

Appendix H

Cost Estimate Assumptions

APPENDIX H: COST ESTIMATE ASSUMPTIONS

GENERAL NOTES

The cost estimates presented herein have been developed at an accuracy of -30 to +50%, in accordance with USEPA guidance (USEPA 2000).

- Total costs represent an estimated capital cost associated with individual items.
- Unit costs are in 2013 dollars and estimated from standard estimating guides (e.g., means site work and landscape cost data, vendors, professional judgment, and/or experience from other similar projects [i.e., TCRAs]).
- These estimates have been developed using current and generally accepted engineering cost estimation methods. These estimates are based on assumptions concerning future events and actual costs may be affected by known and unknown risks including, but not limited to, changes in general economic and business conditions, site conditions that were unknown at the time the estimates were performed, future changes in site conditions, regulatory or enforcement policy changes, and delays in performance.

A detailed description of assumptions for each alternative listed is provided below.

ASSUMPTIONS FOR SEDIMENT ALTERNATIVES

Alternative S-2: MNR, ICs, and ECs

- Long-term monitoring (LTM) operation and maintenance (O&M) costs include fish tissue, sediment, and surface water sampling and verification of institutional controls. LTM samples would be collected once a year for the first 5 years and then once every 5 years until year 30. The samples would be submitted for laboratory analysis for PCBs (Aroclors) and fish tissue would also be analyzed for lipids. Fish tissue sampling would include 7 locations spanning Area 1 and background/ reference areas with a total of 6 fish of each species/type (smallmouth bass fillet, smallmouth bass whole, and carp) collected per location; for a total of 126 fish per sampling event. Sediment sampling would be performed using an incremental sampling method to compile samples representing three depth intervals in Area 1 Sections 2, 3, 4, 7, and 8 (15 incremental samples) plus QA/QC samples. Surface water sampling costs include the collection 10 analytical samples plus 4 QA/QC samples per sampling event. Verification of ICs would include verifying the status of the ICs and replacing controls (signs) annually until year 30. Initial installation and a one-time maintenance action in year 15 for erosion control are also included. It is assumed that very minor repairs of the river bank in Area 1 will be needed during the 30-year monitoring period. The river bank erosion control would consist of placement of coir logs or rock armor stone at the median water level, installation of erosion control blanket from the median water level to the top of slope, and plantings if necessary or as needed. Data results reporting and 5-year reviews of the LTM program would be completed throughout the MNR period.
- A 20% allowance is included for contingency (e.g., scope and bid) to provide for unforeseen circumstances or variability in estimated areas and costs, and is applied to

the O&M Program costs. A 15% allowance for project management and technical support is also included.

- The estimated cost for the LTM program is calculated using the present worth analysis process outlined by the USEPA (2000). A discount rate of 7% is used for the present worth calculation, and expenditures are assumed to occur at the start of the first LTM event.

Alternative S-3A: Removal of Hot Spot Areas and Crown Vantage Side Channel, MNR, ICs, and ECs

