United States
Environmental Protection
Agency

EPA Proposes Cleanup Plan for Tittabawassee River: Segments 4 & 5

Tittabawassee River, Saginaw River & Bay Site
Midland, Saginaw and Bay City, Michigan September 2016

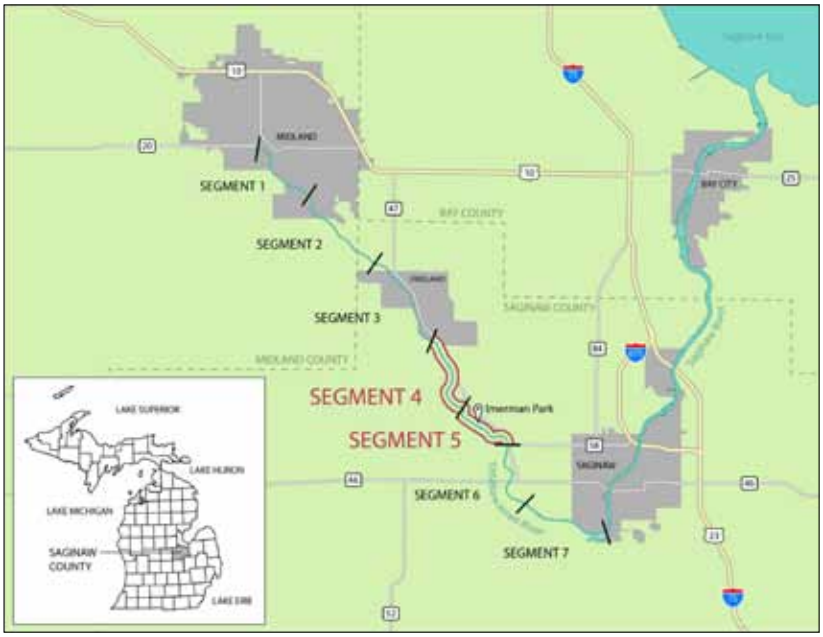
U.S. Environmental Protection Agency, working with the Michigan Department of Environmental Quality, is proposing a plan to clean up dioxin-contaminated sediment and riverbanks in Segments 4 & 5 of the Tittabawassee River. These segments include a six-mile stretch of the river starting about 11½-miles downstream of the Dow Chemical Co. plant in Midland.

There are distinct areas in Segments 4 & 5 that require cleanup called Sediment Management Areas, or SMAs, and Bank Management Areas, or BMAs (*see Figure 1, page 2 and acronym list, page 7)*. Since each area is different, EPA's plan uses different cleanup options. Here is what EPA proposes for the different areas:

- SMA 5-1: A combination of technologies that include digging up and removing some contaminated sediment, safely covering other areas, and monitoring areas where contamination is already buried will be used.
- SMA 5-2: Contaminated sediment will be covered to keep it safely in place.
- BMAs 4-1 through 4-6 and 5-1 through 5-10: Cleanup technologies that stabilize the bank and stop erosion of contaminated riverbank soil will be applied.

Your comments are needed

EPA will select a final cleanup plan after reviewing comments received during the public comment period. This fact sheet gives you background information, describes cleanup options, and explains EPA's recommendations. You can find more details in a document called the Tittabawassee River Segments 4 & 5 Response Proposal. EPA encourages your comments on this technical report, which you can find on our website and at the various locations listed on Page 7 (*see box, left, for ways you can participate in the decision-making process*).



Share your opinion

EPA welcomes your comments on this proposed cleanup plan for Segments 4 & 5 of the Tittabawassee River.

The public comment period is Sept. 22 – Nov. 6. There are several ways to comment:

- Orally or in writing at the public meeting.
- Fill out and mail the enclosed comment form, or submit it at the meeting.
- Send an email with your comments to russell.diane@epa.gov.

Public meeting

EPA encourages you to attend the public meeting, **Wednesday, Oct. 19 at 6:30 p.m.** at Arrowwood Elementary School, 5410 Seidel Rd., Saginaw.

Contact EPA

If you need special accommodations at the public meeting or have questions, contact:

Diane Russell
Community Involvement Coordinator
989-395-3493
russell.diane@epa.gov

Mary Logan
Remedial Project Manager
312-886-4699
logan.mary@epa.gov

EPA may modify the proposed cleanup plan or select another option based on new information or public comments, so your opinion is important.

