Hudson River Remedy Part II:
Habitat Replacement and Reconstruction and the Implications for Restoration

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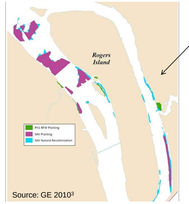
Abstract

The Hudson River PCB Superfund Site encompasses approximately 200 miles from Hudson Falls to the Battery in New York City. The 2002 dredging remedy focused on remediating a mosaic of freshwater habitats in the upper 40 miles (River Sections 1, 2 and 3) of the site between Fort Edward and the Federal Dam (Upper Hudson). Under this remedy, an estimated 2.65 million cubic yards of sediment would be dredged. Phase 1 of the remediation was conducted in River Section 1 in 2009. Phase 2 comprises the rest of the dredge areas, including completion of River Section 1, beginning in Spring 2011. The remedy includes a habitat replacement and reconstruction program that consists of backfilling dredged areas, wetland mitigation, re-establishment of rooted aquatic vegetation via passive and active approaches, and re-vegetation of shorelines to prevent, mitigate, or compensate for impacts related to project implementation. As Natural Resource Trustees charged with protection and restoration of natural resources that may be impacted by the PCB release and the remedy, NOAA and USFWS believe that a robust PCB cleanup and high quality design for habitat replacement and reconstruction are the first stages in recovering unconsolidated river bottom, submerged vegetative, shoreline and wetland habitats impacted by the remedy. We provide recommendations to improve the Phase 2 habitat replacement and reconstruction, increase flexibility in habitat reconstruction approaches, and strengthen adaptive management during the construction phase to accelerate recovery of these resources.

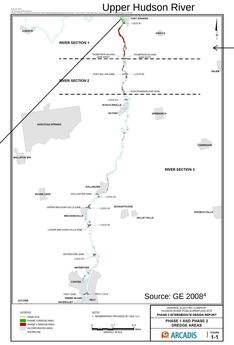
Recommended Components of a High Quality Habitat Design

- Greater PCB removal in Upper Hudson and habitat reconstruction specific to ESUH areas
- > 1:1 replacement and reconstruction of SAV, RFW, and SHO habitat
- Provision of sufficient backfill quantity and quality for optimal re-establishment of all disturbed SAV beds
- Backfill tolerances more suitable for habitat reconstruction (±0.1 ft RFW, -0.25 ft to +1ft SAV)
- More gradual river bottom slopes (≤10:1) for re-establishment of SAV, RFW, stability, low resuspension of sediments
- Habitat layer on top of all caps to support emergent and aquatic plants, nesting fish, and burrowing invertebrates and wildlife
- Revegetate from locally collected stock (EPA Eco Level III Region 59 Hudson River sub-region[15])
- Reconstruction and seeding of dredged freshwater mussel beds lost during remediation
- Natural (soft) shorelines
- Replacement of plant species diversity and structure
- Adaptive management should be based on an understanding of system functions using effective monitoring and models to adjust management approaches to improve outcomes[16]
- Performance-based criteria demonstrating successful recovery of function, sustainability, and resilience of reconstructed habitats

Upper River
- 57 Especially Sensitive or Unique Habitats (ESUH) [1,2]



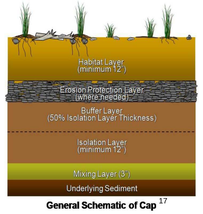
Phase 1 habitat reconstruction areas.



Lower River
- 39 NYS Significant Coastal Fish & Wildlife Habitats[6]
- 4 NOAA National Estuarine Research Reserves[7]
- 3 USFWS Significant Habitat Complexes[8]

Emergent and floating vegetation at ESUH 24

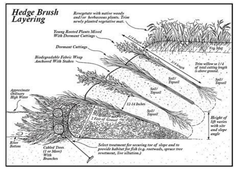
Water celery, Vallisneria americana at mouth of ESUH 22



General Schematic of Cap [17]

Cap with habitat layer providing greater benefit than current design

Beds of Elliptio complanata[18] and other mussel species impacted by remedy implementation



Example of reconstructed shoreline[19] incorporating live plant material with woody debris in design

