Habitat Assessment Report for Candidate Phase 1 Areas Hudson River PCBs Superfund Site

Community Advisory Group (CAG) Meeting

December 8, 2005

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Habitat Related Documents

- **Habitat Delineation and Assessment Work Plan**
  - **August 2003**
  - **Part of the RD AOC**
  - **Outlines methods and contains SOPs for habitat delineation and assessment activities**
- **Habitat Delineation Report**
  - **Submitted June 2005 – under review**
  - **Provides maps that depict habitat types in the 40 mile project area**
- **Phase 1 Habitat Assessment Report**
  - **Approved by EPA November 2005**
  - **Describes methods and results for the habitat-specific assessments completed in 2003 and 2004**

Habitat Related Documents (cont'd)

- Supplemental Habitat Assessment Report (SHAWP)
  - Approved by EPA November 2005
  - Provides maps depicting the general locations for all habitat assessment sampling stations
    - Target Stations (within areas to be dredged)
    - Reference Stations (outside of areas to be dredged)
  - Contains SOPs for collecting additional habitat data and habitat suitability index (fish and wildlife models) data

Classification of Hudson River Habitat

- Unconsolidated River Bottom (UCB)
  - Sand, gravel, cobble, or muddy areas with no vegetation
- Aquatic Vegetation Beds
  - Plants that grow entirely underwater (submerged aquatic vegetation, or SAV)
  - Floating aquatic vegetation
- Shoreline (SHO) – terrestrial habitat along edge of river
  - Natural shoreline has vegetation
  - Maintained shoreline has mowed lawns, bulkheads, or large stone (riprap)
- Riverine Fringing Wetlands (WET)
  - Generally in shallow water transitional area from shoreline to deeper water

Components of Hudson River Habitat Field Program

- **Habitat Delineation**
  - **Mapping the habitats - survey of the entire 40-mile project area using aerial photographs**
    - **On-water surveys of project area (ground-truthing)**
- **Habitat Assessment**
  - **Composition of habitats - collected samples from each habitat type to document site-specific physical and biological conditions**
  - **Sampling Stations Selected to:**
    - **Characterize habitat strata identified from habitat delineation**
    - **Include an equal number of target (dredge) and reference (non-dredge) stations**
    - **Be allocated along river sections in rough proportion to the relative areas of the habitat to be dredged**

Sampling Stations

- Phase 1 area sampling complete, some Phase 2 areas also assessed. Totals assessed to date (2003 to 2005):
  - UCB – 46 stations; 414 samples
  - SAV – 26 stations; more than 234 samples
  - SHO – 50 stations; 150 samples
  - WET – 6 stations; more than 54 samples
- Additional sampling in Phase 2 areas scheduled for 2006
  - 54 UCB; 26 SAV; 18 SHO; 10 WET

Goal of Habitat Assessment

- For each habitat type, collect information on physical and biological variables related to ecological functions within reference areas and within areas affected by dredging
- Use information to develop the basis of design for habitat replacement and reconstruction in Phase 1 areas
- Compare post-remediation conditions to range of reference conditions

Functional Capacity Indices (FCIs)

- Series of habitat-specific variables identified to represent physical, hydrologic, and biological characteristics of a site that reflect its ability to perform important ecological functions

- General methodology developed by US Army Corps of Engineers (Hydrogeomorphic Assessments)
  - Site-specific models developed for Hudson River

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FCI Variables

- **Unconsolidated River Bottom**
  - substrate, cover, percent fines and TOC
- **Aquatic Vegetation Beds**
  - shoot biomass, shoot density, plant species composition (% native), % cover, TOC, water depth, percent fines, nutrient availability [K, NH_4, PO_4])
- **Shoreline**
  - bank stability, bank vegetation protection, downfall, riparian edge cover
- **Riverine Fringing Wetlands**
  - slope, stem density, stem length, stem thickness, wetland edge, plant species composition, % nuisance species, aboveground biomass, contiguous with other habitats

Habitat Assessment Sampling

- Riverine Fringing Wetland Sampling

  (burreed)

- Aquatic Vegetation Sampling

  (wild celery)

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Habitat Assessment -Specific Measurement Parameters

Unconsolidated River Bottom	Aquatic Vegetation Beds	Natural Shoreline	Riverine Fringing Wetlands
Substrate type; epifaunal substrate and cover; total organic carbon; water quality; percent fines; embeddedness; and downfall	Total organic carbon; shoot density; percent cover; shoot biomass; plant species composition (including percent nuisance species); sediment nutrient availability; light availability; water depth; water quality; percent fines; and Downfall	Downfall; bank vegetation protection; bank stability; slope; substrate components; riparian edge cover; and plant species composition and percent cover (by vegetation strata)	stem density; stem length; stem thickness; soil properties; percent cover; shoot biomass; plant species composition (including percent nuisance species); slope; water depth/inund.; water quality; area; wetland edge area of buffer; and percent contiguous with other habitats.