- Mobilization/demobilization includes mobilization and demobilization of labor, equipment, and materials necessary to perform remedial activities. Estimate assumes 5% of capital costs excluding transportation and disposal related costs.
- Site preparation cost includes labor, equipment, and materials necessary to perform clearing, installing temporary erosion and sedimentation controls, constructing material staging and decontamination areas, constructing temporary access roads, and preparing the site for construction. Access roads would be constructed 20 feet wide, underlain with woven geotextile, and would consist of a 1-foot-thick stone base. Cost assumes approximately 5,000 feet of access roads. Five material staging areas would be required, one each for S-IM1 and Crown Vantage and three for the other four hot spot areas. Each would measure approximately 1/2-acre in size and would be constructed with an average 1.5-foot-thick stone base, and underlain with nonwoven geotextile, 40-mil flexible membrane liner. Each staging area would be sloped to a sump for staging removed material to facilitate material dewatering and compartmented with concrete bin blocks to support material handling and stabilization. Material staging areas would also be equipped with decontamination areas.
- Resuspension controls cost includes labor, equipment, and materials necessary to install turbidity curtains, sheetpile deflection walls equipped with turbidity curtains, and/or sheetpile enclosures. Due to the variability and uncertainty of site conditions, the cost estimate assumes a resuspension control for removal area(s) of 70% turbidity curtains, 25% deflection walls with turbidity curtains, and 5% sheetpile enclosures.
- Debris removal cost includes labor, materials, equipment, and services necessary for handling/removing obstacles and debris (e.g., boulders, remnant concrete slabs, etc.) from remediation areas prior to removal. Assumes 4 acres of debris removal area.
- Mechanical removal activities cost includes labor, materials, equipment, and services necessary to complete excavation of impacted material. Excavated material would be transported via barge to a material staging area for dewatering and stabilization. Removal of impacted material is assumed using conventional construction equipment (e.g., excavators, cranes equipped with clamshell buckets, etc.). Assumes one crew with a daily production rate of 200 cy per day. The removal volume was estimated at 19,500 cy and incorporates additional volume to account for constructability and implementation constraints per Section 3.4.3 of the Technical Guidelines for Environmental Dredging of Contaminated Sediments (Palermo, et al. 2008).
- Material dewatering and handling activities cost includes the dewatering and stabilization of material following excavation activities. Dewatering would occur passively at the

material staging area. A stabilization admixture (e.g., portland cement) would be added at a ratio of 12% of the volume of material to be stabilized. It is assumed that water generated in association with material management would be treated onsite via a temporary water treatment system.

- Water treatment cost includes installation and operation. Cost estimate assumes a 100-gallon per minute (gpm) water treatment system including pumps, influent piping and hoses, frac tanks, carbon filters, bag filters, discharge piping and hoses, and flow meter. Cost estimate assumes daily bag filter change outs. Estimate assumes treated water would be discharge back to the Kalamazoo River. Duration based on assumed excavation rate and associated river work activities (i.e., survey, confirmation sampling, etc.). Duration also includes an additional two months for a system startup and testing period and system demobilization.
- Post-removal confirmation sampling cost includes labor, materials, and laboratory analytical costs necessary to collect and analyze sediment samples confirming the PCB levels achieved. Consistent with the TCRAs, cost assumes sampling frequency of one per 500 square feet of removal area.
- Residuals management cost includes procurement, transportation of material, and placement of a clean cover layer over the removal area. Material placement is assumed via barge and excavator or a crane equipped with a clamshell bucket. The layer would consist of a 6-inch thin lift of clean sand placed over the removal area. Assumes a daily production rate of 300 cy and 20% additional material to account for loss during transportation and placement. It is assumed that 100% of the removal area would require cover placement.
- Transportation and disposal of material cost assumes materials would be disposed off site. Disposal volume estimate assumes removed in situ materials bulked due to stabilization agent. Assumes removed materials would be 15% TSCA and 85% non-TSCA by weight. TSCA material would be disposed at a landfill located approximately 140 miles from the site. Non-TSCA material would be disposed at a landfill located approximately 70 miles from the site. Sampling includes the analysis of samples (including TCLP metals, PCBs, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), ignitability, reactivity, and corrosivity); however, waste characterization analyses are subject to change based on the selection of final disposal facility. Costs assume that waste characterization samples would be collected at a frequency of one sample per every 500 tons of material destined for off-site treatment/disposal.
- Environmental monitoring cost, consistent with the TCRAs, includes labor and equipment necessary to perform air and water column monitoring during remediation. Air monitoring activities would include perimeter air monitoring for particulates at the material staging area and real-time continuous particulate air monitoring at the active work zone. Water column monitoring would consist of real-time turbidity monitoring at three locations (one upstream and two downstream) and water column sampling would consist of total suspended solids (TSS) and PCB (Aroclors) at the three locations weekly during removal and cap (TSS only) activities.
- Survey cost includes performing field surveys documenting pre- and post-construction conditions of the remediation. The remedial area surveys would include pre-construction, interim, and final surveys using either multi-beam acoustic depth measurement

techniques in accordance with the USACE Hydrographic Surveying Engineering Manual (USACE 2004) and/or conventional survey methods, as dictated by field conditions. In addition, conventional surveys of the disturbed areas to support the construction (i.e., access roads, material staging areas) would also be performed pre- and post-construction. Documentation of the limits of restoration would be included.

