The TVA Kingston Ash Recovery Project: Ecological Risk Approach

Daniel Jones[†]
Suzy Young[†]
Amber Stojak[†]
Neil Carriker [‡]
[†]ARCADIS U.S., Inc.; [‡] Tennessee Valley Authority

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Overview

- **Environmental Management and the Integrated Research Program**
- **River System ERA Status**
- **Ecological Receptors**
  - Exposure pathways
  - Lines of evidence
  - Bioaccumulation data
  - Effects Data
- **Environmental Management and Future Monitoring**

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TVA Kingston: Environmental Management

	Remediation	Restoration	Stewardship
Goals	Protection of • Human Health • Environment	Replacement of Environmental Services Lost	Services Maintenance • Human Use • Ecological
Assessments	• HHRA • ERA	NRDA • Human Use • Ecological	Monitoring
Guidance & Guidelines	• RAGS • ERA 8-Step	Federal Guidance • 43 CFR 11	TVA Stewardship Programs and Standard Operating Procedures
Decisions	Risk Management	Services Compensation	Resource Management

- Integrated assessment and research program

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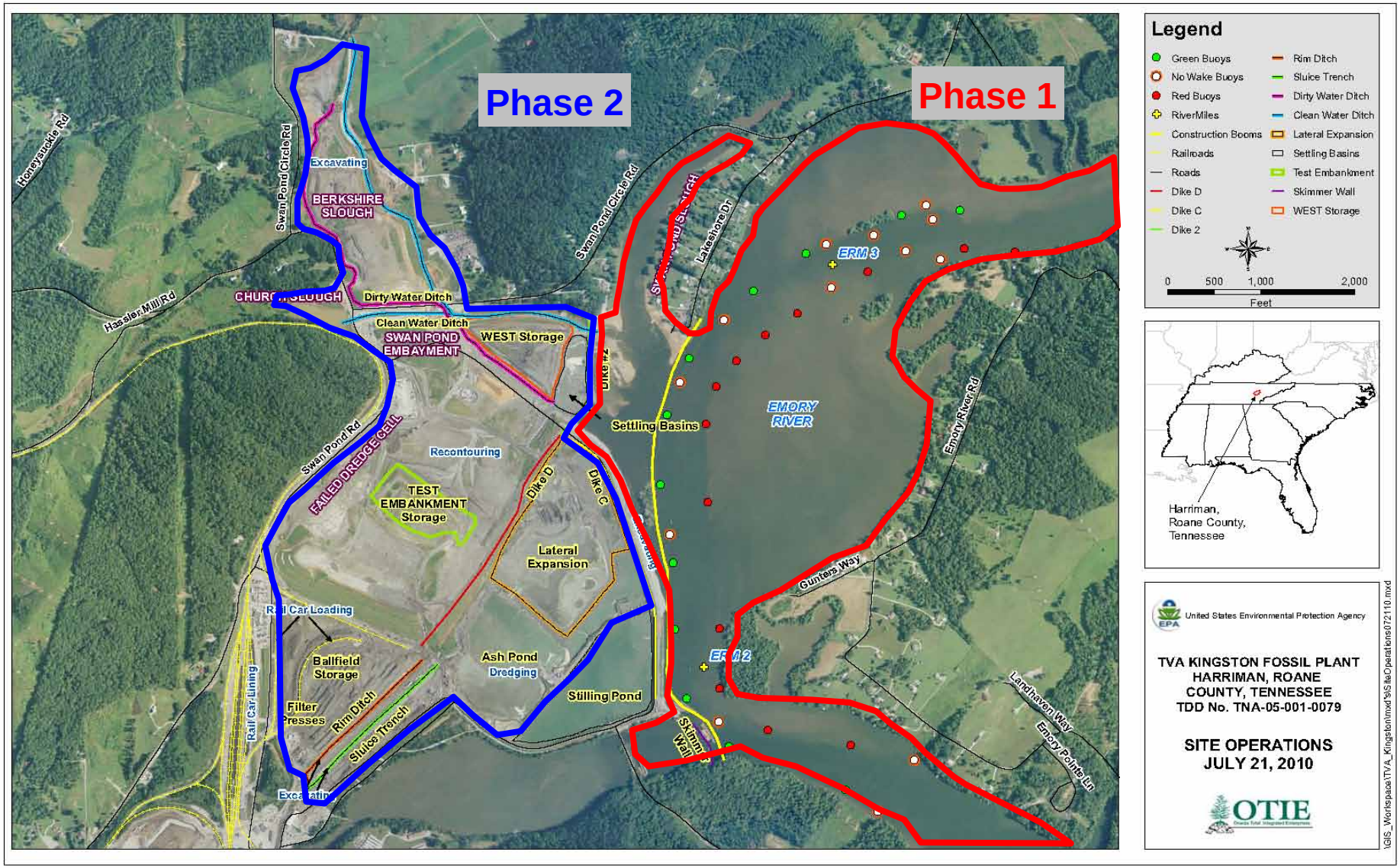
Three-Phased Removal Strategy



