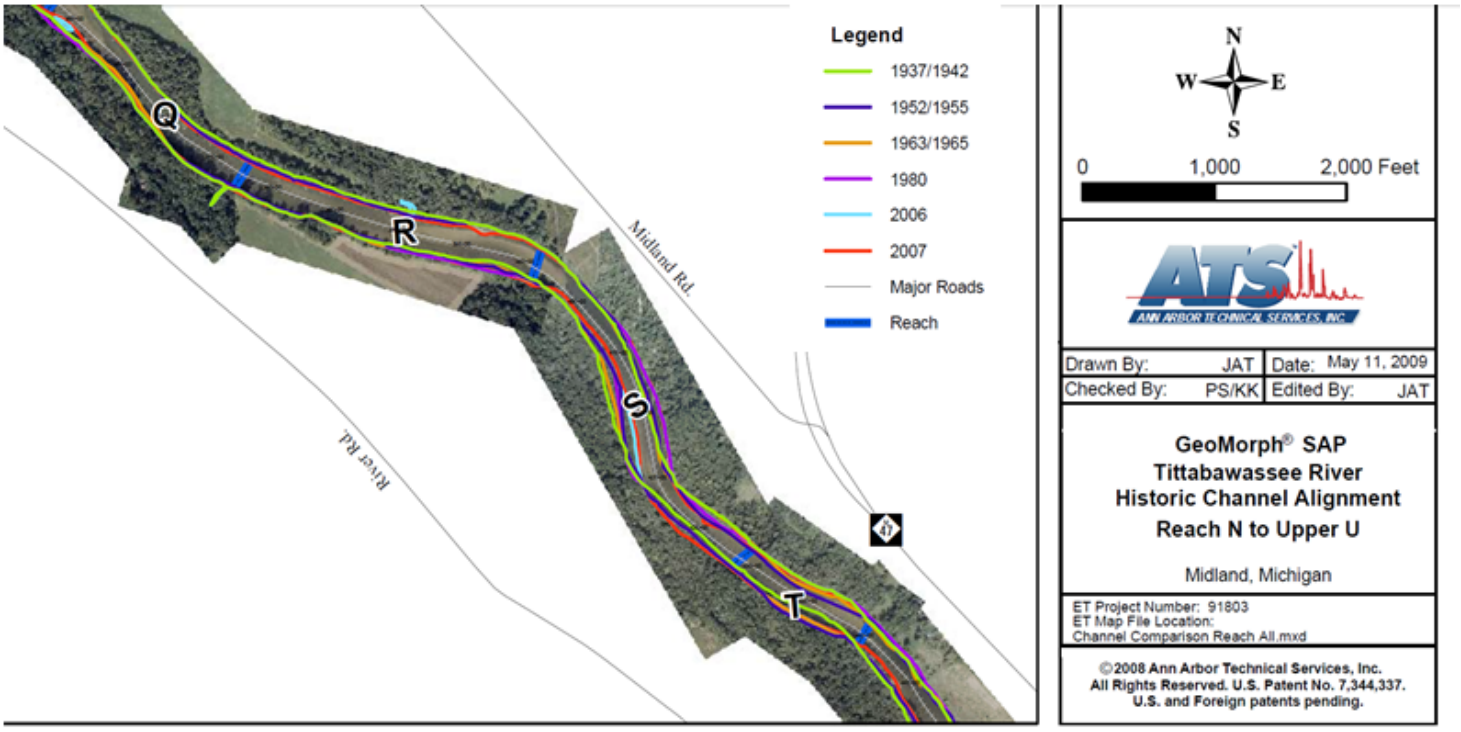
Conceptual Model of Solids Exchange Between Tittabawassee River and Floodplain

Principle 5 – Use an Iterative Approach in a Risk-based Framework

The MDEQ supports an adaptive management approach that allows for course corrections in the CSM and remedial approach(es) as more information is obtained.

- Periodic reassessment as the remedy progresses will be essential in this high energy, dynamic environment, particularly because erosion management implemented in specific reaches may have consequences in downstream reaches.

- Exposure pathways should also be periodically re-evaluated. The monitoring of bank stability is focused on the physical stability of the banks and does not currently include a direct measurement of the degree to which the banks might continue to release TEQ into the river. In addition, it is necessary to continue to monitor high TEQ banks that are currently identified as "stable" in order to apply additional bank stabilization remedies as necessary as river conditions change. As the figure below shows, significant bank migration can occur and these changing conditions may result in the destabilization of currently stable banks with high TEQ concentrations.



