

Memorandum

To: Paul Ruesch, OSC USEPA
From: John D. Jolly, VP/Program Manager, GEI Consultants
CC: Bryan Heath, NCR Corporation
Date: June 30, 2023
Re: Area 4 TCRA Recommended Alternative

As presented in NCR Corporation's letter of February 14, 2023, this memorandum provides a conceptual-level proposal for an alternative to address the direction in Comments #2 and #3 (included separately as comment enclosure) of United State Environmental Protection Agency's (EPA's) January 5, 2023 disapproval (EPA 2023a, 2023b) of the Area 4 Time Critical Removal Action (TCRA) Removal Work Plan (GEI, 2022). Specifically, this memorandum provides a conceptual alternative to address the comment that "the design should evaluate and implement methods to decrease the total additional sediment mobilization volume resulting from the TCRA to less than or equal to the normal average annual volume of sediment transport through Area 4." This memorandum also responds to the direction in Comment #3 to identify locations alternative to Subarea F for the placement of pilot channel sediments until an agreed to appropriate long-term solution for the sediments is determined in the Record of Decision. The portion of EPA's Comment #1 relating to riffle construction and the portion of Comment #2 relating to the hydrologic model were separately addressed in a memorandum from GEI submitted May 5, 2023 and resubmitted with clarification May 9, 2023 (GEI, 2023a).

Background

During early stages of design development, projected sediment mobilization rates and timing for the lowering of the impoundment water level were presented during a May 19, 2021 design presentation¹ and are attached here as Figure 1. The estimate of sediment to mobilize was based on what would remain after remedial dredging completion. As discussed in subsequent sections, it is widely understood that this post-dredge material contains concentrations of regulated substances, though not at levels that pose an unacceptable ecological or human health risk. For the purposes of this memorandum, we refer to this material as "remaining sediment" (RS) to distinguish it from the sediments containing polychlorinated biphenyls (PCBs) targeted for removal. At that initial stage of design, a conservative estimate of 430,000 cubic yards (CY) of RS was shown to potentially mobilize and reach a steady state at approximately 3.5 years following dam removal, with the majority of the sediment migrating in the first 2 years of drawdown.

During subsequent work group meetings with the agencies, the EPA rebuffed the idea of an extended drawdown to manage the 430,000 CY of RS, expressing a preference to shorten the duration as much as possible. As a result of EPA's direction, and though it was not necessary to meet the scope and intent of the TCRA action memorandum (EPA, 2020), the design was revised to include a pilot channel to remove RS after the PCB dredge, reducing the volume of RS that could potentially mobilize downstream during dam removal and reducing the amount of time required to lower the impoundment. Existing riffles were also enhanced, in part, to reduce sediment mobility.

¹ The presentation was formally submitted to the agencies after the meeting (see slide 21 of that presentation for the graph).

Based on these adjustments, modeling of the draft final design included removal of 149,000 CY RS with placement in Subarea F as part of pilot channel installation, retention of approximately 108,000 CY of potentially mobilized RS in Area 4 after the drawdown, and approximately 173,000 CY of RS potentially mobilized downstream during and after dam removal. The design also included techniques for managing mobilized RS. This design was disapproved by EPA in a letter dated January 5, 2023.

In a meeting with EPA on February 7, 2023 to discuss the January 5, 2023 disapproval letter, EPA directed NCR to evaluate measures for lowering the impoundment so the TCRA work does not generate more than 90,000 CY of excess sediment per year. As discussed in the meeting, this combined with the annual “baseload” estimate of 90,000 CY baseline sediment transport would establish a threshold of 180,000 CY of RS to migrate out of Area 4 each year during construction. Additionally, EPA indicated that an extended timeline for the drawdown was no longer a concern, and that NCR would not be expected to separately manage and dispose of RS. Finally, EPA reiterated that NCR should evaluate alternatives to placement of pilot channel sediment in Subarea F. This information was confirmed in a letter from NCR to EPA dated February 14, 2023.

As a preliminary step to submission of this memorandum, NCR and GEI met with EPA’s modeling team on April 13, 2023 to discuss EPA’s comments on the modeling related to the January 5, 2023 disapproval. On May 5, 2023, GEI submitted a written report of model issues and its proposals for addressing those issues. (GEI revised that report and resubmitted it on May 8, 2023.) EPA provided its response to the model report by email on June 28, 2023. Based on an agreed schedule for responding to the EPA disapproval letter, this memorandum is due 2 weeks after June 28, 2023, or July 12, 2023. NCR and GEI have elected, however, to submit this memorandum now and will respond separately to individual points in response to EPA’s June 28 email by July 12.