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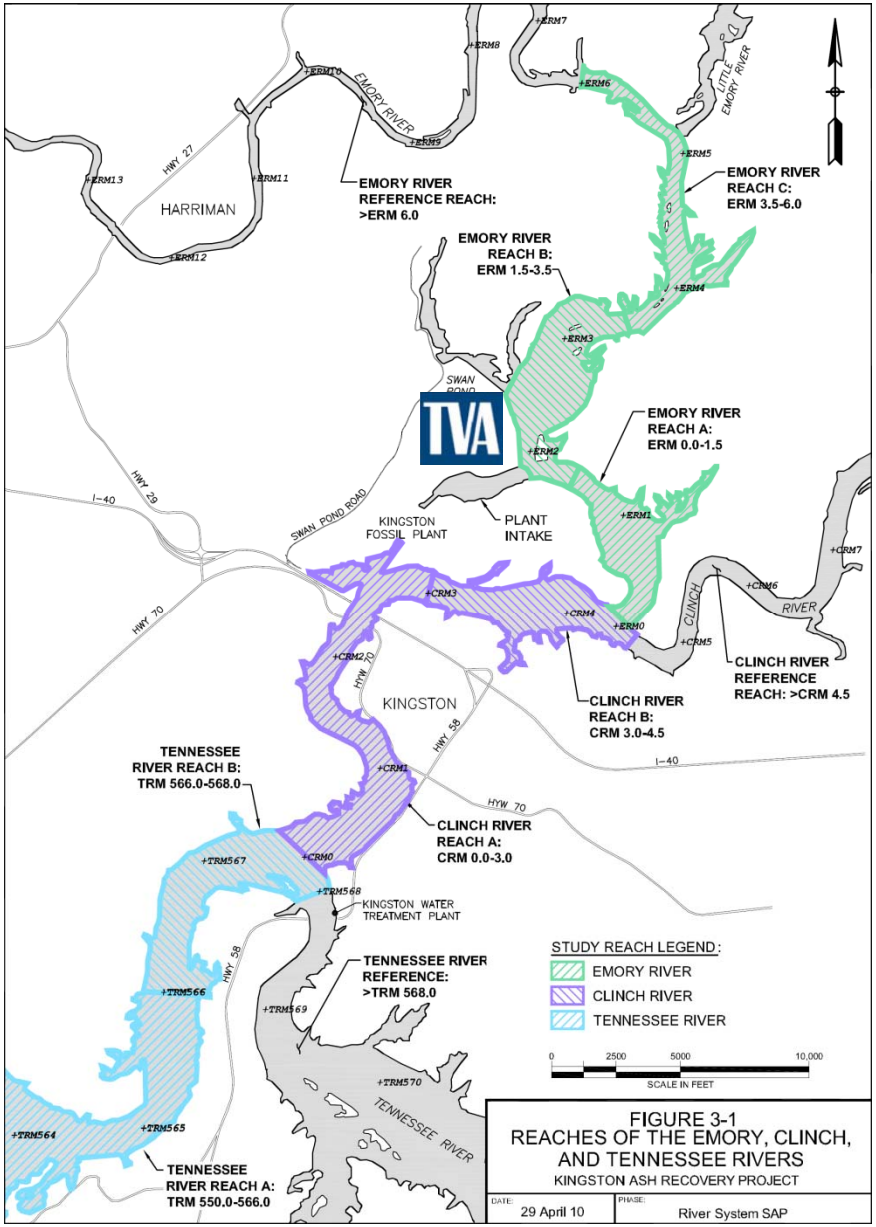
Cleanup: Phase 3