- Restoration cost includes labor, equipment, and materials to restore upland, wetland, and riverbank habitat areas disturbed during the remediation. The habitat areas would be restored with native seed mixes, woody plantings, and topsoil. Bank restoration assumes the disturbed banks would receive coir logs placed at the median water level, installation of erosion control blanket from the median water level to the top of slope, and restoration plantings at a density of 300 plants per acre (consistent with the TCRAs). In addition, it is assumed that 50% of the banks would receive river rock armor stone and a geotextile filter layer installed from the median water level to toe of slope. The assumed width of restored bank is 25 feet.
- A 35% allowance is included for construction contingency (e.g., scope and bid) to provide for unforeseen circumstances or variability in estimated areas, volumes, and costs, and is applied to the sum of itemized subtotaled capital costs. A 15% allowance for project management (5%), remedial design (5%), and construction management (5%) is also included. Pre-remedial design sampling costs assume sample collection from 30 transects spanning the remedial reach.
- Restoration monitoring includes performing erosion inspections of the disturbed areas annually for the first 5 years and then once every 5 years until year 30 and would include visual inspections. Reporting would be included as a component of the LTM, and would summarize the results of the monitoring activities. Cost does not include exotic/invasive species control.
- LTM O&M cost assumptions are consistent with Alternative S-2 (MNR, ICs, and ECs)
- A 20% allowance is included for contingency, and project management/technical support at 15% is applied to the O&M Program costs.
- The estimated cost for the LTM program is calculated using the present worth analysis process outlined by the USEPA (2000). A discount rate of 7% is used for the present worth calculation, and expenditures are assumed to occur at the end of construction.

Alternative S-3B: Removal of Hot Spot Areas and Capping Crown Vantage Side Channel, MNR, ICs, and ECs

- Cost assumptions are consistent with Alternative S-3A for hot spots excavation.
- Costs for Crown Vantage side channel cap include labor and materials for the procurement and transportation necessary for the placement of cap materials. Cap material placement is assumed using a barge and excavator or a crane equipped with a clamshell bucket. The cap will consist of a 1.5-foot-thick soil cap comprised of a 1-foot thick layer of clean sand followed by a 0.5-foot thick layer of gravel armor stone. Assumes a daily production rate of 300 cubic yards and 20% additional material to account for loss during transportation and placement.
- Cap monitoring and maintenance cost includes cap inspections at a frequency of once every year for the first 5 years and then once every 5 years until year 30. A one-time

maintenance event for erosion control is assumed and the cost is based on 10% of the total costs for LTM. It is assumed that cap maintenance activities would be performed concurrent with the cap monitoring activities. Reporting and a 5-year review of the cap monitoring and maintenance program would be completed throughout the 30 years.

Alternative S-4A: Removal of Hot Spot Areas, Crown Vantage Side Channel, and Section 3 River Edges, MNR, ICs, and ECs