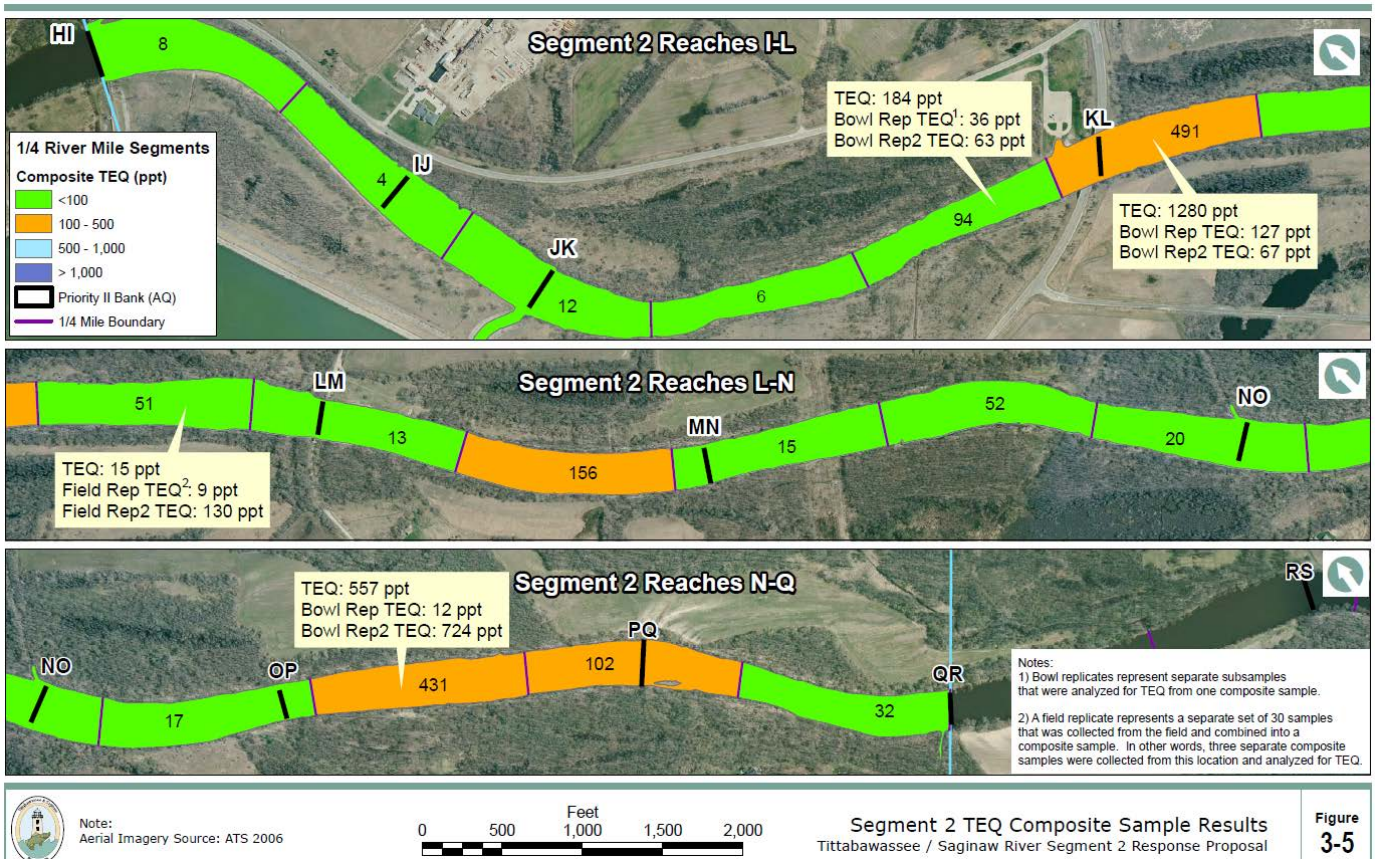
- Sufficient data on exposure and temporal trends in biota and sediment will need to be collected to support residual risk analysis and decision making in Task 10 of the AOC for this Site.

Principle 6 – Carefully Evaluate the Assumptions and Uncertainties Associated with Site Characterization Data and Site Models

Challenges:

- Possibly the largest challenge presented by this project is the development of representative soil and sediment data to support remedial decision making. The TEQ contamination is present as highly contaminated particles in a relatively clean sandy sediment matrix. It is not uncommon to have replicate analyses of the same sample differ by several orders of magnitude. This is illustrated in the figure below which is from the Segment 2 Response Proposal and shows the results of composite samples collected in quarter mile sampling units

throughout Segment 2. As can be seen, where replicates have been taken, even out of the same bowl, the analytical results can vary by several orders of magnitude. Additional work needs to be conducted to ensure that representative and reproducible sampling results can be obtained for reliable remedial decision making. Dow is currently working on a methodology to grind and better mix the samples prior to subsampling for extraction and analysis.



- Secondary constituents of interest (SCOIs) also need to be evaluated and it is our understanding that they are currently proposed to be addressed as part of the Task 10 Residual Risk Assessment. The MDEQ strongly recommends that SCOIs that exceed criteria be addressed at the same time as TEQ to reduce the potential to have to revisit sites where remedial actions have already been implemented. It should be noted that the SCOIs were analyzed at a much lower frequency than TEQ and additional data may be needed to support final remedial decisions. This data could be collected, at least in part, during design and data gap sampling to support future Tittabawassee River response activities.