Habitat-Specific FCI Models

- Unconsolidated river bottom (UCB)
  - Potential to support benthic macroinvertebrates
  - Potential to support fish populations
- Aquatic vegetation bed (SAV)
  - Support phytophilous and benthic macroinvertebrate populations
  - Provide habitat for fish populations
  - Stabilization of substrate
  - Nutrient cycling

Habitat-Specific FCI Models (continued)

- **Shoreline**
  - **Shoreline stability**
  - **Shade and cover**
  - **Wildlife habitat (habitat suitability)**
- **Riverine fringing wetlands**
  - **Surface-water exchange**
  - **Energy dissipation**
  - **Nutrient and organic cycling**
  - **Maintain character plant community**
  - **Wildlife habitat (habitat suitability)**

Relating Measured Parameters to Habitat Functions (FCIs) - Aquatic Vegetation Beds

Function (FCI Code)	Measured Variable (Units)	Variable Code
Support PMI/BMI Populations **(FCISAVMACROS)**	Shoot biomass (g/m2)	VSAVBIO
	Shoot density (number/m2)	VSAVDENSE
	Plant species composition (% native)	VSAVSPP
	TOC (percent)	VSAVTOC
	Water depth (cm)	VSAVDEPTH
Provide Habitat for Fish Populations **(FCISAVFISH)**	Shoot biomass (g/m2)	VSAVBIO
	Shoot density (number/m2)	VSAVDENSE
	Plant species composition (% native)	VSAVSPP
	TOC (percent)	VSAVTOC
	Water depth (cm)	VSAVDEPTH
	Percent cover (percent)	VSAVCOVER
Stabilization of Substrate **(FCISAVSTAB)**	Shoot density (g/m2)	VSAVDENSE
	Percent fines (percent)	VFINES
	Percent cover (percent)	VSAVCOVER
Nutrient Cycling **(FCISAVNUTS)**	Shoot biomass (g/m2)	VSAVBIO
	TOC (mg/kg)	VSAVTOC
	Sediment nutrient availability (mg/kg)	VSNN

Transforming Field Data into FCIs

- Data transformed into unitless subindices ranging from 0.0. to 1.0 for integration into FCI models
- For most variables, the highest measured value is set at 1.0
- All stations collected to date are used as "reference stations" since they represent current, pre-dredging conditions

Example: Aquatic Vegetation Bed

- $FCI_{SAVMACROS}$: Ability to support phytophilous and benthic macroinvertebrates
- Five variables averaged
  - (Shoot biomass (g/m^2) V_{SAVBIO}
  - Shoot density ($number/m^2$)$V_{SAVDENSE}$
  - Plant species composition (% native) V_{SAVSPP}
  - TOC (percent) V_{SAVTOC}
  - Water depth (cm) $V_{SAVDEPTH}$

$$\frac{(V_{SAVBIO} + V_{SAVTOC} + V_{SAVDENSE} + V_{SAVSPP} + V_{SAVDEPTH})}{5}$$

Success Criteria

- Habitat-specific criteria will be developed based on range of conditions found in reference areas
- Range defines “bounds of expectations” for habitat replacement and reconstruction
- Developed for conditions within specific habitats

Additional Measures

- Approach employed to determine success will be presented in the Adaptive Management Plan (anticipated submittal March 2006)
- Habitat Suitability Indices will be used as a secondary measure for evaluating success

HSI Fish and Wildlife Species

- Belted kingfisher
- Great blue heron
- Wood duck
- Muskrat
- Mink
- Snapping turtle
- Yellow perch
- Largemouth bass
- Smallmouth bass
- Common shiner
- Bluegill

Additional Data Collection and Needs

- Spot-checking and reassessment
- Assessments in remaining Phase 2 areas
- Assessments in off-site reference areas: off-site reference stations for each of the four habitats will be selected in the Upstream Upper Hudson and/or Lower Mohawk River
- Validation of FCI models using site-specific data
  - Functional data assessment (e.g., fish and wildlife observations)
  - Existing data
  - On-going data collections (from other sampling programs)

Upcoming Habitat Assessment Field Work

- Complete habitat assessments at remaining Phase 2 areas and off-site reference areas
  - June-September 2006
- Conduct habitat reassessments at a subset of Phase 1 areas to determine year-to-year variability
  - June – September 2006

Components of Habitat Program

- **Habitat Delineation**
  - **Document the extent of habitat types in the 40 mile project area**
    - **Unconsolidated River Bottom**
    - **Aquatic Vegetation Beds**
    - **Shoreline (Riparian)**
    - **Riverine Fringing Wetlands**
- **Habitat Assessment**
  - **Quantify habitat-specific parameters to be used to develop replacement and reconstruction designs**
  - **Quantify habitat function for use in determining success of habitat replacement reconstruction**

Components of Habitat Program, (cont'd)

- **Habitat Replacement and Reconstruction Designs**
  - **Habitat-specific designs to replace or reconstruct those areas removed by dredging**
  - **Designs must be integrated with residuals standards**
- **Adaptive Management**
  - **Corrective actions if needed to meet goals of program**