Plan builds on previous work

Segments 4 & 5 are the next stretches of the Tittabawassee River where EPA is proposing cleanup work. This proposed plan is similar to previous successful cleanups upstream in Segments 1, 2 and 3. There was one previous cleanup in Segment 5, which was completed in 2011. At that time, EPA had Dow remove Island MM, a small island that was contaminated and eroding quickly.

EPA studied Segments 4 & 5 extensively, evaluating many samples and looking at sediment and riverbanks to see how they change or erode over time. EPA also studied how contaminants build up in the food chain.

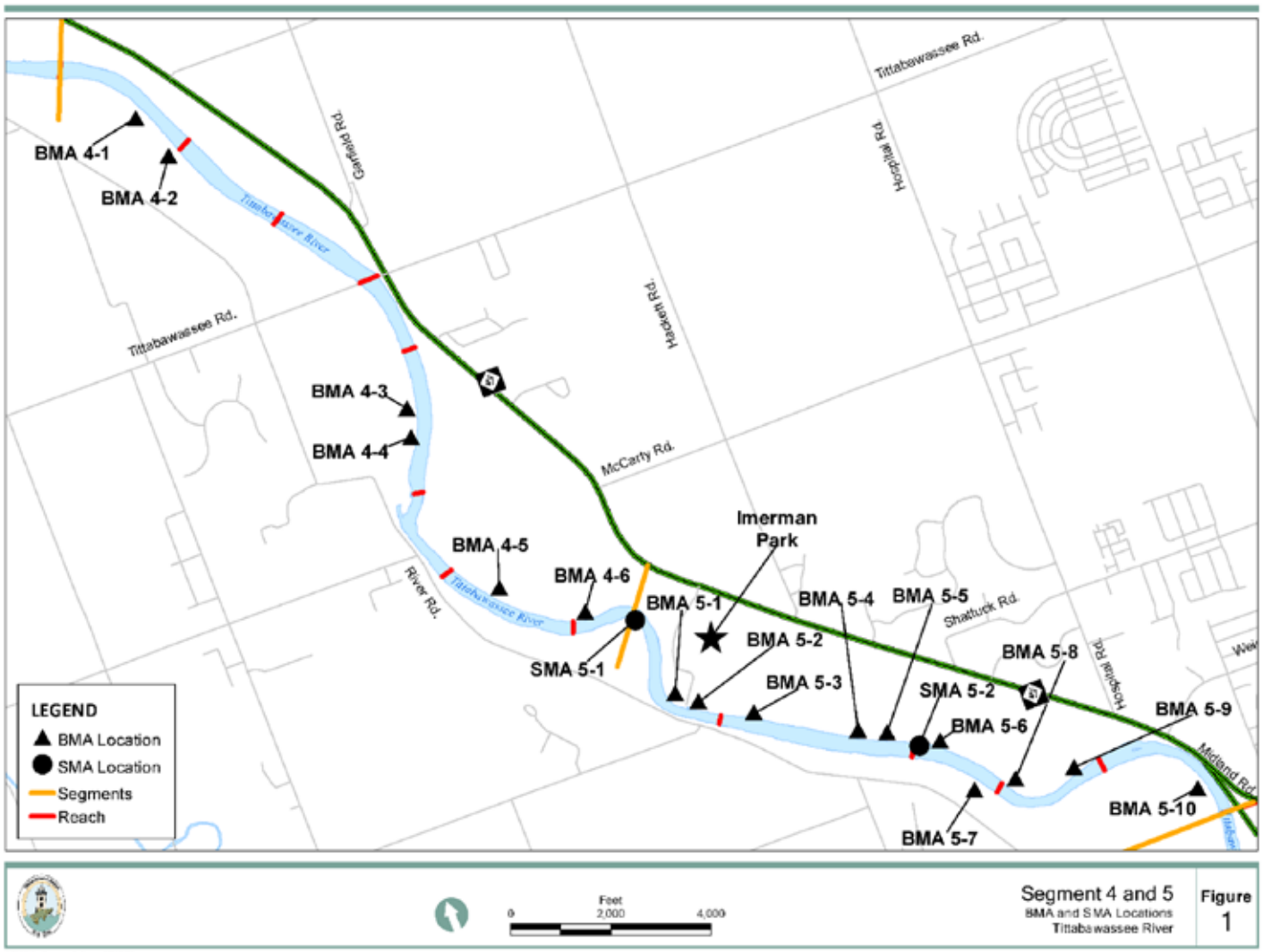
Not all of the sediment and riverbank soil needs cleanup. EPA has identified two SMAs in Segment 5. These areas include deposits that contain higher levels of dioxins that built up long ago. Each of the SMAs is a little under an acre in size. EPA identified 16 areas as BMAs because they are the least stable riverbanks and they could release dioxins back into the river if the banks erode. The BMAs range in length from about 150 feet to 650 feet. In total, the BMAs EPA identified in Segments 4 & 5 measure just over one mile.

