Table 7-1. Fireworks Site Sediment – Initial Screening of Remedial Technologies

General Response Action	Remedial Technology/Process Option	Description of Option	Likely to Achieve a Permanent or Temporary Solution?	Are Individuals with Expertise Needed to Effectively Implement Solution Available?	Retained?	Comments
No Action	None	Also known as natural recovery, this action relies on the fact that physical, chemical, and biological processes may continue over time to isolate, weather and degrade the concentrations of the chemicals of concern in the sediment. These processes may result in a reduction in some contaminant concentrations in the area, but would not eliminate the potential for direct contact with the COCs in the sediment.	No	Not Applicable	Yes	This GRA is retained as a baseline for comparative purposes.
Monitored Natural Recovery	Natural Physical Recovery Processes and Periodic Monitoring	Contaminated sediment would be left in place. Natural recovery relies on the fact that physical, chemical, and biological processes may continue over time to isolate, weather and degrade the chemicals of concern present in the sediment. A comprehensive long term monitoring plan for Site sediments and fish tissue would be developed and implemented to evaluate changes in the concentrations of the COCs in the sediments and fish tissue over time.	Yes – temporary solution when used in conjunction with other GRAs such as Non-engineering Measures/ Institutional Controls	Yes	Yes	This GRA has been retained to be combined with other GRAs to assemble alternative(s) that are likely to achieve a temporary solution.
Non-Engineering Measures/ Institutional Controls	Activity and Use Limitations	AULs specify the set of activities and uses that are prohibited or are allowed at the Site in the future. AULs are registered on property deeds and include a Grant of Environmental Restriction or a Notice of Activity and Use Limitation. An advisory on fish consumption and/or a fishing ban would be likely AULs associated with the Site sediments.	Yes – temporary solution	Yes	Yes	This GRA has been retained to be combined with other remedial technologies and/or GRAs to assemble alternative(s) that are likely to achieve a temporary solution.
	Access Restriction - Fencing	Fencing would be installed and maintained to minimize access to portions of the Site where COC concentrations in the exposed sediment could pose a significant risk to human health.	Yes – temporary solution	Yes	Yes	

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Non-Engineering Measures/ Institutional Controls	Warning Signs	Locations of likely public access to areas of exposed contaminated sediments or preferred fishing locations would have posted signs that warn of the direct contact or fish ingestion risks.	Yes – temporary solution	Yes	Yes	
	Educational Programs	Community information and education programs would be implemented to enhance public awareness of potential hazards associated with Site sediments and fish consumption.	Yes – temporary solution	Yes	Yes	
In-Situ Containment	Isolation Capping with Long-Term Monitoring and Maintenance	Capping consists of the placement of clean materials over identified areas of contaminated sediment to limit the potential for contact by people and ecological receptors. Caps can be constructed using a single material (such as clean sand) or can be multi-layer in construction consisting of combinations of materials such as clay, sand, and sorbent materials. Isolation caps of natural materials that can be used to physically and chemically isolate contaminated sediments and promote the recovery of the benthic community are typically 2 to 3 feet thick. Long term monitoring of capped areas would be performed to verify the continued physical and chemical isolation of contaminated sediments and to assess the recovery of the benthic community. Maintenance would be performed as necessary.	Yes – permanent solution	Yes	Yes	

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In-Situ Containment	Thin Capping with Long-Term Monitoring and Maintenance	Thin capping (also known as enhanced natural recovery) typically involves the placement of 6 to 12 inches of clean material over contaminated sediments to improve the sediment quality in the biologically active zone. Thin capping is appropriate in areas where the risks to people and ecological receptors due to exposure to the contaminated sediments are low. Long term monitoring of thin-capped areas would be performed to verify the continued physical and chemical isolation of the contaminated sediments and to assess the recovery of the benthic community. Maintenance would be performed as necessary.	Yes – permanent solution	Yes	Yes	This GRA has been retained for use as a stand alone action or in combination with removal, transportation, and disposal actions to assemble a remedial alternative that is likely to achieve a permanent solution.
	Excavation	This process is the physical removal of the contaminated sediment using conventional earth moving equipment in areas adjacent to and accessible by land.	Yes – permanent solution	Yes	Yes	This GRA has been retained for use as a stand alone action or in combination with removal, transportation, and disposal actions to assemble a remedial alternative that is likely to achieve a permanent solution.

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Removal	Dredging	This process is the physical removal of the contaminated sediment using mechanical, hydraulic, or specialty dredging equipment. Mechanical dredging equipment uses some type of bucket to excavate the sediment. The bucket is lowered to the sediment surface, closed, then raised to the surface and sediment is off-loaded for treatment (if necessary) and disposal. Enclosed buckets (also known as "environmental buckets") are generally used for mechanical dredging of contaminated sediments. Such buckets minimize the dispersion of dredge material through the water column as the bucket is raised to the surface. Mechanical dredging is suitable for removal of cohesive or consolidated sediment as well as for sands and gravels. Hydraulic dredging equipment uses suction, piping, and pumps to dislodge sediment and pump dredge material to an intermediate or final disposal location. Cutter head, auger and other specialty attachments are available to assist during hydraulic dredging of more cohesive sediments. Hydraulic dredging is most suitable for use in areas with minimal debris and soft sediments. Hydraulically dredged material must be dewatered prior to disposal. Decant water from dewatering operations may need to be treated prior to disposal or discharge. Specialty dredging equipment is equipment modified or built to meet specific project needs.	Yes – permanent solution	Yes	Yes	This GRA has been retained to be used in conjunction with solidification/stabilization, transportation and disposal actions and could be combined with containment actions.