Appropriate Disposition of RS After PCB Dredge

The TCRA requires removal and disposal of PCB-containing materials to defined cleanup standards. Precedent has been established, particularly in Area 3, to allow RS, which theoretically could contain PCBs below the defined standards, to migrate downstream (i.e., over the former Plainwell Dam into the downstream scour hole). In an abundance of caution, RS from the Area 4 pilot channel was proposed to be placed in Subarea F, which was subsequently disapproved as detailed above. A second location for placement of the dredged pilot channel sediments in Geotubes in the Subarea G floodplain was considered and is detailed below.

The chemical/toxicity rationale for allowing this material to be placed in these locations or migrate downstream includes the following: The Area 4 Phase 3 pre-design investigation (PDI) included depth-composited samples from approximately 42 cores for evaluation of polycyclic aromatic hydrocarbons (PAHs) and metals. These included cores below the PCB dredge footprint in Subarea E and cores from Subareas C and D within and lateral to areas where a pilot channel was contemplated (GEI, 2023b). The average concentrations of these constituents are consistent with upstream background data and data collected from Area 3 prior to sediments in Area 3 being allowed to be placed in the Area 4 scour hole.

Michigan Department of Environment, Great Lakes, and Energy (formerly Michigan Department of Environmental Quality [MDEQ]) conducted non-PCB evaluations in Areas 3 and 4 in 2016. (MDEQ 2016a; and MDEQ 2016b). These studies showed a similar range of concentrations of metals, but in some cases somewhat higher concentrations of PAHs than what GEI collected in Phase 3. As noted above, this material was allowed to migrate downstream during the Area 3 TCRA.

The MDEQ (2016a) sample plan proposed evaluating samples collected in the Area 4 Trowbridge Impoundment for biotoxicity, presumably some variation of sediment toxicity test. Although sediment chemistry was evaluated, we are not aware of any actual biotoxicity results for this 2016 effort. However, following removal of the dam in Area 3, additional sediment cores were collected in the Area

4 Trowbridge Impoundment for chemical analysis and toxicity testing using standard 10-day *Hyalella azteca* and *Chironomus dilutus* tests. These samples, collected in 2018 following Area 3 dam removal, would be representative of RS mobilized into Area 4. Eight samples of paired data are available (MDEQ 2018, GLEC 2018). As EPA has previously indicated verbally, the sediments were found to be nontoxic. The MDEQ samples exhibited similar or higher concentrations than the Area 4 PDI Phase 3 samples for RS. Given this, Area 4 RS is expected to be nontoxic. It is not necessary to pursue further biotoxicity studies relative to allowing RS to migrate downstream.

An issue raised by EPA has been the potential for physical smothering of aquatic biota as sediment redeposits downstream of Area 4. At EPA's direction, a more gradual drawdown can be used to limit incremental project-related downstream transport to 90,000 CY per year, contributing to the protection of aquatic biota.

Based on the preponderance of evidence from the Phase 3 PCB and non-PCB data and from the earlier MDEQ non-PCB studies, there is a low likelihood of adverse ecological effects from the gradual migrations of RS downstream of Area 4.

Evaluation of Alternatives for Pilot Channel Sediment Placement

Two alternatives were evaluated for managing RS without using Subarea F as a location for placement. The use of Subarea G was considered but found to be less favorable than the second alternative. The selected alternative is an extended drawdown period that allows sediments to move downstream in a controlled manner. The selected alternative addresses both comments #2 and #3 of the EPA disapproval.

Placement of RS in Subarea G Alternative

Assuming a pilot channel were included in the final design, an alternative location for RS placement within Area 4 would be Subarea G as shown on Figure 2. Interest in this alternative placement location was expressed by both EPA and Michigan Department of Natural Resources (MDNR). RS would be delivered to Geotubes and staged within Subarea G. The Geotube field would encompass an estimated 8 acres of the Subarea G floodplain. Geotubes would remain in place and future disposal, if required, would be added to the final Area 4 remedy described in a future Record of Decision (ROD).

