Cleanup Alternatives

Background

The Superfund program is administered by EPA in cooperation with state and tribal governments. EPA directs the process for Superfund site cleanups.

The Superfund process has multiple steps leading to site cleanup, including site investigations, evaluation of health risks to people and the environment, and identifying methods to clean up the site contamination. A feasibility study identifies a range of cleanup methods, called cleanup alternatives, that could meet the cleanup objectives for the site. A feasibility study also evaluates the cleanup alternatives using the criteria identified in the National Contingency Plan. EPA uses the alternatives and evaluation performed in the feasibility study to identify the preferred alternative and after getting state, tribal, and community input, select the final cleanup.

The East Waterway is part of the Harbor Island Superfund Site in Seattle, Washington. Sediments within the East Waterway have been contaminated with polychlorinated biphenyls (PCBs), arsenic, polycyclic aromatic hydrocarbons (PAHs), dioxins and furans, mercury, tributyltin, and other chemicals. Contamination is largely a result of historical industrial activities around the waterway. The contaminated sediments pose risks to people and the environment. These risks are described in the Remedial Investigation for the site. This fact sheet summarizes the cleanup alternatives developed in the East Waterway Feasibility Study that are designed to address the risks.

This fact sheet answers the following questions:

- Where is the East Waterway and how is it used?
- How were the cleanup alternatives developed?
- What methods may be used to clean up the East Waterway?
- What are the cleanup alternatives and how are they evaluated?
- What is the next step in the Superfund Cleanup Process for the East Waterway?

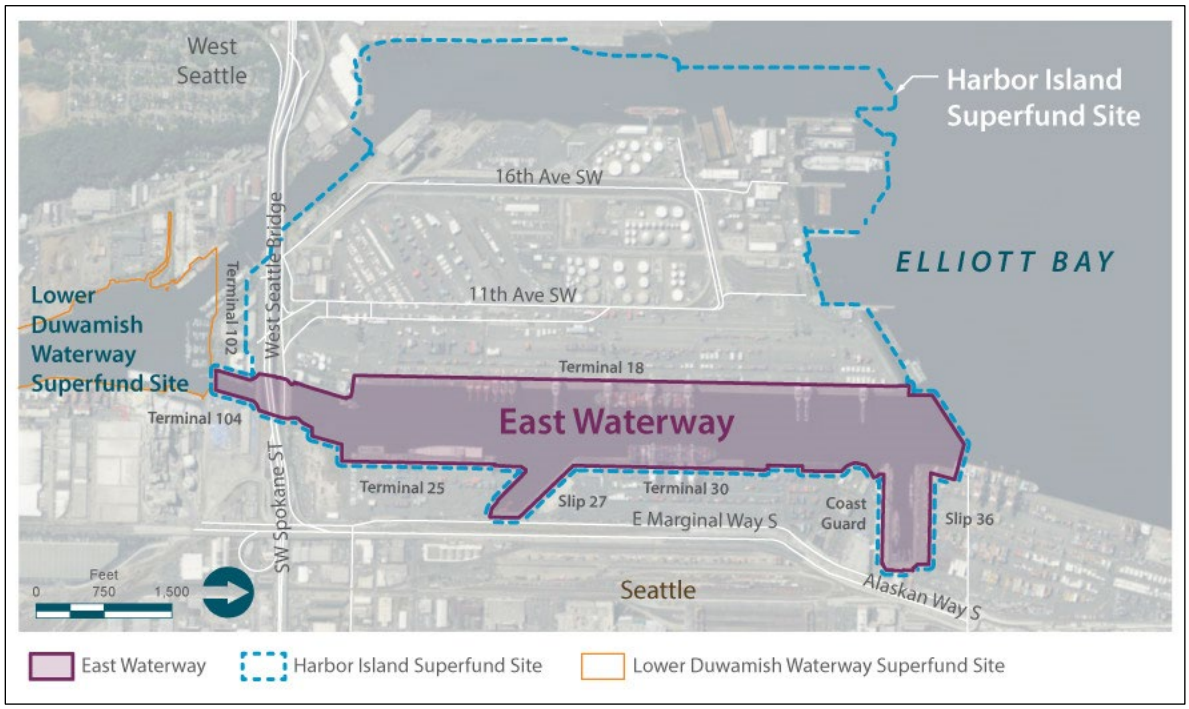
Where is the East Waterway?