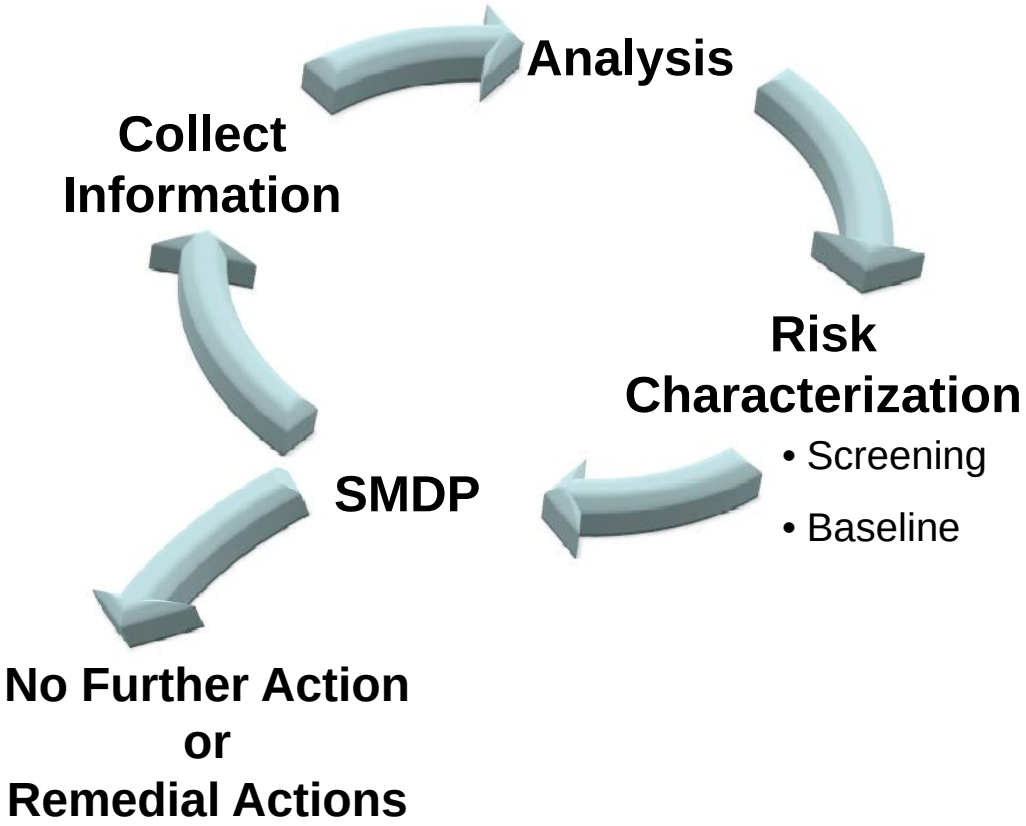
- **River System**
  - Emory River (post-dredging)
  - Clinch River
  - Tennessee River

- **EE/CA Implementation**
  - Residual ash, larger area
  - Numerous receptors
  - Risks are uncertain
  - Cleanup is challenging



Cleanup: Phase 3

- **Non-Time Critical**
- **Removal Action**
  - Screening RAs done
- **Baseline RAs**
  - Human Health, Ecological
  - Comprehensive, robust
  - Site-specific data
  - Fewer assumptions
  - Refined uncertainties
  - Scientifically defensible
  - Rational decisions