EPA will have Dow begin cleanup in these distinct sediment and riverbank areas. Additionally, EPA will continue to evaluate other places in Segments 4 & 5 where cleanup may be needed.

Why is this cleanup important?

Dioxin can build up, or bioaccumulate, in the food chain over time. When people or animals eat fish from the Tittabawassee River they may be exposed to small amounts of the pollutant. The contamination in deeper sediment and in the riverbanks is also a concern because erosion of these areas can move contamination into surface sediment or downstream.

EPA has two main cleanup goals for these proposed actions. First, limit the spread of dioxin-contaminated riverbank soil and sediment to reduce dioxin levels in Segments 4 & 5 and farther downstream. Second, help keep dioxin from building up in fish in the Tittabawassee River.



Background

The Dow Chemical Co. has been operating at its Midland plant since the 1890s. Dioxin (primarily furans) is found in and along the Tittabawassee and Saginaw rivers and in Saginaw Bay from former waste management practices at Dow's Midland plant. In the past, chemicals got into the Tittabawassee River where they settled in some sediment and built up in some riverbanks, like the SMAs and BMAs in Segments 4 & 5. Current waste management practices now assure that there are no unacceptable contaminant releases from Dow's facility.

The term "dioxin" refers to a large family of similar chemicals, including furans. EPA has concluded that dioxin may cause cancer or other health effects such as skin problems, liver damage and reproductive issues, depending on exposures. Dioxin is not created intentionally, but can be formed by human activity or naturally – by fires, for example. In this case, dioxin formed as a byproduct of Dow's early manufacturing processes. Dioxin binds strongly to particles of soil or sediment and does not easily dissolve in water.

EPA, working with MDEQ, is directing Dow's investigation and cleanup of the river. EPA divided the Tittabawassee River into seven segments ranging from three to four miles each. River work is being done in stages from upstream to downstream, segment-by-segment. Dow conducted cleanups in Segment 1, a 3-mile stretch next to Dow's Midland plant, in 2012 and 2013, and in Segment 2, a 4-mile stretch, in 2014 and 2015. Dow started cleanup of Segment 3, another 4-mile stretch, in 2016 and EPA expects construction to be complete later this year.

Evaluation and cleanup of properties in the adjacent Tittabawassee floodplain started in 2015 and will be an ongoing, multi-year project.

Summary of cleanup alternatives

SMA cleanup technologies: There are three technologies to clean up sediment that may be applied separately or in combination. Table 1 on page 4 shows how these technologies have been combined into alternatives for each SMA. Here is a brief description of the sediment technologies:

- Monitored natural recovery, or MNR, relies on natural processes to reduce contaminant levels and risks over time.
- Capping places clean material such as sand or gravel over contaminated sediment, isolating it and preventing erosion. An innovative approach used in earlier cleanups is called a cellular containment system cap or CCS cap. The CCS cap fills naturally with river sand.
- Removal involves taking contaminated sediment out of the river with heavy equipment. It can be done in either wet or dry conditions. Water is managed, and the sediment is hauled off-site to an approved location for disposal.

Workers install a CCS cap.

Stabilized riverbank with native vegetation.

BMA cleanup alternatives: There are two alternatives to clean up the BMAs. Here is a brief description of the riverbank soil technologies:

- **BMA Alternative 1:** Stabilization relies on natural and engineered approaches to prevent erosion of contaminated riverbanks. Stabilization always uses native, deep-rooted plants to enhance the bank's stability. Often the technology also includes approaches like bank reshaping or installing bank stabilization products that control erosion, followed by planting with native vegetation.
- **BMA Alternative 2:** Removal involves using heavy equipment on specific bank deposits and hauling them off-site for disposal at an approved location. All existing vegetation is cleared. After soil is removed, the area is re-graded and replanted.

Common elements to all alternatives

Some features are common to each alternative. More evaluations will be needed to better understand the final footprints of the work areas. Temporary roads in the floodplain or work ramps into the river will be used. Any material produced during the cleanup will be disposed of at approved locations and all construction will be monitored. A health and safety plan will ensure worker and community safety while the cleanup is underway. To ensure long-term effectiveness, a monitoring and maintenance plan will be required. In some cases, institutional controls may be required. Institutional controls include administrative and legal controls that help protect cleanup integrity.