- Mobilization/demobilization cost assumptions are consistent with Alternative S-3A (Removal of Hot Spot Areas and Crown Vantage Side Channel, MNR, ICs, and ECs).
- Site preparation cost assumptions are consistent with Alternative S-3A. Cost assumes approximately 10,000 linear feet of access roads.
- Resuspension controls cost assumptions are consistent with Alternative S-3A, with application extending through Section 3 for edge removal activities.
- Debris removal cost assumptions are consistent with Alternative S-3A.
- Mechanical removal activities cost assumptions are consistent with S-3A. The removal volume was estimated at 63,900 cy and incorporates additional volume to account for constructability and implementation constraints per Section 3.4.3 of the Technical Guidelines for Environmental Dredging of Contaminated Sediments, 2008 - ERDC/ELTR-08-29.
- Material dewatering and handling activities cost assumptions are consistent with Alternative S-3A.
- Water treatment cost assumptions are consistent with Alternative S-3A.
- Post-removal confirmation sampling cost includes labor, materials, and laboratory analytical costs necessary to collect and analyze sediment samples confirming the PCB levels achieved. Consistent with the TCRAs, cost assumes sampling frequency of one per 500 square feet of removal area.
- Residuals management cost assumptions are consistent with Alternative S-3A.
- Transportation and disposal of material cost assumptions are consistent with Alternative S-3A.
- Environmental monitoring cost assumptions are consistent with Alternative S-3A.
- Survey cost assumptions are consistent with Alternative S-3A.
- Restoration cost assumptions are consistent with Alternative S-3A, with post-excavation sand cover applied to 100% of hot spot excavation footprint, and 50% of edge removal areas, revegetation of staging areas and 25 ft along the bank of edge removal areas, and armoring along 50% of the edge removal length.
- A 35% allowance is included for construction contingency (e.g., scope and bid) to provide for unforeseen circumstances or variability in estimated areas, volumes, and costs, and is applied to the sum of itemized subtotaled capital costs. In addition, 15% allowance for project management (5%), remedial design (5%), and construction management (5%) is included. Pre-remediation remedial design sampling for the remedial reach is consistent with Alternative S-3A.

- Restoration monitoring cost assumptions are consistent with Alternative S-3A.
- LTM O&M cost assumptions are consistent with Alternative S-2 9MNR, ICs, and ECs).
- A 20% allowance is included for contingency and project management/technical support at 15% is applied to the O&M Program costs.
- The estimated cost for the LTM program is calculated using the present worth analysis process outlined by the USEPA (2000). A discount rate of 7% is used for the present worth calculation, and expenditures are assumed to occur at the end of construction.

Alternative S-4B: Removal of Hot Spot Areas, Section 3 River Edges, and Capping Crown Vantage Side Channel, MNR, ICS, and ECS

- Cost assumptions are consistent with Alternative S-4A for hot spot and edge removal activities, and with Alternative S-3B for additional Crown Vantage Side channel capping and LTM activities.

Alternative S-5: Area 1-Wide Removal (RAL = 1 mg/kg)

- Mobilization/demobilization cost assumptions are consistent with Alternative S-3A.
- Site preparation cost assumptions are consistent with Alternative S-3A. Cost assumes approximately 58,000 linear feet of access roads. At least 20 material staging areas would be required to address the locations with sediments containing PCBs > 1 mg/kg.
- Resuspension controls cost assumptions are consistent with Alternative S-3A.
- Debris removal cost assumptions are consistent with Alternative S-3A.
- Mechanical removal activities cost assumptions are consistent with Alternative S-3A. The removal volume was estimated at 485,650 cy and incorporates additional volume to account for constructability and implementation constraints per Section 3.4.3 of the Technical Guidelines for Environmental Dredging of Contaminated Sediments (Palermo, et al, 2008).
- Material dewatering and handling activities cost assumptions are consistent with Alternative S-3A.
- Water treatment cost assumptions are consistent with Alternative S-3A.
- Post-Removal confirmation sampling cost assumptions are consistent with Alternative S-3A.
- Residuals management cost assumptions are consistent with Alternative S-3A.
- Transportation and disposal of material cost assumptions are consistent with Alternative S-3A.
- Environmental monitoring cost assumptions are consistent with Alternative S-3A. Survey cost assumptions are consistent with Alternative S-3A.
- Restoration cost is consistent with Alternative S-3A.
- A 45% allowance is included for construction contingency (e.g., scope and bid) to provide for unforeseen circumstances or variability in estimated areas, volumes, and costs, and is applied to the sum of itemized subtotaled capital costs. In addition, 25%

allowance for project management (10%), remedial design (5%), and construction management (10%) is included. Pre-remedial design sampling for all of Area 1 (22 miles) is proportional to cost for the remedial reach sampling effort for the 3-mile remedial reach in the other remedial alternatives.