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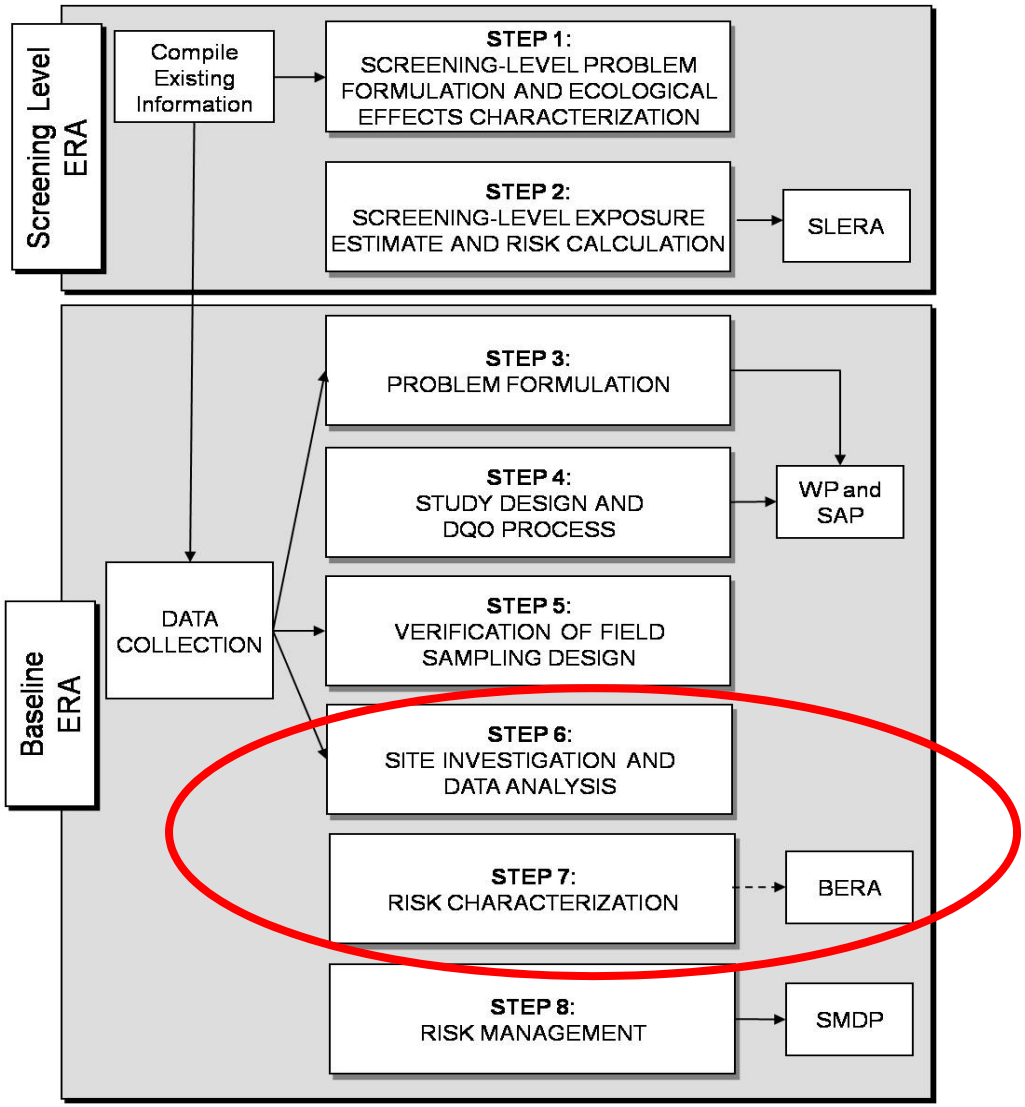
River System ERA