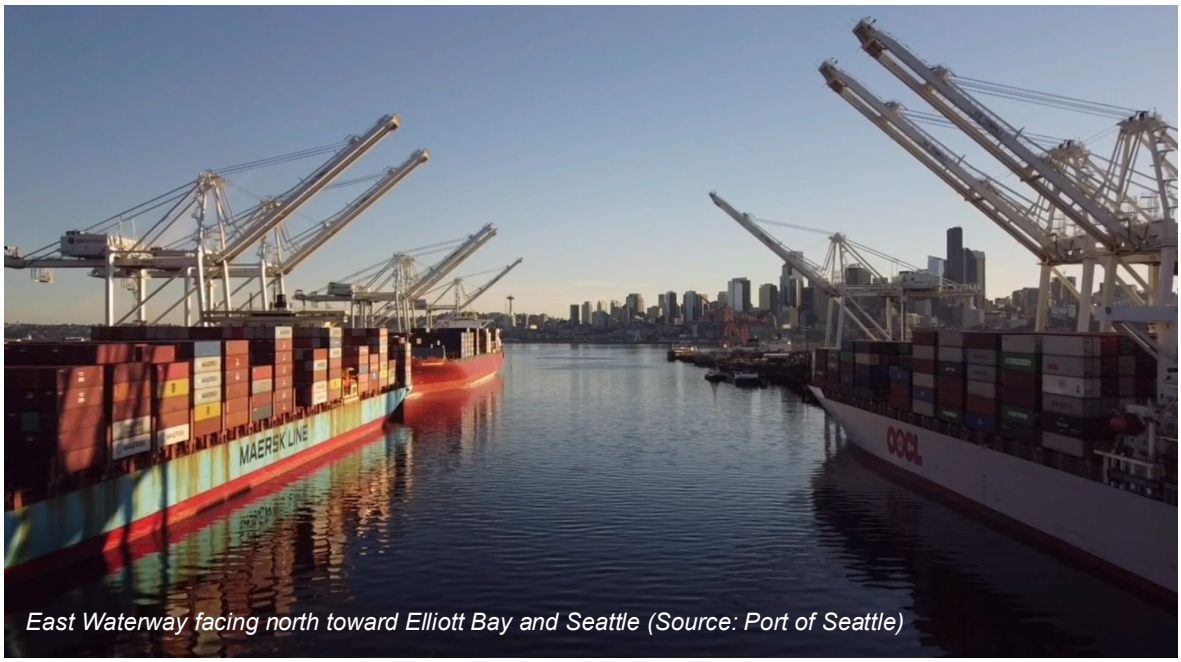
The East Waterway is 1.5 miles long, 157 acres in size, and is located along the east side of Harbor Island (see the figure on the following page). It is located immediately downstream of the Lower Duwamish Waterway Superfund site and is open to Elliott Bay to the north. The East Waterway was created during the construction of Harbor Island in the early 1900s to serve developing industries and commerce in Seattle.

How is the East Waterway used?

The East Waterway is a commercial waterway primarily used as an industrial port to support shipping container vessels. It also supports tribal, subsistence, and recreational fishing. It is part of the Duwamish River that discharges freshwater flowing from the Green River to Puget Sound.

East Waterway





East Waterway facing north toward Elliott Bay and Seattle (Source: Port of Seattle)

How were the cleanup alternatives developed?

Cleanup alternatives were developed by answering the following questions:

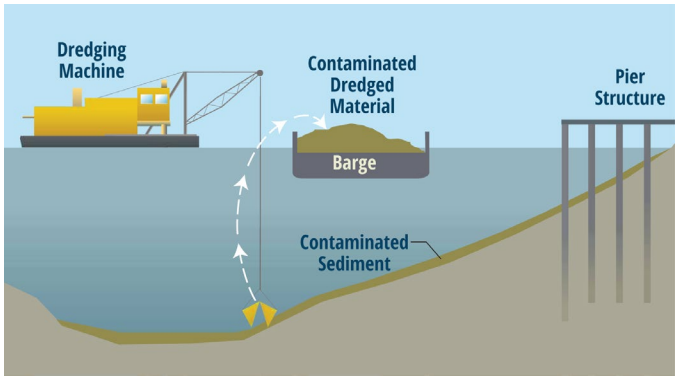
- What areas of the site require remediation to meet cleanup goals?
- What technologies can be used to clean up the site?
- How can the cleanup technologies be combined to develop cleanup alternatives?

The areas of the site that require remediation were determined using Remedial Action Levels (RALs). RALs are contaminant concentrations that define the areas and depths of sediment that require active cleanup in order to meet cleanup objectives. RALs are based on the approach that if sediments with higher contaminant concentrations are cleaned up through active remediation, concentrations across the entire waterway will decrease until they reach a point where cleanup objectives can be met over time through passive remediation, or natural recovery. RALs balance the maximum risk reduction through active cleanup with the potential impacts and costs of active remediation.

The Proposed Remedial Goals (PRGs) are the long-term goals for contaminant concentrations in East Waterway sediments. The PRGs that were used in the Feasibility Study were based on Washington State Sediment Management Standards, risk-based threshold concentrations, and natural background concentrations for Puget Sound.