- Restoration monitoring cost assumptions are consistent with Alternative S-3A.
- Due to the large scope of work required to implement this alternative (S-5), it is assumed that construction activities and costs would be allocated over a 10-year period. Regular inspections of completed work and erosion controls would be performed throughout the 10 year construction period.
- LTM O&M cost assumptions are consistent with Alternative S-3A, excluding sediment sampling. Long term monitoring would be performed annually for the first 5 years starting in year 11, and every 5 years thereafter. River bank erosion control activities would be performed in year 20. It is assumed that 50% of the river banks in Area 1 would need erosion control measures. The erosion control measures would consist of placement of coir logs or rock armor stone at the median water level, installation of erosion control blanket and geotextile filter layer from the median water level to the top of slope, and plantings. The cost of performing erosion control measures is assumed to be 10% of the capital costs.
- A 20% allowance is included for contingency and project management/technical support at 15% is applied to the O&M Program costs.
- The estimated cost for the LTM program was calculated using the present worth analysis process outlined by the USEPA (2000). A discount rate of 7% was used for the present worth calculation and expenditures are assumed to occur at the end of construction.

ASSUMPTIONS FOR FLOODPLAIN ALTERNATIVES

Alternative FPS-2: MNR, ECs, AND ICs

- Floodplain exposure sampling costs include sampling of representative residential exposure units (i.e., residential backyards or equivalent exposure unit area on a non-residential property) by incremental sampling methodology (ISM). Scope includes sampling 10% of the non-state-owned parcels (i.e., 10% of the residential, agricultural, and commercial/industrial zoned parcels) in Area 1 outside the former TCRA study areas. ISM samples will be collected at two depth intervals (0-6" and 6"-12") for analysis. Sampling and analytical costs are based on 2013 ISM sampling performed in Area 3, and include site access agreements QC samples. Costs also include desktop evaluations to identify representative parcels for sampling (flood modeling, geomorphic landforms assessment, parcel zoning/land use evaluation, title searches, etc.), site reconnaissance, data validation, data evaluation, and reporting; plus a 20% contingency.
- LTM costs include collection of soil samples and visual inspection of the floodplain area. Visual inspections would be performed annually for the first 5 years and then once every 5 years until year 30. It is assumed that a baseline core sampling event would occur at year 0 and then be repeated at year 5 to estimate natural recovery rates. Cost includes 10 sample locations within a 7-acre area with PCB concentrations greater than 20 mg/kg at four depth intervals of 0"-1", 1"-2", 2"-4", and 4"-6".

- A contingency of 10% (scope of work and bidding) and project management/technical support cost of 15% is assumed.
- The estimated cost for the LTM program is calculated using the present worth analysis process outlined by the USEPA (2000). A discount rate of 7% is used for the present worth calculation, and expenditures are assumed to occur at the start of the first LTM event.

Alternative FPS-3: Capping (RAL = 20 mg/kg), ECs and ICs

- Mobilization/demobilization includes mobilization and demobilization of labor, equipment, and materials necessary to perform remedial activities. Estimate assumes 5% of capital costs excluding transportation- and disposal-related costs.
- Site preparation cost includes labor, equipment, and materials necessary to perform clearing of the area to be capped, installing temporary erosion and sedimentation controls, constructing material staging and decontamination areas, constructing temporary access roads, and otherwise preparing the site for construction. Cleared vegetation would be chipped and left onsite. Access roads would be constructed 20 feet wide, underlain with woven geotextile and would consist of a 1-foot-thick stone base. Cost assumes approximately 1 mile of access road. Three material staging areas would be required; each would measure approximately 1/2-acre. Each would be constructed with an average 1.5-foot-thick stone base, underlain with nonwoven geotextile, and sloped to a sump for drainage. Material staging areas would also be equipped with decontamination areas.
- Cap cost includes labor and materials for the procurement and transportation necessary for the placement of cap materials. Cap material placement is assumed using conventional construction equipment (e.g., excavator). The cap would consist of a 1.0-foot-thick system consisting of a 0.5-foot-thick layer of clean borrow fill followed by a 0.5-foot thick layer of topsoil. Prior to placement of the cap, a nonwoven geotextile layer would be placed over the existing ground surface. Assumes one crew with a daily production rate of 750 cy and approximately 20% additional material to account for loss during transportation and placement and 3% additional geotextile material to account for overlapping of adjacent panels.
- Environmental monitoring cost includes labor and equipment necessary to perform air monitoring during site preparation and construction. Air monitoring activities would include perimeter air monitoring for particulates at the material staging area, real-time particulate air monitoring at the active work zone, health and safety related monitoring, and daily inspections.
- Restoration cost includes labor, equipment, and materials to restore upland and wetland areas disturbed during the remediation. The habitat areas would be restored with native seed mixes, woody plantings, and topsoil. Restoration plantings would be at a density of 300 plants per acre, consistent with the TCRAs. Cost assumes restoration of approximately 11 acres of disturbance.
- Survey cost includes performing conventional surveys documenting pre- and post-construction conditions. In addition, conventional surveys of the disturbed areas (i.e., access roads, material staging area) to support the construction would also be