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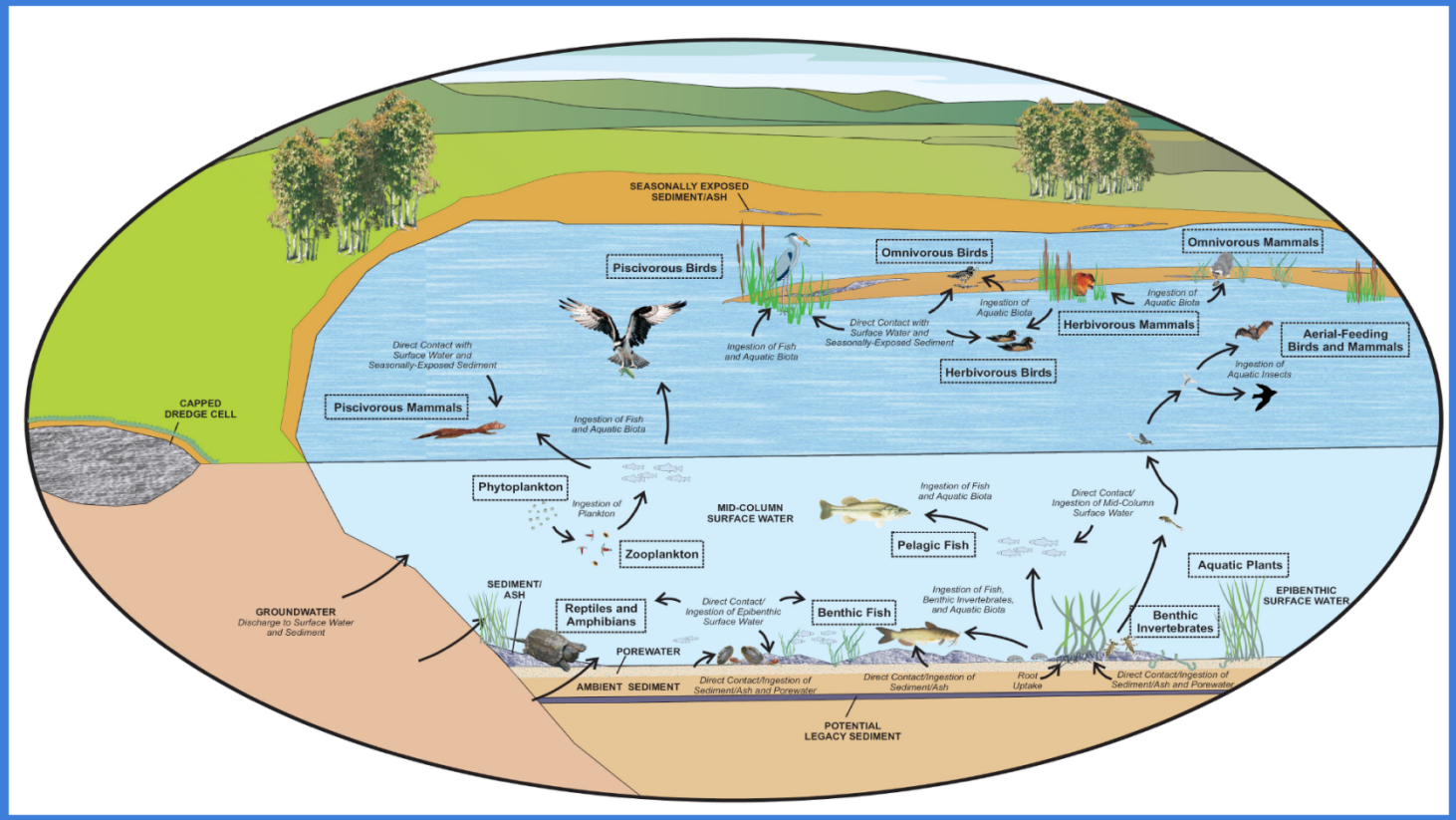
CONCEPTUAL SITE MODEL: PICTOGRAPH



ECOLOGICAL MEASUREMENT ENDPOINTS

LITERATURE VALUES: DIRECT CONTACT

Constituent concentrations in ambient media compared with no-observed-adverse-effect levels (NOAELs), lowest-observed-adverse-effect levels (LOAELs), and chronic values.

- Fish: Pelagic Benthic
- Benthic Invertebrates
- Aquatic Plants: Emergent Vegetation Periphyton
- Amphibians (?) Reptiles (?)

LITERATURE VALUES: FOODWEB

Measured or estimated concentrations in prey and in incidentally ingested ambient media compared with literature derived toxicity reference values (TRVs).

- Birds: Herbivores Omnivores Piscivores
- Mammals: Herbivores Omnivores Piscivores
- Aerial-Feeding Insectivores: Birds Mammals

BIOSURVEYS

Direct measurements of the quality of the biological community. Biological studies conducted for the river system include biological characterization, monitoring, and assessment data from a variety of studies and sources.