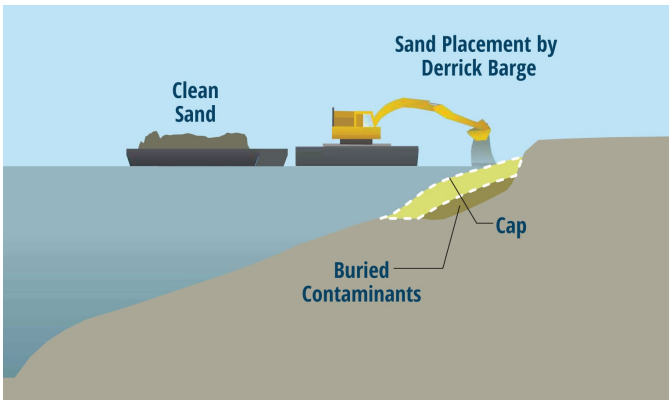
Methods to clean up contaminated sediment

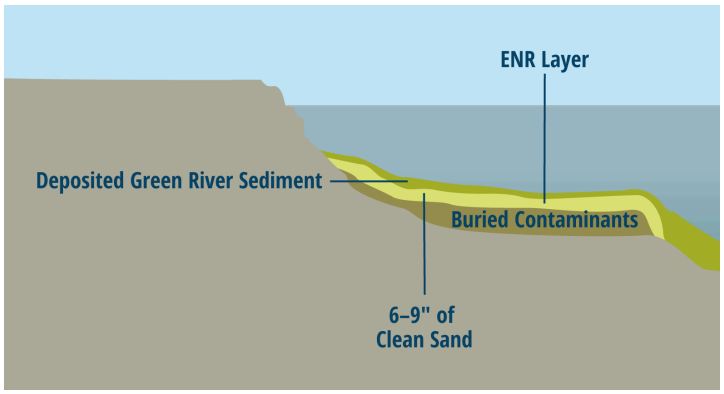
The following graphics illustrate the technologies that can be used to clean up contaminated sediment in the waterway. These technologies are used in different areas in each of the alternatives.



Dredging removes contaminated sediment from the waterway. After removal, dredged material will be disposed of in a permitted landfill.

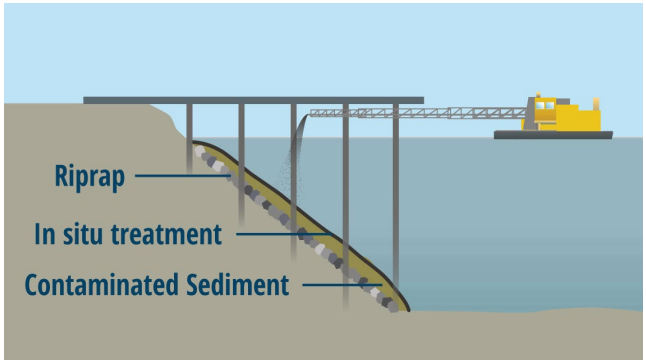
Containment covers the contaminated sediments with layers of sands, silts, gravel and rock designed to contain and isolate the contamination. This is commonly referred to as capping.