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Ex-Situ Physical/ Chemical Treatment	Solidification/ Stabilization (S/S)	Contaminants are physically bound or enclosed within a stabilized mass (solidification) or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization). The target contaminant group for ex-situ S/S is inorganics. On-site ex-situ S/S could be employed if excavated sediment does not pass the Paint Filter Liquids Test (40 CFR 264.314). Off-site ex-situ S/S could be employed to treat excavated sediment to meet the Land Disposal Restriction Standards (40 CFR Part 268).	Yes – could be part of a permanent solution	Yes	Yes	
Pre-Treatment or Treatment of Water from Dredge Material or Excavated Sediment	Filtration and GAC Treatment	Filtration is the physical process of mechanical separation based on particle size whereby particles suspended in a fluid are separated by forcing the fluid through a porous medium. As fluid passes through the medium, the suspended particles are trapped on the surface of the medium and/or within the body of the medium. Assuming that the metals are bound to the sediment, they will be filtered out. Treatment of water using GAC will reduce the levels of the organic compounds that may be present in the water. The dissolved contaminants are made to pass through beds of GAC particles which provide ample surface area for the organics to become attached and bound. The contaminants can be subsequently removed from the GAC and disposed while the GAC can be reused. The treated water can them be discharged back into the pond or stream (via a permitted discharge) or disposed of off-site.	Yes	Yes	Yes	This GRA has been retained to be used in conjunction with removal, transportation and disposal actions.

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Transportation	Truck Transport (water)	Transport of pre-treated water that is separated from excavated sediment or dredge material by truck to a local POTW for final treatment in conjunction with removal, pretreatment and disposal actions.	Yes – could be part of a permanent solution	Yes	Yes	These technologies have been retained to be used in conjunction with removal, transportation and disposal actions.
	Truck Transport (dredge material)	Transport of excavated sediment or dredge material by truck to treatment/disposal facility in conjunction with removal and disposal actions.	Yes – could be part of a permanent solution	Yes	Yes	This technology has been retained to be used in conjunction with removal and disposal actions
	Rail Transport (dredge material)	Transport of excavated sediment or dredge material by rail to treatment/disposal facility in conjunction with removal and disposal actions.	Yes – could be part of a permanent solution	Yes	Yes [1]	This technology has been retained to be used in conjunction with removal and disposal actions
Disposal	On-Site Disposal at a Newly Constructed, Permitted Disposal Facility (dredge material)	Non-hazardous excavated sediment or dredge material will be disposed of at an on-site, permitted disposal facility.	Yes – could be part of a permanent solution	Yes	Yes [2]	This technology has been retained to be used in conjunction with removal and disposal actions
	Off-Site Disposal at a Permitted Disposal Facility (dredge material)	Non-hazardous excavated sediment or dredge material will be disposed of at an off-site, permitted disposal facility.	Yes – could be part of a permanent solution	Yes	Yes	This technology has been retained to be used in conjunction with removal and transportation actions
	On-Site Disposal at a Hazardous Waste Landfill (dredge material)	Characteristically hazardous excavated sediment or dredge material (if any) will be disposed of at an off-site, permitted hazardous waste disposal facility.	Yes – could be part of a permanent solution	Yes	Yes	This technology has been retained to be used in conjunction with removal and transportation actions

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Disposal	Off-Site Disposal Decant Water at a Permitted POTW	Pretreated (filtered) decant water from hydraulic dredging or dewatering operations will be transferred to local POTW for final treatment.	Yes – could be part of a permanent solution	Yes	Yes	This technology has been retained to be used in conjunction with removal and transportation actions
	On-Site Disposal Decant Water at a Permitted Outfall	Treated decant water from hydraulic dredging or dewatering operations will be discharged on-site at a permitted outfall.	Yes – could be part of a permanent solution	Yes	Yes	This technology has been retained to be used in conjunction with hydraulic dredging, ex-situ treatment, transportation, and disposal actions.

NOTES:

[1] Though the rail transport technology/process option was retained, truck transport of excavated soil has been selected as the representative process option within the transportation category to be carried forward into the alternative development process.

[2] Though the on-site disposal at a permitted disposal facility technology/process option was retained, off-site disposal of excavated soil at a solid waste landfill or at a hazardous waste landfill has been selected as the representative process options within the disposal category to be carried forward into the alternative development process. Most dredge material is not expected to be hazardous waste based on prior TCLP testing and total contaminant concentrations.