- Benthic Invertebrates: Body burden, community metrics
- Pelagic and Benthic Fish: Body burden, community metrics
- Amphibians: Body burden
- Piscivorous Birds: Eggs, nestlings, community surveys (clutch size, hatchling success, etc.)
- Reptiles: Body burden
- Aerial-Feeding Insectivorous Birds: Eggs, nestlings, community surveys (clutch size, hatchling success, etc.)
- Omnivorous Mammals: Blood, organ status

LITERATURE VALUES: BODY BURDEN

Body burden effects data (whole or organ) compared with toxicity data found in the literature. Specific focus on arsenic and selenium.

- Fish: Pelagic Benthic
- Amphibians
- Birds: Herbivores Omnivores Piscivores
- Reptiles
- Mammals: Herbivores Omnivores Piscivores
- Aerial-Feeding Insectivores: Birds

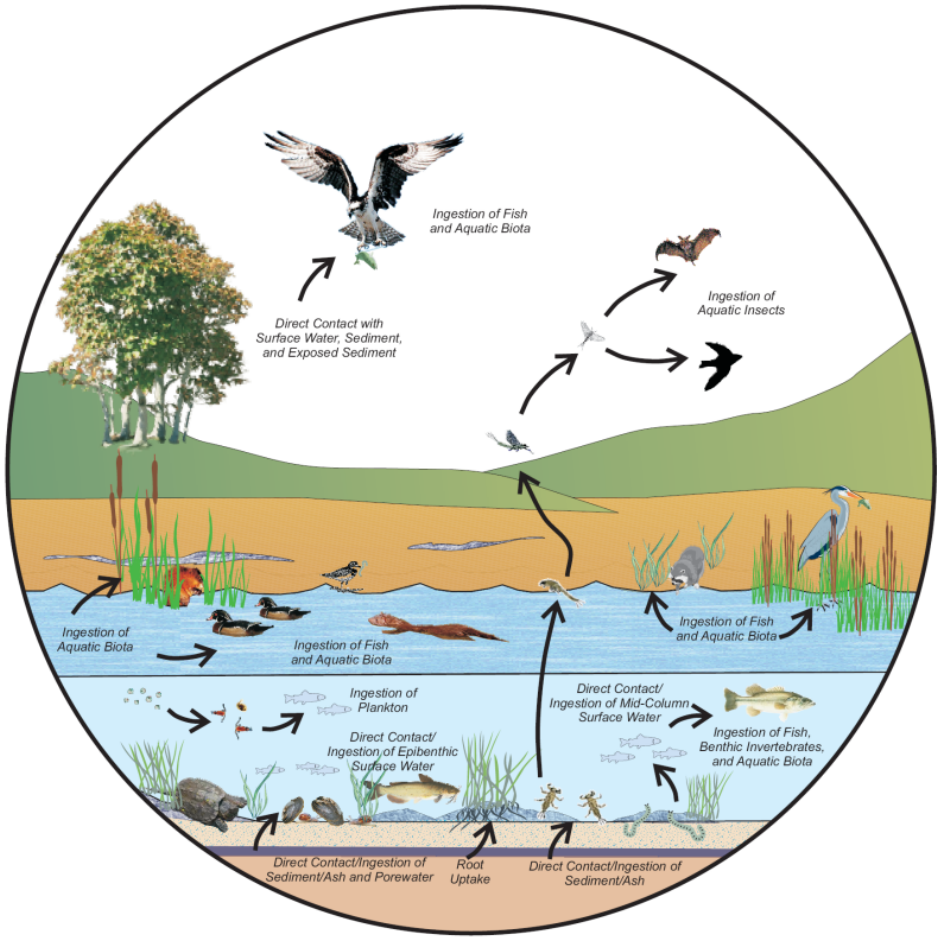
BIOASSAYS

Bioassays, or toxicity testing, may be appropriate when the evaluation of chemical data indicates that toxicity to fish or invertebrates is possible, but the likelihood of toxicity is uncertain. Conducted on submerged sediment, and surface water.