Evaluation of alternatives

EPA is required to evaluate the alternatives against the criteria of effectiveness, implementability and cost (*see box at right*). These three criteria are used to help compare how the alternatives will meet cleanup goals.

SMA alternatives

Table 1 compares each SMA alternative against EPA's evaluation criteria. EPA is recommending Alternative 4 for SMA 5-1 and Alternative 2 for SMA 5-2.

Effectiveness: All SMA alternatives are expected to help protect human health and the environment, meet the cleanup goals and comply with laws and regulations. The location of contaminants within the sediment – either closer to the surface or deeper – can influence the effectiveness of cleanup options. The potential effectiveness of the alternatives differs due to various factors.

Explanation of evaluation criteria

For this type of action, EPA uses three criteria to evaluate and compare cleanup options.

- **Effectiveness** evaluates the ability of an alternative to meet project objectives, and whether it is protective and reliable.
- **Implementability** evaluates how difficult the option will be to complete, whether materials and services are available in the area, and whether it is acceptable to the community.
- **Cost** includes the estimated costs to construct the option (for example, equipment, materials and labor), as well as the long-term costs of monitoring and maintaining the option.

Long-term effectiveness and permanence – All SMA alternatives are expected to be effective in the long term.

- The time frame to attain protection is uncertain for MNR, especially for parts of SMA 5-1 where elevated dioxin levels are close to the sediment surface. This alternative must be closely monitored to make sure it is working on an acceptable timeframe.
- Capping provides an immediate benefit by isolating and safely containing the contamination. Capping options at the SMAs may offer the benefit of maintaining or enhancing habitat. Caps have to be monitored and may need maintenance to make sure they are reliable in the long term.

SMA Alternative	Effectiveness	Implementability	Estimated Cost
Sediment Management Area 5-1			
Alt 1: MNR	Low to Moderate	Easy to implement	$28,000
Alt 2: Cap and MNR	Moderate to High	Moderately difficult to implement	$210,000 – 680,000
Alt 3: Remove and MNR	Moderate to High	Highly difficult to implement	$1,790,000 – 2,240,000
Alt 4: Remove, Cap and MNR	High	Moderately difficult to implement	$1,510,000 – 1,880,000
Sediment Management Area 5-2			
Alt. 1: MNR	Low to Moderate	Easy to implement	$28,000
Alt. 2: Cap	High	Easy to moderately difficult to implement	$280,000 – 760,000
Alt. 3: Remove	High	Moderately to highly difficult to implement	$2,240,000 – 2,750,000

Table 1 – Compares how each SMA alternative meets the evaluation criteria, relative to other SMA alternatives. (Shaded alternatives are recommended by EPA)

Removing sediment in dry conditions.

- Removal would be effective in the long term because it permanently removes contaminated sediment from the river system. Sometimes it can be difficult to completely remove all the contaminated material, especially if removal is performed in wet conditions or if there is debris. The materials left behind that cannot be removed are called residuals. After removal is complete EPA expects cleaner upstream sediment to quickly cover any residuals.

Short-term effectiveness – All options, except MNR, would have some short-term effects that would temporarily disrupt areas in and along the river during construction. If possible, short-term effects would be managed by construction practices.

- Capping takes less time to complete than removal does. Capping could result in short-term turbidity, or a cloudy appearance, in the water.
- Removal could also result in short-term turbidity and release of contaminants to the water during construction, especially if the work is done in wet conditions. If removal is performed during dry conditions, care is needed to prevent erosion in nearby areas.
- If capping is done using sand or gravel, there would be truck traffic to deliver the clean cover materials. Removal would require truck traffic to take the contaminated sediment to an approved landfill.
- Construction may require clearing areas that obstruct access to the site, which could affect the existing habitat, including mature trees in adjacent wooded areas. Removal, especially in wet conditions, affects a larger nearby work area than capping using sand or gravel, and significantly more area than a CCS cap.

Implementability: All of the SMA alternatives can be carried out. Dow successfully completed similar actions in other areas in the Tittabawassee River. All equipment, personnel and material necessary to implement the alternatives should be locally available. EPA will evaluate community acceptance after public comments are received. MDEQ generally supports EPA's recommended options, but will make a recommendation after considering public comments.