Potential benefits of placement of material within Subarea G and its adjacent floodplain include the following:

- The subject area is accessible due to existing or planned access roads.
- Limited grading and clearing / grubbing would be required to prepare the subgrade (assuming any floodplain contamination would not need to be addressed prior to pad construction).
- Use of the subject area does not appear to be flood prone.
- The subject area is fairly isolated.
- The subject area appears to be of sufficient size to contain the anticipated staging footprint.

Several issues associated with this alternative make it an unfavorable option.

- Additional costs would be incurred to construct a management pad for the Geotubes.
- The management pad and location of the Geotubes could interfere with future investigation efforts to support remediation of the floodplain.
- Dewatered sediments would require a future level of on-site management and associated costs (e.g., grading and planting, re-use in other areas, etc.).
- Additional costs would be incurred to maintain site security and pad maintenance until a ROD is approved.

- This option would be aesthetically unsightly, for an extended period, until the material is removed and/or reused.
- Use of this option would need to be included in the Feasibility Study for the Area 4 Floodplain currently being prepared by others so that it is addressed in the ROD for the remedial work.

Managed Mobilization of Erodible RS Alternative

To address comments related to sediment transport and alternative areas for placement of the dredged pilot channel sediments, a second alternative was evaluated. This alternative became available because EPA retracted its prior direction to complete the drawdown within an arbitrary time period. This alternative uses the planned water control structure to meter the rate of sediment transport to less than 180,000 CY per year, as EPA has directed.

The exact length and sequence of this proposed drawdown will be established during revision of the design using the sediment transport model. Initial modeling has been performed as part of this response, resulting in a new prediction of annual sediment mobilization. Preliminary results indicate mobilization of sediment can be managed to less than 180,000 CY annually during the TCRA removal period. The preliminary model run is based on initial drawdown from the current spillway elevation of 654.5 feet to the water control structure elevation of 646 feet over a period of 1 year and then to the proposed final riffle elevation of 643 feet over a period of approximately 2 more years. To address sediment mobilization concerns, stop logs can periodically be added to the water control structure to temporarily raise the water surface elevation and slow velocity to slow sediment mobilization.

Figure 3 depicts the preliminary sediment modeling results, which show less than 90,000 additional CY RS mobilized per year from the TCRA area over a 3- to 4-year simulated drawdown period. The predicted volumes are tabulated in Figure 4. As shown in Figure 3, the water control structure is lowered and then periodically raised throughout the drawdown period to limit sediment mobilization. Considering total volume expected to mobilize and the allowable mobilization rate, drawdown is expected to take 3 to 4 years.

Given the marginally longer drawdown period to achieve the sediment transport threshold, neither a pilot channel nor riffle enhancements upstream of the dam is necessary. A gradual drawdown will also reduce the potential for ecological damage from sediment accumulating downstream of the Trowbridge Dam.

The proposed alternative that includes a gradual drawdown approach will also mitigate exposure to PCB-contaminated riverbank and floodplain soils. It will do so by first removing sediment exceeding the action levels set out in the TCRA action memorandum and by ensuring a stable river channel, both on the riverbanks and riverbed.

As stated in the May 5, 2023 memo regarding modeling comments, both vegetated banks and banks with properly installed protective treatments are designed to withstand expected erosive forces. Exposed and graded surfaces along the banks will be seeded at appropriate seeding rates with a riparian/bank native Michigan plant seed mix that will include annual oat and rye seed. The prepared seed bed and overall subgrade will be protected using a high-strength coir erosion control blanket (ECB). The ECB serves as bank protection until permanent vegetation has filled in. The North American Green C-125BN ECB specifies an unvegetated shear stress threshold of 2.35 lbs/ft². Vegetated coir fabric has a permissible shear stress of 4–8 lbs/ft² (Fischenich, 2001).

Bank treatment design was developed to withstand modeled 100-year shear stresses from the toe to the top of the bank, which vary throughout the reach up to a maximum of 4.1 lbs/ft², and will be updated with any future changes to the design. In areas of higher stresses, the bank lifts just above the stone toe will be constructed from Bio-D block, which has an unvegetated shear stress threshold of 4.5 lbs/ft².

Maintenance and monitoring during the temporary erosion control period will verify the establishment of both temporary (annual) and permanent (perennial) vegetation.