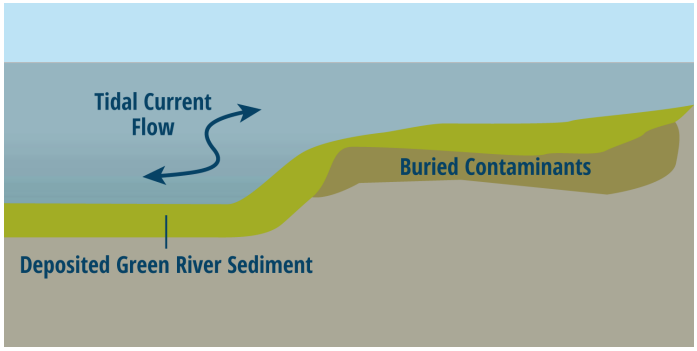




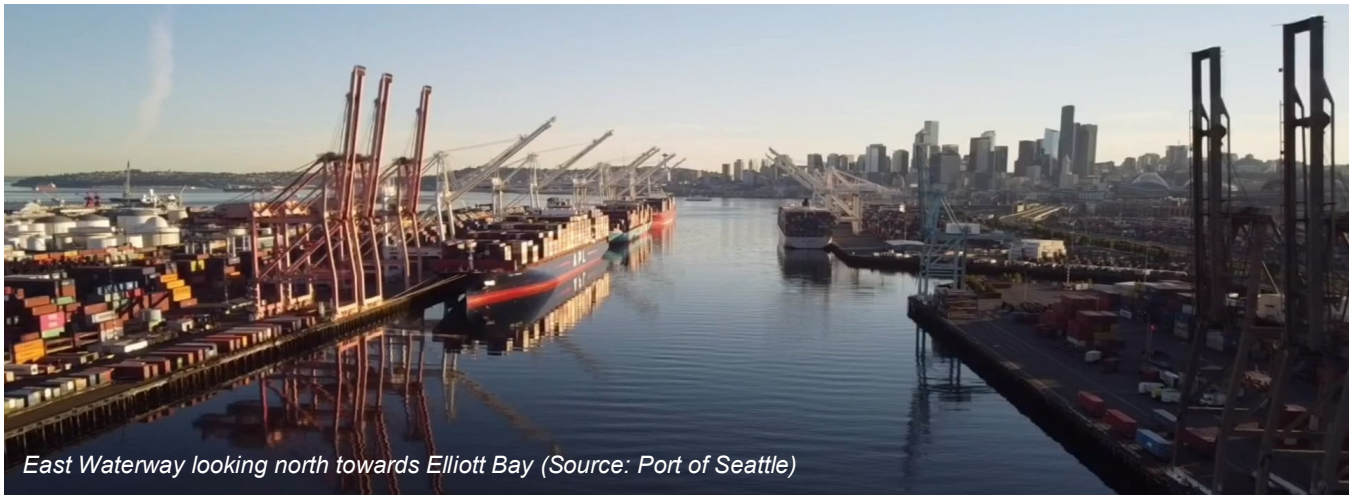
Enhanced Natural Recovery uses a thin layer of sand to cover the contamination and speed up the natural recovery process.

In situ treatment includes adding an agent that make contaminants less toxic and reduces the ability for contamination to enter the food chain. The treatment agent is placed on top of the contaminated sediments and is mixed into sediments by natural processes.





Monitored Natural Recovery relies on the natural flow of cleaner sediments from upriver to cover contaminated sediments in the waterway. The clean sediments are monitored to measure the reduction in contamination over time.



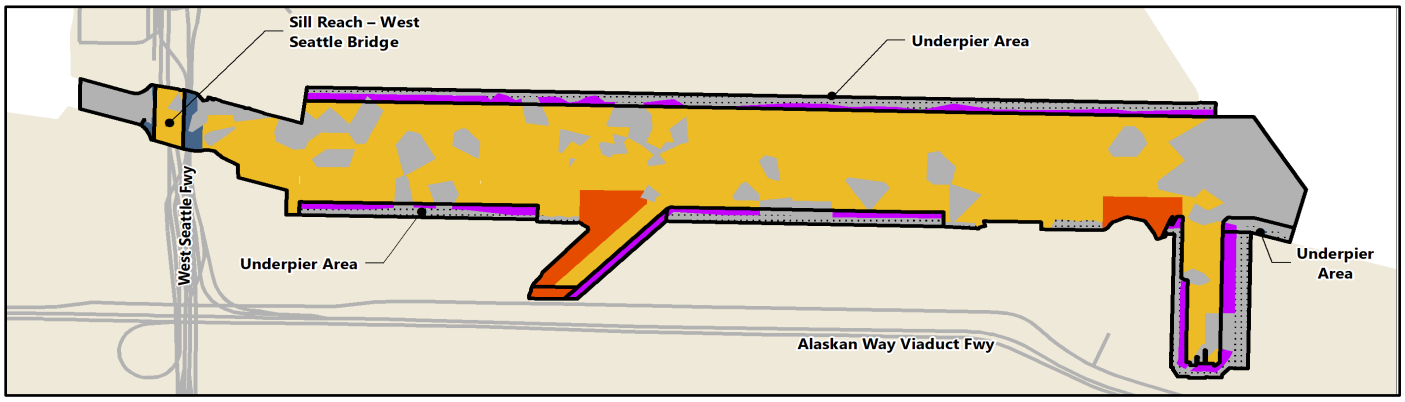
East Waterway looking north towards Elliott Bay (Source: Port of Seattle)

Cleanup alternatives

The Feasibility Study includes ten cleanup alternatives for the East Waterway. One alternative is the No Action alternative, which is a requirement under the Superfund regulations, to understand the result of no further cleanup actions. The following bullets summarize the remaining nine alternatives:

- Most of the East Waterway will be actively cleaned up using a combination of construction techniques including dredging, capping, in situ treatment, and enhanced natural recovery. Using these cleanup technologies, all cleanup alternatives will actively clean up between 108 and 132 acres out of 157 acres (69 to 84 percent of the site, shown in Table 1).
- All areas of the site will be monitored to verify that cleanup levels are achieved, and contaminant concentrations remain low over time.
- The alternatives primarily rely on dredging, removing between 810,000 and 1,040,000 cubic yards of contaminated sediment. This is 27,000 to 35,000 twenty-ton dump trucks loads.
- The alternatives also include placing clean material to further improve waterway conditions through capping, enhanced natural recovery, and in situ treatment. Between 270,000 and 290,000 cubic yards of material will be placed (9,000 to 9,700 twenty-ton dump truck loads).
- Institutional controls will be required to ensure protectiveness of the remedy and will include fish consumption advisories, deed restrictions, and other controls,
- The costs to implement the alternatives range from $256 to $411 million.
- The estimated time to complete the cleanup construction actions ranges from 9 to 13 years.