performed. Documentation of the limits of restoration would also be included. Survey cost assumes survey of approximately 11 acres of disturbance.

- A 35% allowance is included for construction contingency (e.g., scope and bid) to provide for unforeseen circumstances or variability in estimated areas, volumes, and costs, and is applied to the sum of itemized subtotaled capital costs. In addition, a 15% allowance is included for project management (5%), remedial design (5%), and construction management (5%). Pre-remedial design sampling assumes collection and analysis of 180 samples for PCBs in the former Plainwell Impoundment area.
- Floodplain exposure sampling costs include sampling of representative residential exposure units (i.e., residential backyards or equivalent exposure unit area on a non-residential property) by incremental sampling methodology (ISM). Scope includes sampling 10% of the non-state-owned parcels (i.e., 10% of the residential, agricultural, and commercial/industrial zoned parcels) in Area 1 outside the former TCRA study areas. ISM samples will be collected at two depth intervals (0-6" and 6"-12") for analysis. Sampling and analytical costs are based on 2013 ISM sampling performed in Area 3, and include site access agreements QC samples. Costs also include desktop evaluations to identify representative parcels for sampling (flood modeling, geomorphic landforms assessment, parcel zoning/land use evaluation, title searches, etc.), site reconnaissance, data validation, data evaluation, and reporting; plus a 20% contingency.
- LTM includes performing visual inspections of the approximately 11 acres of disturbed areas annually for the first 5 years and then once every 5 years until year 30. Cost does not include exotic/invasive species control. Cap inspections would consist of visual observation of cap materials and erosion. Cap maintenance is a one-time cost based on approximately 10% of the capital cost of the cap placement; a contingency of 10% and project management/technical support at 10% are applied to the maintenance event. Reporting would be included as a component of the LTM event. Five-year reviews would be completed throughout the 30 years.
- The estimated cost for the LTM program was calculated using the present worth analysis process outlined by the USEPA (2000). A discount rate of 7% was used for the present worth calculation, and expenditures are assumed to occur at the end of construction.

Alternative FPS-4A: Removal (RAL = 20 mg/kg) AND ICs

- Mobilization/demobilization cost assumptions are consistent with Alternative FPS-3.
- Site preparation cost includes labor, equipment, and materials necessary to perform clearing of the area to be excavated, installing temporary erosion and sedimentation controls, constructing material staging and decontamination areas, constructing temporary access roads, and preparing the site for construction. Cleared vegetation would be chipped and left onsite. Access roads would be constructed 20 feet wide, underlain with woven geotextile, and would consist of a 1-foot-thick stone base. Cost assumes approximately 1 mile of access road. Three material staging areas would be required; each would measure approximately 1 acre. Each would be constructed with an average 1.5-foot-thick stone base, underlain with nonwoven geotextile, 40-mil flexible membrane liner. Each staging area would be sloped to a sump for staging excavated material to facilitate material dewatering and compartmented with concrete bin blocks to support material handling and stabilization. Material staging areas would also be equipped with decontamination areas.