- There are no implementation challenges with monitored natural recovery.
- Both capping and removal are easier during lower-flow conditions. Typically, this work is planned later in the summer, but unexpected high flows can bring challenges.
- Capping using both sand and gravel and the CCS has been done with no major challenges. Sand and gravel caps require heavy equipment, while CCS caps rely on intensive man-power.
- Sediment removal has been done in both wet and dry conditions. Removal in dry conditions is typically easier to implement than wet removal. Buried logs and other debris in the Tittabawassee River make removal more difficult.
- For safety reasons, deeper water usually requires removal to be done in wet conditions. However, even in deeper areas, the Tittabawassee River is not deep enough for many wet removal approaches.
- Implementability differs between alternatives because of the need for access to the river. Capping may require access roads and staging areas on privately held land, particularly for sand and gravel caps. CCS caps provide more flexibility in river access because heavy equipment is not used and the SMAs could be approached by water. Removal would require the greatest degree of site access, including temporary roads and staging areas for heavy equipment, contaminated sediment staging and transport, and water management equipment.

Cost: Table 1 on page 4 shows the estimated cost for each alternative by SMA. Monitored natural recovery is the least costly and removal is the most costly. The range of costs for capping reflects different cap designs. The range of costs for removal reflects different expected costs for work in dry versus wet conditions. The total estimated cost for EPA's recommended SMA alternatives ranges from about $1,800,000 to $2,600,000 (cumulative low end and high end costs of Alt. 4 for SMA 5-1 and Alt. 2 for SMA 5-2).

The previous Island MM cleanup cost about $520,000.

BMA alternatives

There are two BMA alternatives: **BMA Alternative 1**: Stabilization and **BMA Alternative 2**: Removal. EPA is recommending Alternative 1 for all of the BMAs.

Effectiveness: Both BMA alternatives are expected to help protect human health and the environment, meet the cleanup goals and comply with laws and regulations. Some differences in potential effectiveness include:

Long-term effectiveness and permanence **–** Both alternatives are expected to be effective in the long term.

- Stabilization (BMA Alternative 1) is effective in the long term by ensuring that contaminated banks do not erode into the river. A long-term plan to monitor and maintain the banks is needed.
- Removal (BMA Alternative 2) is effective in the long term because it removes contaminated riverbank soil from the river system.

Short-term effectiveness – Both BMA alternatives would have short-term effects that would temporarily disrupt areas along the river during construction.

- Stabilization takes less time than removal does.
- Removal requires heavy construction equipment along the riverbanks during excavation and re-grading and also truck traffic as contaminated bank soil is transported from the area. Stabilization creates significantly less construction impacts and traffic.
- Stabilization would cause the least change to existing riverbank conditions. With stabilization the riverbank habitat would remain or be improved. The materials or approach needed to prevent erosion may change the look of some bank faces and surfaces. Some trees may be pruned or removed to improve light and bank stability. Also, small vegetation may be removed and replaced with native plants.
- More extensive changes to existing habitats are associated with removal. Removal requires clearing out all vegetation before work begins, including mature trees. Efforts to restore disrupted areas are part of the removal alternative. However, some habitats require decades to return to their pre-construction condition.

Implementability: Both of the BMA alternatives can be carried out. Dow successfully completed similar actions along the Tittabawassee River in Segments 2 and 3. The necessary personnel and equipment are available. EPA will evaluate community acceptance after public comments are received. MDEQ generally supports EPA's recommended options, but will make a recommendation after considering public comments.

- Landowner access is required for all BMA alternatives because these alternatives will require access roads and staging areas through privately held and public land. Additional owner access is required for stabilization because establishing the native vegetation can take a couple of years, and the banks will need irrigation, periodic on-going inspections and long-term maintenance.
- Some Segment 5 BMAs are in Imerman Park, so either alternative will require coordination with the Saginaw County Parks and Recreation Commission and possible restrictions in the park during the construction period.
- Stabilization is easier to construct. Extremely high or steep banks may pose unique challenges for the placement of certain slope stabilization materials, and reshaping the banks may be necessary.
- Removal is more difficult to implement, although it has been done successfully upstream. In areas of dense vegetation or areas where access is limited, the BMA and surrounding areas would require extensive clearing and preparation to allow equipment to access the bank. This would include roads and staging areas for heavy equipment, as well as areas for contaminated soil staging and transport, and equipment decontamination.