- The current CSM is based on past and current conditions. Consideration should also be given to the potential for extreme flood events and other reasonable worst case scenarios based on future projections of climate conditions, land use, and river management. Evaluation of

assumptions and uncertainties about bank and sediment stability should take this range of reasonable future conditions into account.

- The current CSM assumes that the potential for contribution of floodplain soil contamination back into the river system is insignificant. As previously noted, the MDEQ does not agree with this assumption and suggests that it needs to be carefully evaluated and validated with data.

Principle 7 – Select Site-specific, Project-specific, and Sediment-specific Risk Management Approaches that will Achieve Risk-based Goals

Challenges:

- The 2010 AOC, using an AMP, employs a strategy where prioritized work is completed to address transport and exposure pathways. A residual risk assessment(s) is to be performed after substantial work has been completed to determine if the implemented remedial measures has reduced risk to acceptable levels. The MDEQ supports the development and implementation of measurable metrics with associated data quality objectives that reliably track progress toward remedy completion.

- The MDEQ supports robust human health and ecological risk assessment that considers all relevant exposures and effects.

Principle 8 – Ensure that Sediment Cleanup Levels are Clearly Tied to Risk Management Goals

Challenges:

- To date, sediment cleanup levels that are clearly tied to risk have not been established for this Site. When established, sediment cleanup levels will need to lead to removal of fish consumption advisories and address risks to aquatic life and aquatic-dependent life (e.g., fish-eating birds and riparian insectivores).

- As noted elsewhere in this document, the accurate measurement of sediment (and bank) TEQ levels is a problem that has not yet been adequately resolved.

Principle 9 – Maximize the Effectiveness of Institutional Controls and Recognize their Limitations

The MDEQ supports durable institutional controls (ICs) as part of the overall remedial strategy for the Tittabawassee River and floodplain. A number of ICs are already in place via State of Michigan initiated fish and wild game consumption advisories and the notification to contractors conducting work in the floodplain via the use of the “Miss Dig” program. In addition, Michigan has worked with local governments to implement advisory signage for these exposure pathways and for soil contact. Michigan supports the EPA’s continued efforts to sustain these ICs.

Challenges:

- The Response Proposal for Segment 2 (and response work currently anticipated for downstream segments) is to limit erosion of highly contaminated bank soils via targeted bank stabilization. Depending upon the type of stabilization technique that is used, this approach may not address human direct contact and ecological exposures. However, it is anticipated that these exposure pathways will be at least partially addressed by the Floodplain Response Proposal and the residual risk assessment(s) to be conducted under Task 10 of the AOC. It is anticipated that ICs will be used to limit and control human exposure to bank soils via direct contact as part of the Floodplain Response Proposal.

- ICs often do not protect wildlife and other biological resources since they are usually intended and designed only to limit potential human exposure. ICs are not likely to achieve substantial risk reduction for ecological and human food chain pathways at the Site.

- If ICs are used, an effective monitoring plan is necessary to ensure that ICs remain in place and continue to be effective where they are used. Advisory signage can be subject to damage and removal and may be insufficient to modify established behavior if the signage is not supplemented with more proactive and sustained educational campaigns. In some cases, permanent markers should be erected where contaminants remain in place. Fish and wildlife consumption advisories and park use advisories should also be tailored to be effective across diverse cultural demographics in the affected communities.

Principle 10 – Design Remedies to Minimize Short-term Risks while Achieving Long-term Protection

Challenges:

- The long term stability of sediments and banks might be jeopardized by river dynamics under future conditions. As noted earlier in these comments, river channel migration is to be expected over the long term which has the potential to mobilize deposits that have been stabilized or have been determined to be stable under current conditions.

- Bank management techniques to limit erosion potential currently include canopy management and bank smoothing. While these techniques preserve and may even enhance some ecological functions, other ecological functions are lost or diminished. These include loss of shade for the river, loss of large woody debris recruitment to the river, and loss of habitat heterogeneity, resulting in habitat shifts and loss of use for some riparian bird and animal species as well as aquatic organisms. The MDEQ will work with EPA, the NRDA Trustees, and Dow to review and consider the potential tradeoffs involved in such decisions, and to document the acceptable expected losses or advocate when appropriate, that such losses be avoided, minimized or prevented.

Principle 11 – Monitor During and After Sediment Remediation to Assess and Document Remedy Effectiveness

The MDEQ supports a robust and multifaceted monitoring program to assess and document remedy effectiveness and/or to determine what changes may be necessary to ensure effectiveness. Under an AMP, monitoring is necessary to determine what adjustments need to be made as necessary to the CSM, sediment fate and transport model, and risk assessments. Post-remedy monitoring needs to be designed to detect the potential for re-release of hazardous substances under all conditions that can be reasonably expected to be significant in the river system.

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