Example Alternative



Range of Areas for Cleanup Alternatives

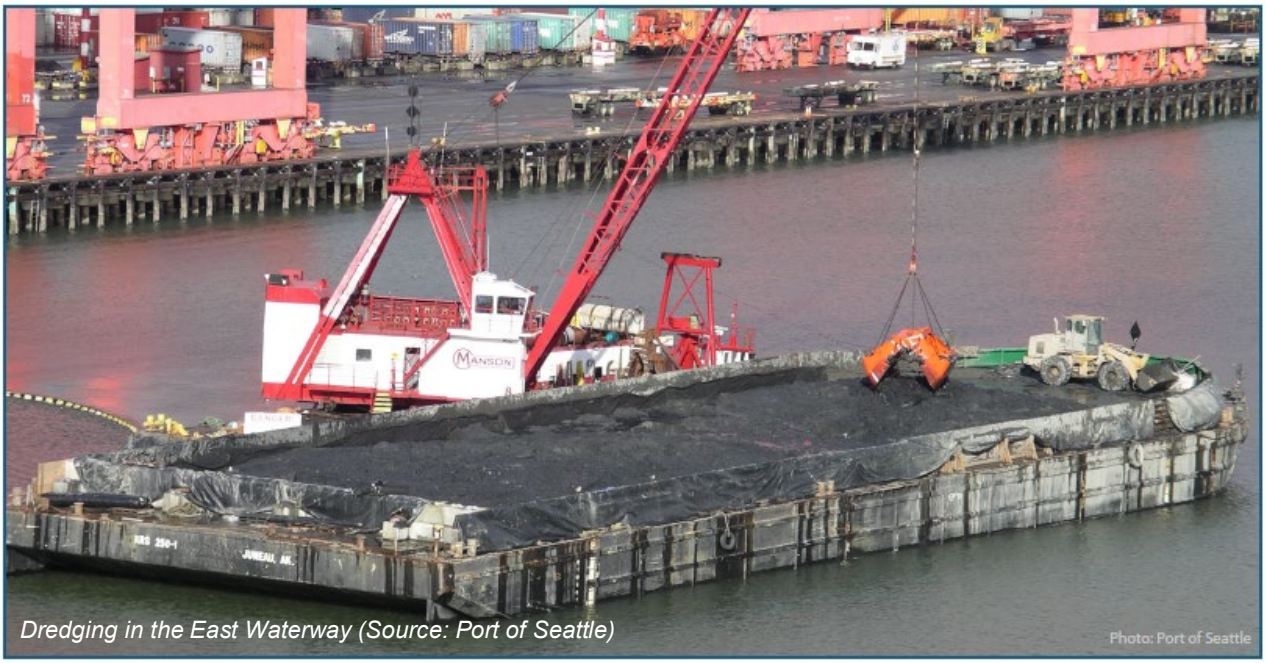
Cleanup Technology	Area (acres)
Total Construction	**108 to 132**
Dredging	77 to 124
Partial Dredge and Capping	7 to 13
Enhanced Natural Recovery	1 to 19
In Situ Treatment	0 to 13
Monitored Natural Recovery	25 to 49
Riprap	No sediment
Total Waterway	156
Cost	**$256–$411 million**

Alternatives Description

Action Alternatives	Technologies for Open-water Areas	Technologies for Restricted Access Areas (Underpier and Low Bridges)	PCBs RAL All Areas
No Action			
1A(12)	1. Removal with capping and ENR where applicable	A MNR	(12) 12 mg/kg OC
1B(12)		B In situ treatment	
1C+(12)		C+ Diver-assisted hydraulic dredging followed by in situ treatment for PCBs or mercury > CSL; in situ treatment elsewhere	
2B(12)	2. Removal with capping where applicable	B In situ treatment	
2C+(12)		C+ Diver-assisted hydraulic dredging followed by in situ treatment for PCBs or mercury > CSL; in situ treatment elsewhere	
3B(12)	3. Maximum removal to the extent practicable	B In situ treatment	
3C+(12)		C+ Diver-assisted hydraulic dredging followed by in situ treatment for PCBs or mercury > CSL; in situ treatment elsewhere	
2C+(7.5)	2. Removal with capping where applicable		(7.5) 7.5 mg/kg OC
3E(7.5)	3. Maximum removal to the extent practicable	E Diver-assisted hydraulic dredging followed by in situ treatment	

Notes:

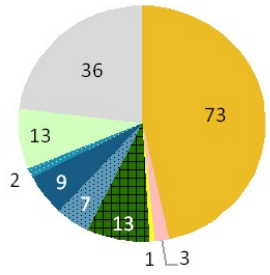
CSL – cleanup screening level
ENR – enhanced natural recovery
mg/kg – milligrams per kilogram
MNR – monitored natural recovery
OC – organic carbon
PCB – polychlorinated biphenyl
RAL – remedial action level



Dredging in the East Waterway (Source: Port of Seattle)

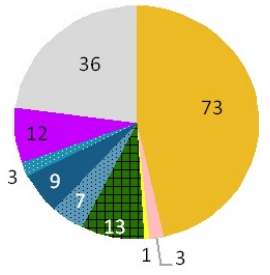
Alternatives Areas, Volumes, and Costs

Alternative 1A(12)



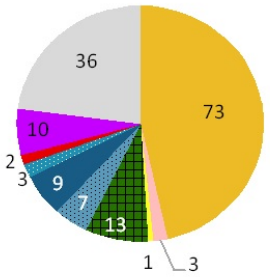
Cost	$256M
Construction Time	9 yr
Removal Volume	810,000 cy
Placement Volume	290,000 cy

Alternative 1B(12)



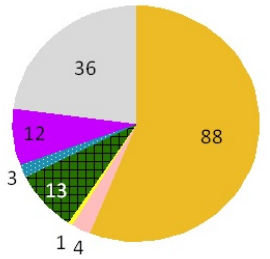
Cost	$264M
Construction Time	9 yr
Removal Volume	810,000 cy
Placement Volume	290,000 cy

Alternative 1C+(12)



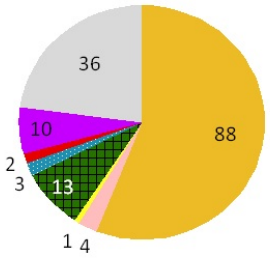
Cost	$277M
Construction Time	9 yr
Removal Volume	820,000 cy
Placement Volume	290,000 cy

Alternative 2B(12)



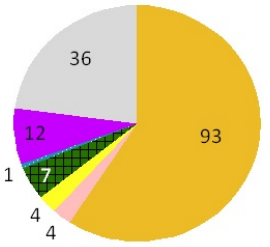
Cost	$284M
Construction Time	10 yr
Removal Volume	900,000 cy
Placement Volume	280,000 cy

Alternative 2C+(12)



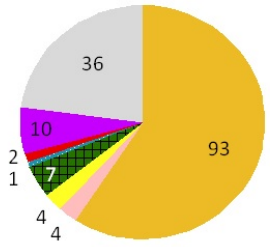
Cost	$297M
Construction Time	10 yr
Removal Volume	910,000 cy
Placement Volume	280,000 cy

Alternative 3B(12)



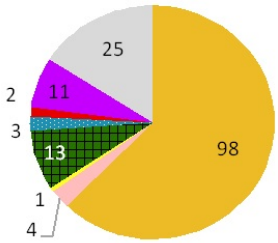
Cost	$298M
Construction Time	10 yr
Removal Volume	960,000 cy
Placement Volume	270,000 cy

Alternative 3C+(12)



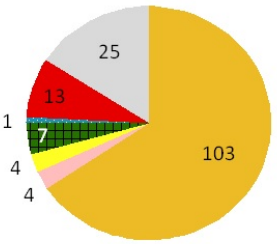
Cost	$310M
Construction Time	10 yr
Removal Volume	960,000 cy
Placement Volume	270,000 cy

Alternative 2C+(7.5)



Cost	$326M
Construction Time	11 yr
Removal Volume	1,010,000 cy
Placement Volume	290,000 cy

Alternative 3E(7.5)



Cost	$411M
Construction Time	13 yr
Removal Volume	1,080,000 cy
Placement Volume	270,000 cy

Legend:

- Removal
- Removal to Extent Practicable; Backfill
- Removal; Backfill to Existing Contours
- Partial Removal and Capping
- ENR-nav with Partial Dredging
- ENR-nav
- ENR-sill
- MNR Under-pier
- Hydraulic Dreding followed by In Situ Treatment
- In situ Treatment
- MNR

Notes:

Numbers in chart represent acres; total sediment area is 157 acres.
cy - cubic yards
ENR-nav - enhanced natural recovery in the navigation channel
ENR-sill - enhanced natural recovery in the Sill Reach
RAOs - remedial action objectives
yr -years

Evaluation of the cleanup alternatives

The Superfund law requires that EPA evaluate the remedial alternatives using nine criteria. There are two threshold criteria and five balancing criteria, which have been used to evaluate the FS alternatives. The two remaining modifying criteria consider Tribal/State and Public acceptance of the preferred alternative. These two criteria are addressed after public comments have been received on the Proposed Plan.