Also detailed in the May 5, 2023 memo, bed stability will be maximized by keying the stone toe to the alluvium, building the riffles on stable subgrade (if riffles are part of the design), and using appropriately sized stone in those features based on standard engineering practices (e.g., NRCS, 2007). As discussed in meetings with EPA on November 3, 2022 and April 13, 2023, GEI's intent is to construct the proposed riffle and stone toes on alluvial subgrade. Given the time-critical designation of this project, the field engineering team will evaluate riffle subgrades in conjunction with EPA oversight and improve as necessary (i.e., undercutting erodible material) until stable subgrade is achieved. Similar to the riffle subgrade preparation approach, the stone toe will also be keyed into alluvium at the banks, and the engineering team will likewise ensure stone toe will be installed on stable subgrade.

These steps will protect against scour and erosion both in the long-term and in the interim period between construction and full establishment of the vegetated banks, meeting the requirement in EPA's June 28 email.

The Recommended Alternative

The second alternative – Managed Mobilization of Erodible Remaining Sediments – is recommended and meets the goals of the TCRA action memorandum (EPA, 2020). The scope of work to address sediment transport under this alternative includes the following:

- Install steel sheeting to support remaining material in Subareas F and G adjacent to TCRA channel work.
- Use best management practices consistent with other approved projects on the river, including temporary turbidity curtains, to minimize sediment mobilization.
- Remove PCB-impacted channel sediment to established cleanup standards.
- Install water control structure to control water-level drawdown and related sediment transport over a multi-year period.
- Install a sediment trap and harvest captured sediment from sediment trap for on-site reuse, as necessary.
- Remove PCB-impacted bank soil to established cleanup standards and restore banks in Subareas C and D.
- Install Osgood and Schnable grade controls.
- Remove Trowbridge Dam and harvest clean left descending bank material for reuse in bank restoration.
- Construct a riffle at former dam; with a crest at elevation 643 feet.
- Optimize the remedy through best management practices to ensure channel stability.

Key Differences Between Revised (Submitted) Design and Recommended Alternative

Several elements from the revised design submitted in August 2022 have been altered in the recommended alternative, including elimination of a pilot channel, elimination of RS placement in Subarea F, and elimination of 11 coarsened riffles upstream of the Trowbridge Dam. The pilot channel and upstream riffles in the revised design were not components of the TCRA action memorandum but were included solely to reduce the amount and rate at which sediment would mobilize given EPA's direction to limit the length of the drawdown period. These features are no longer needed with the application of a slower and longer drawdown period. Initial modeling runs support this means of sediment transport management and indicate it will keep the total annual sediment transport to below the 180,000 CY annual threshold.

Once EPA approves this recommended alternative concept, additional design and hydrologic evaluation will be conducted to optimize the drawdown period and sediment management practices. A drawdown management plan will be developed to actively monitor and maintain the condition of the channel during the extended drawdown period. The plan will include drawdown sequencing, best management practices, and a bank monitoring plan to facilitate completing the bank removal and restoration efficiently.

In summary, our recommended alternative fully addresses the scope and intent of the TCRA action memorandum, is allowable under CERCLA, is the most sustainable, and is consistent with practices used elsewhere on the river. We look forward to providing a plan and timeline to revising the design to get the removal action underway.