Synopsis of Current Habitat Replacement and Reconstruction Program

Four habitat types, unconsolidated river bottom (UCB), aquatic vegetation beds (SAV), riverine fringing wetlands (RFW), and shoreline (SHO) were delineated in Phase 1 and Phase 2 areas in the upper freshwater Hudson. The current Phase 1 and 2 habitat replacement and reconstruction program[9-11] was designed to partially mitigate for remedial disturbance to these habitats and includes adaptive management plan and success criteria. The primary goal of the habitat replacement and reconstruction program is to replace the functions and characteristics of impacted habitats so that they return to the range of functions and characteristics found in similar areas of the river not impacted by dredging. While the goal of the habitat replacement and reconstruction program was to prevent, mitigate, or compensate for impacts related to project implementation[12], the design has several shortcomings including some that are highlighted below:

Positive Aspects of the Habitat Reconstruction Program

•UCB: Non-angular backfill sourced from local quarry natural bank run deposits (riverine origin). Medium sand should support SAV.

•SAV: Backfill placed to original grade if 6-8 ft water depth pre-dredging. Backfill may be placed on top of cap for SAV bed reconstruction.

•RFW: River bottom returned to original bathymetry. Non-angular backfill has higher organic content than type used for UCB or SAV. Planting of 4 emergent and 1 floating species.

•SHO: Some soft stabilization measures employed. Live stakes (5 spp.) installed in armored areas.

•PCBs: Reductions within dredge footprint.

Negative Aspects of the Habitat Reconstruction Program

•UCB: Coarse sand/gravel backfill is of borderline quality for SAV plant growth. TOC and nutrient content of backfill may be inadequate for plant growth. Capping can result in hardening of river bottom especially where uppermost cap layer is angular stone. No specific mussel mitigation (e.g., harvest prior to dredging for transplanting) is required. Steep side slopes are subject to greater erosion.

•SAV: River bottom will generally be deeper than original bathymetry. Backfill placed to 5 ft water depth where targeted beds are 2-5 ft pre-dredging and >8 ft post-dredging. No backfill will be placed where targeted beds are >8 ft pre- and post-dredging. Only ~1/3 of disturbed beds to be replanted (wild celery, American pondweed, and white water lily), the remaining 2/3 re-established through passive natural recolonization. A ±12 in. backfill tolerance is not optimal. Steep side slopes are subject to greater erosion and are not optimal for SAV re-establishment.

•RFW: Zone A is only seeded with annual dominated mix (12 spp.). Seeding is generally less successful than planting of plugs. A perennial mix is preferred. A ±6 in. backfill tolerance is not optimal for plant re-establishment. Steep slopes are subject to greater erosion and are not optimal for RFW.

•SHO: Stabilization can harden shoreline. Non-armored areas are only seeded with herbaceous mix (up to 22 spp.) or a lawn grass mix. Potted trees and shrubs are not planted in non-armored or armored area. No placement of in-river woody debris. Steep slopes are subject to greater erosion.

•PCBs: Elevated concentrations outside the dredge footprint.[13,14]

Impacts of Hudson River Remedy and Habitat Replacement and Reconstruction Program on Habitat Quality and Recovery of Ecosystem Services

•Steep (≥3:1) and Unstable Slopes
•Hardened Shorelines and River Bottom
•Loss of Habitat Complexity, Function, Resiliency, and Sustainability
•Lower Diversity of Plant Community
•Reduced Bottom Habitat Available for SAV Recolonization
•Poorer Quality Breeding, Nursery, Foraging, and Sheltering Habitat
•Delayed and Prolonged Recovery of Freshwater Mussels, a Keystone Species
•Potential for Recontamination of Remediated Sediments and Continued PCB Exposure

Woody debris providing structure and habitat

Pickerelweed, *Pontederia cordata*, in ESUH 8

Implications of the Current Habitat Replacement and Reconstruction Design for Recovery and Restoration

A robust PCB clean up and a high quality design for habitat replacement and reconstruction should be the first stages in recovering all habitats impacted by the remedy.

The current PCB cleanup and habitat design incorporates engineered, physical, and biological constraints that limit restoration of the four habitat types impacted by remedial activities.

Implementation of the current remedy will cause short-term and long-term injury to natural resources because of the shortcomings of the cleanup and habitat reconstruction. The public should be compensated for those injuries.

Efforts to further reduce PCBs in sediments and to improve habitat components of the remedial design, as recommended, could accelerate the recovery of the Hudson River and reduce residual and remedial injury to natural resources.

References

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