- Threshold criteria: conditions that must be met for an alternative to be selected:
  - Overall protection of human health and the environment.
  - Compliance with all applicable federal, state, and local environmental laws and regulations.
- Balancing criteria: other factors that are evaluated as part of the alternative selection process:
  - Long-term effectiveness and permanence: how cleanup alternatives remain protective of human health and the environment over time once the cleanup objectives are achieved.
  - Reduction of toxicity, mobility, or volume of the contamination through treatment technologies.
  - Short-term effectiveness: how the cleanup alternatives impact human health and the environment during the construction phase and until cleanup objectives are achieved.
  - Implementability: how easily the cleanup can be performed, considering both technical and administrative challenges.
  - Cost: construction and long-term monitoring costs.

These criteria are used to inform the identification of the preferred alternative in the Proposed Plan that will be issued for public comment. Once state, tribal, and public comments are considered, EPA will select the final remedy in a Record of Decision.

Evaluation of Cleanup Alternatives

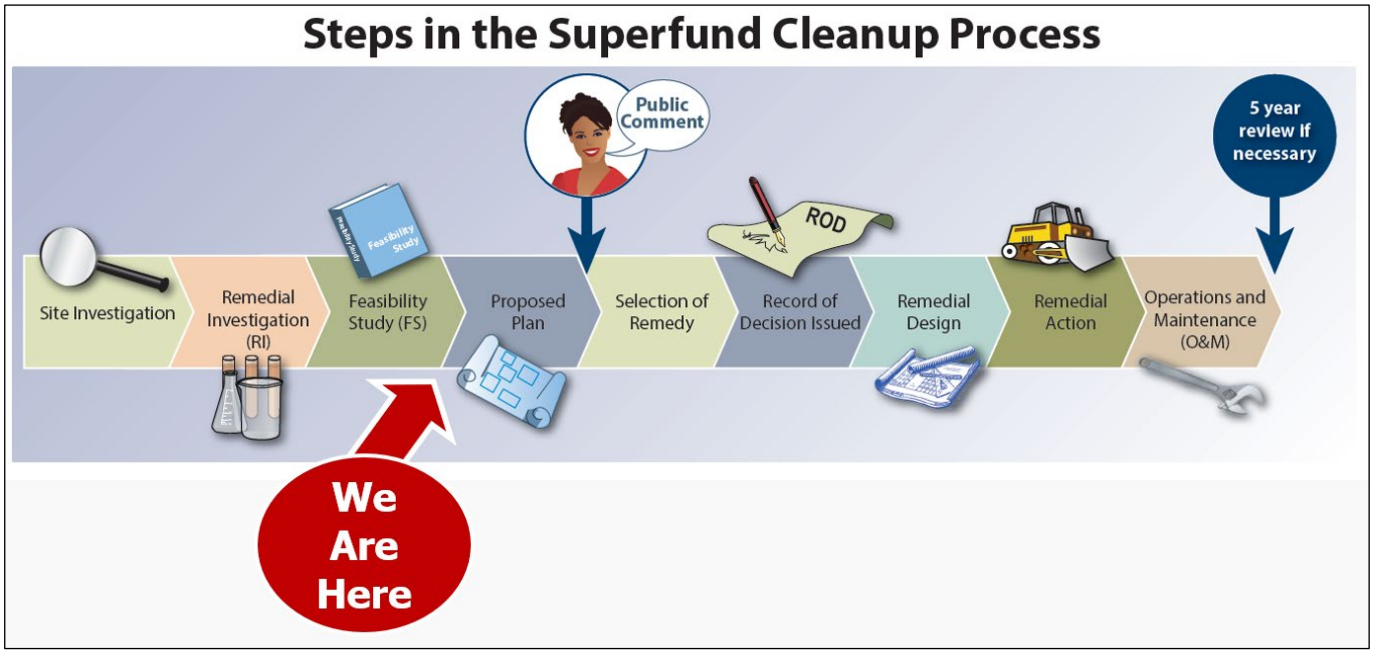
Alternative	Achieve Threshold Criteria?	Long-term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-term Effectiveness	Implementability	Cost
No Action	No	⏬	⏬	⏬	⏫	⏫
1A(12)	Yes	⏸	⏬	🔽	🔼	🔼
1B(12)	Yes	🔼	⏫	⏫	⏸	🔼
1C+(12)	Yes	🔼	⏫	🔼	🔽	⏸
2B(12)	Yes	⏫	⏫	🔼	⏸	⏸
2C+(12)	Yes	⏫	⏫	⏸	🔽	⏸
3B(12)	Yes	⏫	⏫	🔼	⏸	⏸
3C+(12)	Yes	⏫	⏫	⏸	🔽	🔽
2C+(7.5)	Yes	⏫	⏫	🔽	🔽	🔽
3E(7.5)	Yes	⏫	⏫	⏬	⏬	⏬