- Fish: Pelagic Benthic
- Benthic Invertebrates

Ecological Receptors: Bioaccumulation

- **Aquatic plants**
- **Pelagic fish**
- **Benthic fish**
- **Benthic invertebrates**
- **Aquatic- or riparian-feeding birds**
  - Herbivores (wood duck)
  - Omnivores (mallard; killdeer)
  - Piscivores (osprey; great blue heron)
- **Aquatic- or riparian-feeding mammals**
  - Herbivores (muskrat)
  - Omnivores (raccoon)
  - Piscivores (mink)
- **Aerial-feeding insectivores**
  - Birds (tree swallow)
  - Mammals (gray bat)
- **Aquatic- or riparian-feeding reptiles**
- **Aquatic- or riparian-feeding amphibians**



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Ecological Receptors: Effects

- **Aquatic plants**
- **Pelagic fish**
- **Benthic fish**
- **Benthic invertebrates**
- **Aquatic- or riparian-feeding birds**
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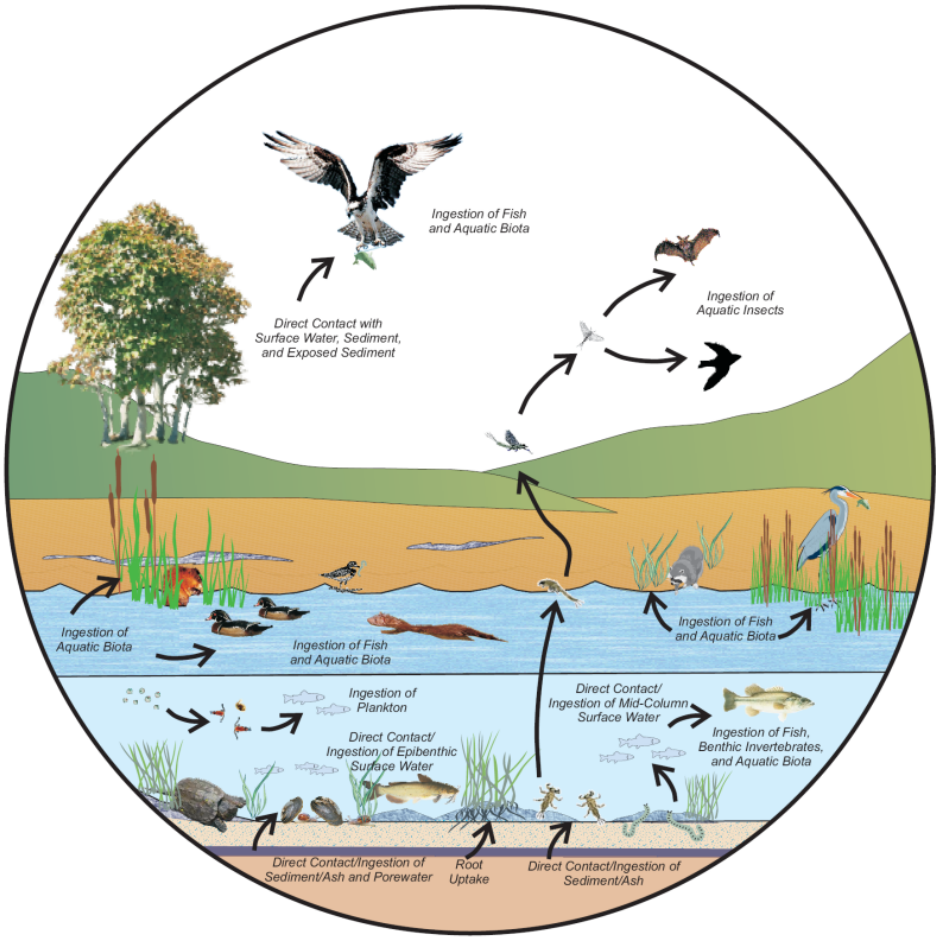

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Lines-of-Evidence

- **Exposure Concentrations vs. Literature-Derived Effects Values**
  - Abiotic media
  - Biota
  - Diet
- **Bioassays**
  - Sediment/Ash
  - Surface water
- **Biosurveys**
  - Fish, Benthics
  - Birds, Mammals
  - Herps, Plants

Weight-of-Evidence

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Environmental Management

- **Three Primary Components**
  - Remediation, Restoration, and Stewardship
  - Monitoring is common to all three
- **Ultimately about Making Decisions**
  - Monitoring must support the decision-making process for EM components
- **Zero-Sum Enterprise**
  - Time, money, effort and expertise spent on one question or action are not available for other environmental activities
  - Choices must be made wisely!

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Questions?

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