- Floodplain soil excavation activities cost includes labor, materials, equipment, and services necessary to complete excavation of impacted material. Excavated material would be transported via off-road articulated dump trucks to a material staging area for dewatering and stabilization. Removal of impacted material is assumed using conventional construction equipment (e.g., excavators, etc.). Assumes one crew with a daily production rate of 500 cy. The removal volume of 12,100 cy assumes a factor of approximately 1.1 times the neat volume to account for constructability and implementation constraints.
- Backfill cost includes labor and materials for the procurement and transportation necessary for the placement of materials. Backfill placement is assumed using conventional construction equipment (e.g., excavator). The backfill would consist of a 1-foot-thick system comprised of a 0.5-foot-thick layer of clean general borrow fill followed by a 0.5-foot-thick layer of topsoil. Assumes one crew with a daily production rate of 750 cy working in parallel with excavation activities (i.e., the time for backfill activities does not contribute to the total duration of the alternative) and approximately 20% additional material to account for loss during transportation and placement.
- Material dewatering and handling activities cost includes the dewatering and stabilization of material following excavation activities. Dewatering would occur passively at the material staging area. Stabilization admixture (e.g., Portland cement) would be added at a ratio of 7% of the volume of material to be stabilized. It is assumed that 25% of the excavated material would require a stabilization admixture. It is assumed that any water generated in association with material management would be treated onsite via a temporary water treatment system.
- Water treatment cost includes installation and operation of a temporary water treatment system. Cost estimate assumes a 50-gpm water treatment system including pumps, influent piping and hoses, frac tanks, carbon filters, bag filters, discharge piping and hoses, and flow meter. Cost estimate assumes daily bag filter change outs. Estimate assumes treated water would be discharge to the Kalamazoo River. Duration is based on assumed excavation rate and associated work activities (i.e., survey, confirmation sampling, etc.). Duration also includes 2 months allotted for a system startup and testing period and system demobilization.
- Post-removal confirmation sampling cost includes labor, materials, and laboratory analytical costs necessary to collect and analyze soil samples confirming the PCB levels achieved. Consistent with the TCRAs, cost assumes sampling frequency of one per 500 square feet of removal area.
- Transportation and disposal of excavated material cost assumes materials would be disposed offsite. Disposal volume estimate assumes removed in situ materials bulked by 7% due to stabilization agent. Assumes removed materials would be 15% TSCA and 85% non-TSCA by weight. TSCA material would be disposed of at a landfill located approximately 140 miles from the site. Non-TSCA material would be disposed at a landfill located approximately 70 miles from the site. Sampling includes the analysis of samples (including, but not limited to, TCLP metals, PCBs, VOCs, SVOCs, ignitability, reactivity, and corrosivity). Cost assumes that waste characterization samples would be collected at a frequency of one sample per every 500 tons of material destined for off-site treatment/disposal.

- Environmental monitoring cost assumptions are consistent with Alternative FPS-3 (Capping (RAL = 20 mg/kg), ECs and ICs).
- Restoration cost assumptions are consistent with Alternative FSP-3.
- Survey cost assumptions are consistent with Alternative FSP-3.
- A 35% allowance is included for construction contingency (e.g., scope and bid) to provide for unforeseen circumstances or variability in estimated areas, volumes, and costs, and is applied to the sum of itemized subtotaled capital costs. In addition, a 15% allowance is included for project management (5%), remedial design (5%), and construction management (5%).
- Floodplain exposure sampling costs include sampling of representative residential exposure units (i.e., residential backyards or equivalent exposure unit area on a non-residential property) by incremental sampling methodology (ISM). Scope includes sampling 10% of the non-state-owned parcels (i.e., 10% of the residential, agricultural, and commercial/industrial zoned parcels) in Area 1 outside the former TCRA study areas. ISM samples will be collected at two depth intervals (0-6" and 6"-12") for analysis. Sampling and analytical costs are based on 2013 ISM sampling performed in Area 3, and include site access agreements QC samples. Costs also include desktop evaluations to identify representative parcels for sampling (flood modeling, geomorphic landforms assessment, parcel zoning/land use evaluation, title searches, etc.), site reconnaissance, data validation, data evaluation, and reporting; plus a 20% contingency.
- LTM cost assumptions are consistent with Alternative FPS-3. Maintenance is a one-time cost based on approximately 30% of the capital cost of the backfill installation and includes erosion maintenance. A contingency of 10% and project management/technical support at 10% is applied to the maintenance event.
- The estimated cost for the LTM program is calculated using the present worth analysis process outlined by the USEPA (2000). A discount rate of 7% is used for the present worth calculation, and expenditures are assumed to occur at the end of construction.