References

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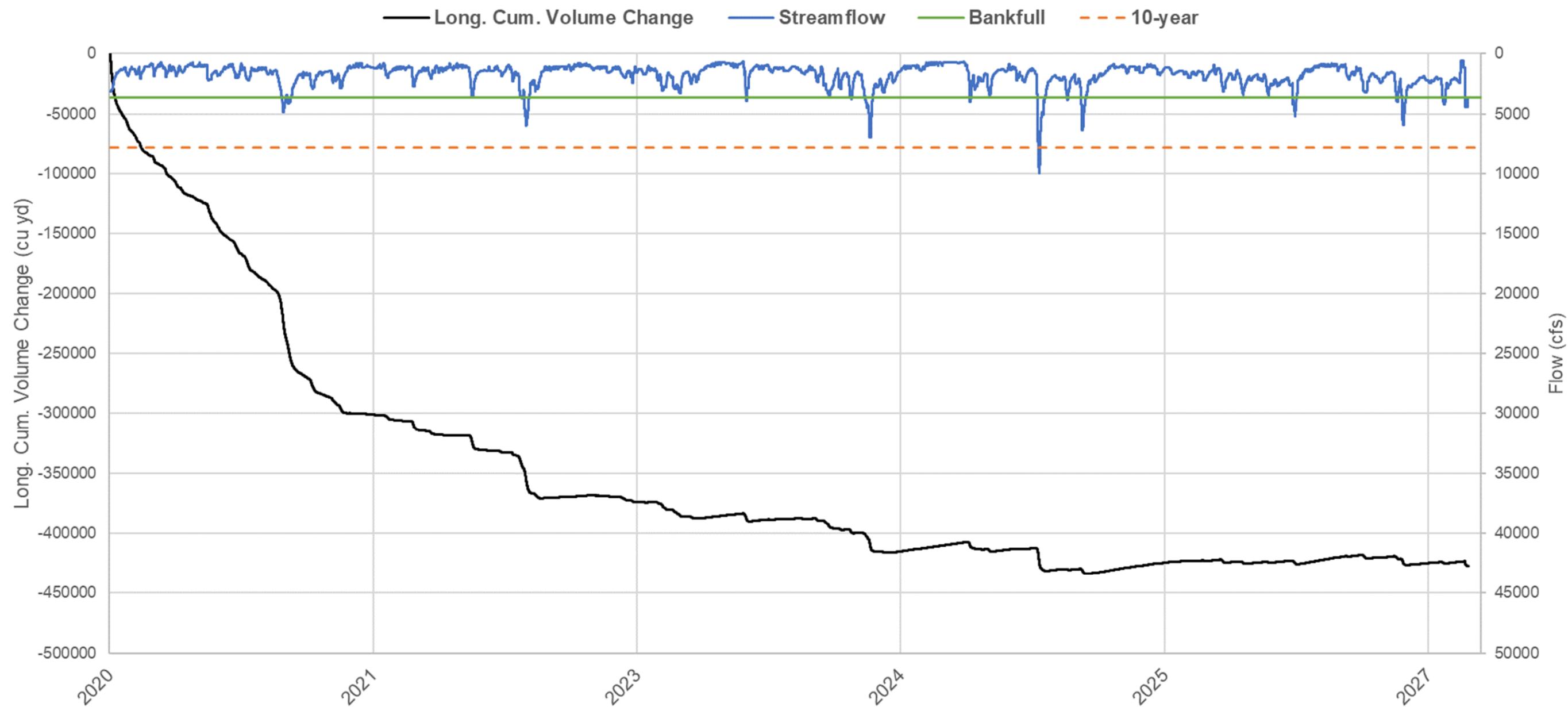