Cost: The riverbank stabilization alternative is less costly than the removal alternative. Stabilization costs about $52,000 per 100 feet of bank and removal costs about $160,000 per 100 feet. There are also costs associated with setting up and taking down each work area. The total estimated cost if all of the Segment 4 & 5 BMAs were removed is about $10.1 million. The total estimated cost for stabilizing all of the BMAs, EPA's recommended alternative, is about $3.4 million. If a combination of removal and stabilization is used, the cost will be in between.

Riverbank removal in 2007; more than 300 mature trees were removed, today the area is a meadow with native vegetation and younger trees.

EPA's recommendation: EPA, in consultation with MDEQ, recommends the following because these alternatives provide the best balance of effectiveness, implementability and cost:

Segments 4 & 5 SMAs. For SMA 5-1 EPA is proposing Alternative 4, a combination of removal, capping and MNR because the area is complex. The middle part of SMA 5-1 has high dioxin levels close to the sediment surface in a stretch with potential erosion. Contaminated sediment will be removed from this area, likely in dry conditions. The water is too deep in the upstream part of the SMA to allow dry removal, so the area will be capped. The adjacent area is thickly wooded, and wet removal could have substantial impacts on the upland habitat. In some parts of the SMA, several feet of cleaner sediment overlays the high contamination. MNR will be used in these areas to monitor buried contamination and trigger evaluation of additional cleanup, if necessary. For SMA 5-2 EPA is proposing Alternative 2, capping, because this area seems to be fairly stable and about a foot of clean sediment already covers the contamination. This SMA seems to be ideal for a CCS cap, which would enhance the sediment stability and habitat, while short-term effects are minimized. Design engineering will identify the final technologies for the SMAs.

Segments 4 & 5 BMAs. For all BMAs 4-1 through 4-6 and 5-1 through 5-10 EPA proposes BMA Alternative 1, stabilization, because these bank stretches have characteristics that indicate that stabilization will be effective and disturb the existing natural habitat much less than removal. There are several technologies included in the stabilization alternative. The design process would examine key characteristics on a bank-by-bank basis, and would allow EPA to select the best suited technologies at each BMA. EPA will consider owner preferences as a factor in the final cleanup plan and will work with each property owner to design and install an acceptable approach.

EPA's estimated costs for all of the cleanups proposed in this fact sheet for Segments 4 & 5 range from about $5.2 million to $6 million. Cost estimates will be refined as the cleanups are designed.

Next steps

Before making a final decision, EPA will review comments received during the public comment period. Based on the comments, EPA, working with MDEQ, may modify the Agency's recommended alternatives or choose another, so your opinion is important. EPA encourages you to review and comment on this proposed cleanup plan and the Tittabawassee River Segments 4 & 5 Response Proposal. More details are available in the official documents on file at the information locations and on EPA's website (*see box at right*).

EPA will respond to comments in a document called a "Responsiveness Summary." This will be part of another document called an "Action Memorandum" that describes the final selected cleanup plan. The Agency will announce the final plan in local newspapers and will place a copy in the information locations and the website.

Once the cleanup plan is final, EPA expects Dow to implement the work in Segments 4 & 5. EPA, working with MDEQ, will oversee Dow's work. EPA expects the cleanup to start in 2017, after Dow completes detailed engineering designs. EPA expects work to require two construction seasons with completion expected in 2018. If EPA finds other SMAs or BMAs in Segments 4 & 5, similar cleanup methods will be used.

Acronyms

BMA – bank management area
CCS – cellular containment system
MNR – monitored natural recovery
SMA – sediment management area

For more information

You can see documents related to the Tittabawassee River, Saginaw River & Bay site at: www.epa.gov/superfund/tittabawassee-river, or at:

Grace A. Dow Memorial Library
1710 W. Saint Andrews St.
Midland

Hoyt Main Library
505 Janes Ave.
Saginaw

Alice and Jack Wirt Public Library
500 Center Ave.
Bay City

EPA Proposes Cleanup Plan For Tittabawassee River: Segments 4 & 5

Tittabawassee River, Saginaw River & Bay Site
Midland, Saginaw, Bay Counties, Michigan

Public Comment Period: Sept. 22 – Nov. 6[1]
Public Meeting: Oct. 19

(details inside)

[1] EPA expects that the public may want more than the normal 30-day public comment period and therefore is providing, in advance, a 15-day extension to the public comment period pursuant to Section 300.415 (n)(4)(iii) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

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TITTABAWASSEE RIVER, SAGINAW RIVER & BAY SITE:
EPA Proposes Cleanup Plan for Tittabawassee River: Segments 4 & 5

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