Alternative FPS-4B: Removal (RAL = 0.5 mg/kg) AND ICs

- Mobilization/demobilization cost assumptions are consistent with Alternative FPS-3.
- Site preparation cost assumptions are consistent with Alternative FPS-3. Assumes construction of approximately 33 miles of access roads. A total of 32 material staging areas, four 1-acre and twenty-eight 1/2-acre material staging areas would be required. Floodplain soil excavation cost assumptions are consistent with Alternative FPS-4A. Assumes two crews operating in parallel with a total daily production rate of 1,000 cy. The removal volume of 1,540,000 cy assumes a factor of 1.1 times the neat volume to account for constructability and implementation constraints.
- Backfill cost assumptions are consistent with Alternative FPS-4A.
- Material dewatering and handling activities cost assumptions are consistent with Alternative FPS-4A.
- Water treatment cost assumptions are consistent with Alternative FPS-4A.

- Post-removal confirmation sampling cost assumptions are consistent with Alternative FPS-4A.
- Transportation and disposal of excavated material cost assumptions are consistent with Alternative FPS-4A.
- Environmental monitoring cost assumptions are consistent with Alternative FPS-4A.
- Restoration cost assumptions are consistent with Alternative FPS-4A. Cost assumes restoration of approximately 949 acres of disturbance.
- Survey cost assumptions are consistent with Alternative FPS-4A. Survey cost assumes survey of approximately 950 acres of disturbance.
- A 35% allowance is included for construction contingency (e.g., scope and bid) to provide for unforeseen circumstances or variability in estimated areas, volumes, and costs, and is applied to the sum of itemized subtotaled capital costs. In addition, a 15% allowance is included for project management (5%), remedial design (5%), and construction management (5%).
- Due to the large scope of work required to implement this alternative (FPS-4B), it is assumed that construction activities would be carried out and cost allocated over a 10-year period.
- Floodplain exposure sampling costs include sampling of representative residential exposure units (i.e., residential backyards or equivalent exposure unit area on a non-residential property) by incremental sampling methodology (ISM). Scope includes sampling 10% of the non-state-owned parcels (i.e., 10% of the residential, agricultural, and commercial/industrial zoned parcels) in Area 1 outside the former TCRA study areas. ISM samples will be collected at two depth intervals (0-6" and 6"-12") for analysis. Sampling and analytical costs are based on 2013 ISM sampling performed in Area 3, and include site access agreements QC samples. Costs also include desktop evaluations to identify representative parcels for sampling (flood modeling, geomorphic landforms assessment, parcel zoning/land use evaluation, title searches, etc.), site reconnaissance, data validation, data evaluation, and reporting; plus a 20% contingency.
- LTM cost assumptions are consistent with Alternative FPS-4A. Long term monitoring would be performed annually for the first 5 years starting in year 11, and every 5 years thereafter. A onetime maintenance of disturbed areas would be performed in year 20. It is assumed that 10% of the disturbed areas would need repair due to erosion. The repair would consist of backfilling the eroded areas with clean fill and topsoil and revegetation. The cost of performing maintenance is assumed to be 20% of the capital costs for clean borrow fill and topsoil.
- The estimated cost for the LTM program is calculated using the present worth analysis process outlined by the USEPA (2000). A discount rate of 7% is used for the present worth calculation, and expenditures are assumed to occur at the end of construction.