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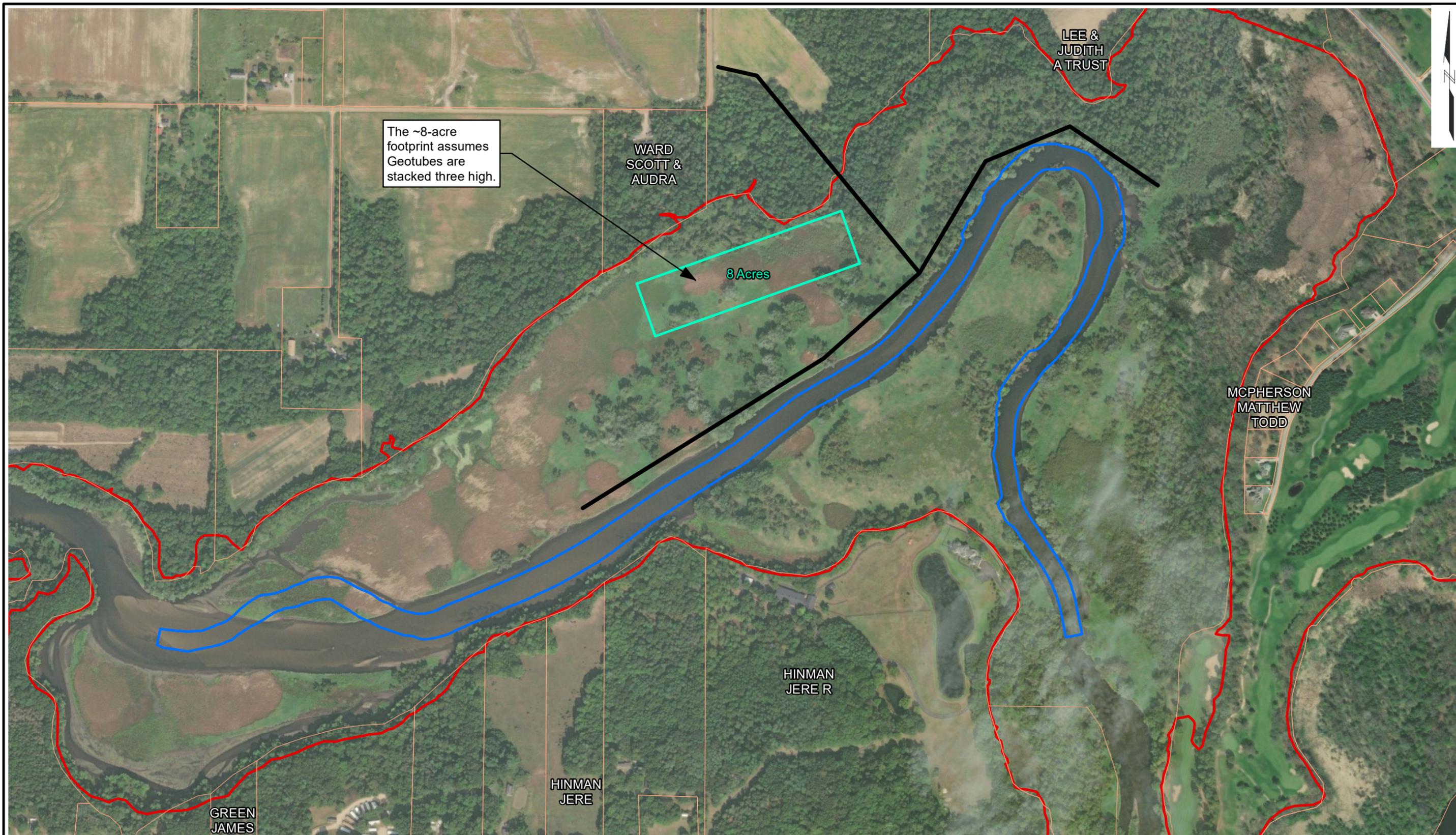


OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site
 Area 4 TCRA – Allegan County, Michigan
 Kalamazoo River Areas 2, 3, and 4 Remediation LLC



SEDIMENT MOBILIZATION AS PRESENTED TO AGENCIES IN 30% DESIGN MEETINGS (5-19-21)
 Project 2000273
 June 2023

Fig. 1



The ~8-acre footprint assumes Geotubes are stacked three high.

WARD SCOTT & AUDRA

LEE & JUDITH A TRUST

8 Acres

MCPHERSON MATTHEW TODD

HINMAN JERE R

GREEN JAMES

HINMAN JERE

- LEGEND:**
- Hauling road
 - Pilot channel
 - Bag field boundary
 - Area 4 Boundary
 - Parcel boundary



OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site
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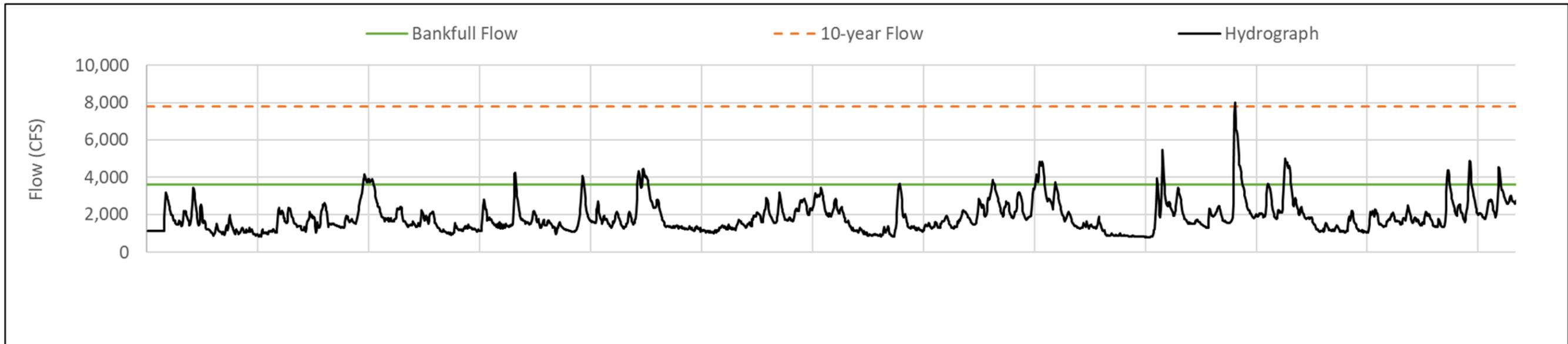
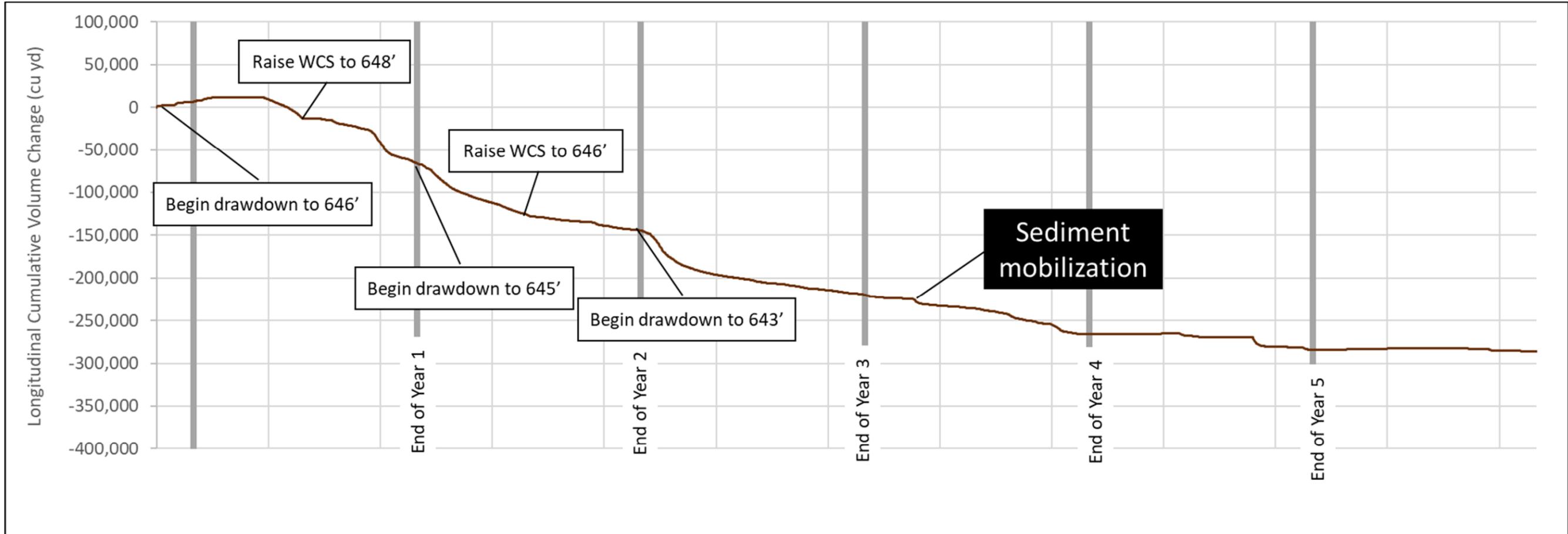
AREAS 2, 3 AND 4 TCRA

Project 2000273

SUBAREA G
 BAG FIELD

June 2023

Fig. 2



OU5 Allied Paper/Portage Creek/Kalamazoo River
Superfund Site
Area 4 TCRA – Allegan County, Michigan

Kalamazoo River Areas 2, 3, and 4 Remediation LLC



SEDIMENT MOBILIZATION
DURING DRAWDOWN

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June 2023

Fig. 3

Sediment Mobilization During Drawdown	
	Volume (CY)
Year1	-66,000
Year2	-78,000
Year3	-75,000
Year4	-46,000
Year5	-19,000
Year6	-1,000
Total	-286,000

Incremental sediment

Total Volume Accounting		
Mobilized Sediment Source	90% Design - Vol (CY)	Alt Analysis - Vol (CY)
Pilot Channel	149,000	0
C, D, & E Mobilized Sediment	173,000	286,000
Sediment Potentially Staying in A4	108,000	144,000
Total	430,000	430,000

OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site Area 4 TCRA – Allegan County, Michigan		SEDIMENT MOBILIZATION DURING DRAWDOWN
Kalamazoo River Areas 2, 3, and 4 Remediation LLC	Project 2000273	June 2023

Fig. 4