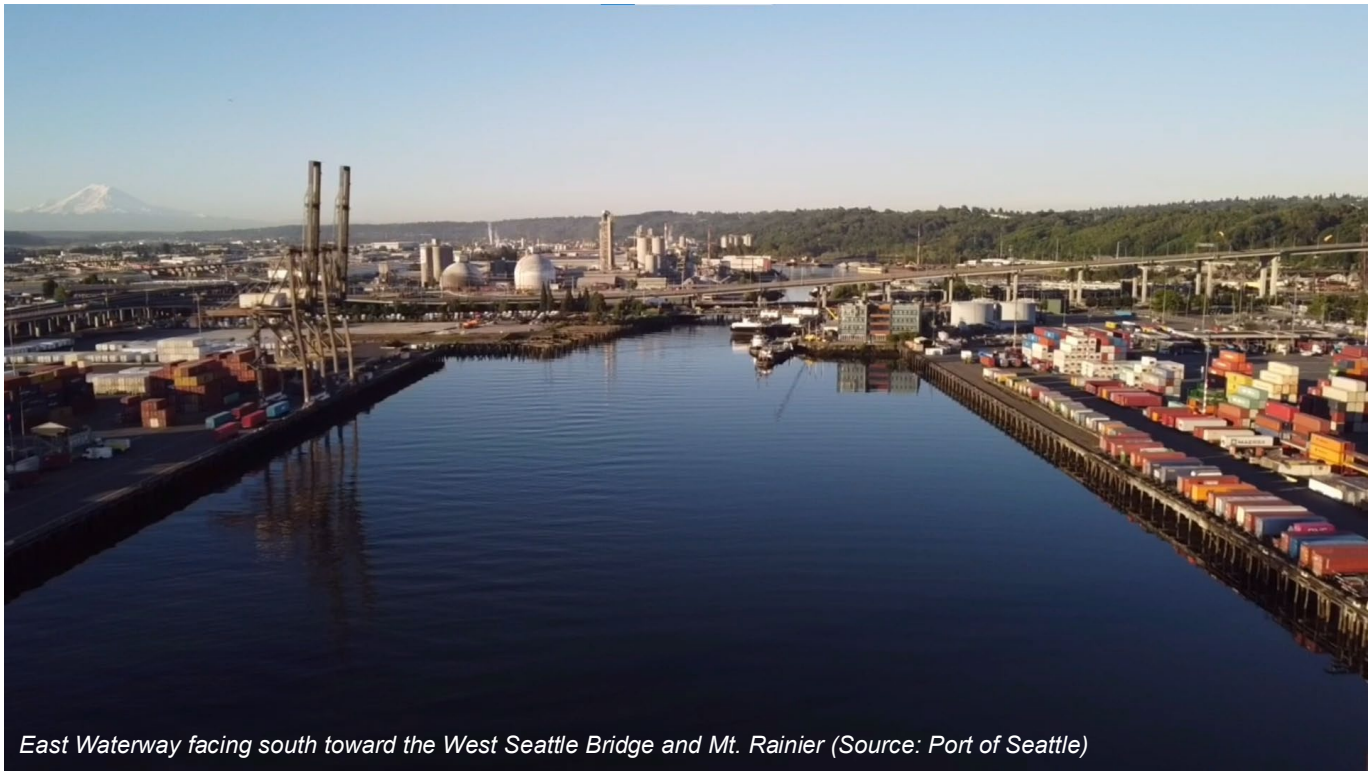
⏫ Ranks very high compared to other alternatives
🔼 Ranks relatively high compared to other alternatives
⏸ Ranks moderate compared to other alternatives
🔽 Ranks low-moderate compared to other alternatives
⏬ Ranks low compared to other alternatives

Notes:
Low costs are given a high rank, and high costs are given a low rank.

What is the next step in the Superfund cleanup process?

After assessing cleanup alternatives in the feasibility study, the EPA develops a draft cleanup plan for the site, called a Proposed Plan. In 2022, EPA plans to release a Proposed Plan for the East Waterway and will request public comment on the plan. The public comment period will last a minimum of 30 days. The full Superfund cleanup process is shown in the following image.





East Waterway facing south toward the West Seattle Bridge and Mt. Rainier (Source: Port of Seattle)

East Waterway Sediment Remediation Seattle, Washington Remedial Alternatives Fact Sheet

Read inside for details

For More Information

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Visit the Harbor Island Superfund Site on the web:

www.epa.gov/superfund/harbor-island

Information Repositories:

EPA Superfund Records Center:
1200 Sixth Avenue, Seattle, WA 98101
Toll-free: 800-424-4372, ext. 4494. *Please call for an appointment.*

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