Assessing Risks in a Dynamic Environment: The TVA Kingston Ash Recovery Project

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Overview

Risk Assessment Strategies

- What is risk assessment?
- Types of sites
- Traditional and Alternative strategies

Kingston Risk Assessments

- Time Critical Removal Action
- Non-Time Critical Removal Action
- Environmental Management

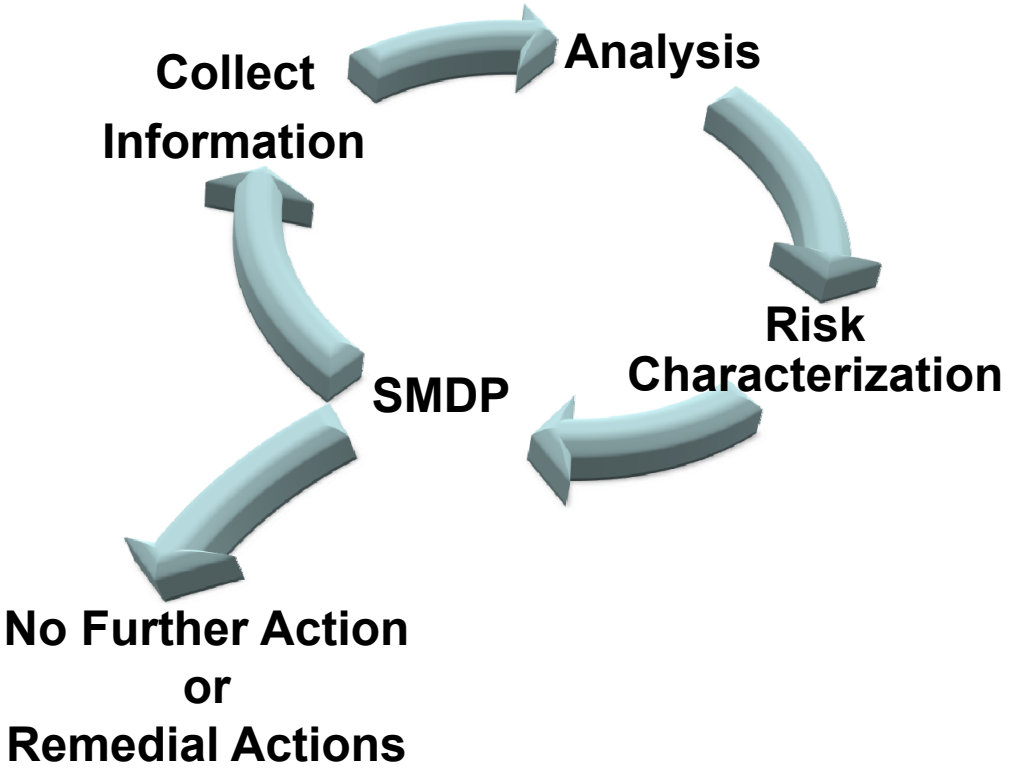
What is Risk Assessment?

Analytical Process

- Likelihood, Magnitude of Adverse Effects
- Objective
- Clear Assumptions
- Explicit Uncertainties
- Quantitative (preferred)
- Iterative (as necessary

Supports the Risk Management Process

- Subjective
- Considers Other Factors



General Types of Sites

Legacy Sites	*Characteristics*	New Releases
Stable	*Physical*	Unstable
Established	*Spatial Extent*	Uncertain
Equilibrated	*Chemical*	Non-Equilibrium
Steady-State	*Bioaccumulation*	Lag Phase
Available	*Habitat*	Eliminated
Adapted	*Biota*	Displaced
Excluded or Exposed	*Human Populations*	Displaced or Exposed
STABLE	***OVERALL***	**DYNAMIC**

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Assessment Strategies: Traditional

Starts Simple, Conservative

- Ambient Media
- Limited Extent
- Max Detects
- Default Exposure Parameters
- Conservative Screening Values
- Shorten the List of COPCs

Reasonableness Increases

- Frequency of Detects
- Mean and UCL95
- Site and Receptor Specific Exposure Parameters
- Range of Effects Values

Complexity Increases

- Bioaccumulation Data
- Bioassays
- Biological Surveys
- Stochastic Exposure Models

Assessment Strategies: Alternative

Starts Comprehensive

- All potential pathways and receptors
- Ambient media and biota
- Early emphasis on biological integrators and direct exposure routes

Why?

- Responses to exposures may take time to develop
- Trend analysis important for evolving situations
- Transient conditions cannot be resampled
- Document “initial” conditions
- “Early” warning
- Supports other Environmental Management objectives
  - Restoration and Stewardship

Focus Longer-Term Efforts

- Establish key metrics for monitoring
- Fewer receptors, measures
- Reduce to periodic snapshots when trends warrant

Time Critical Removal Action

Emory River Channel

- Blocked by ash
- Risks include:
  - Upstream flooding
  - Downstream migration
  - Dissolution of constituents

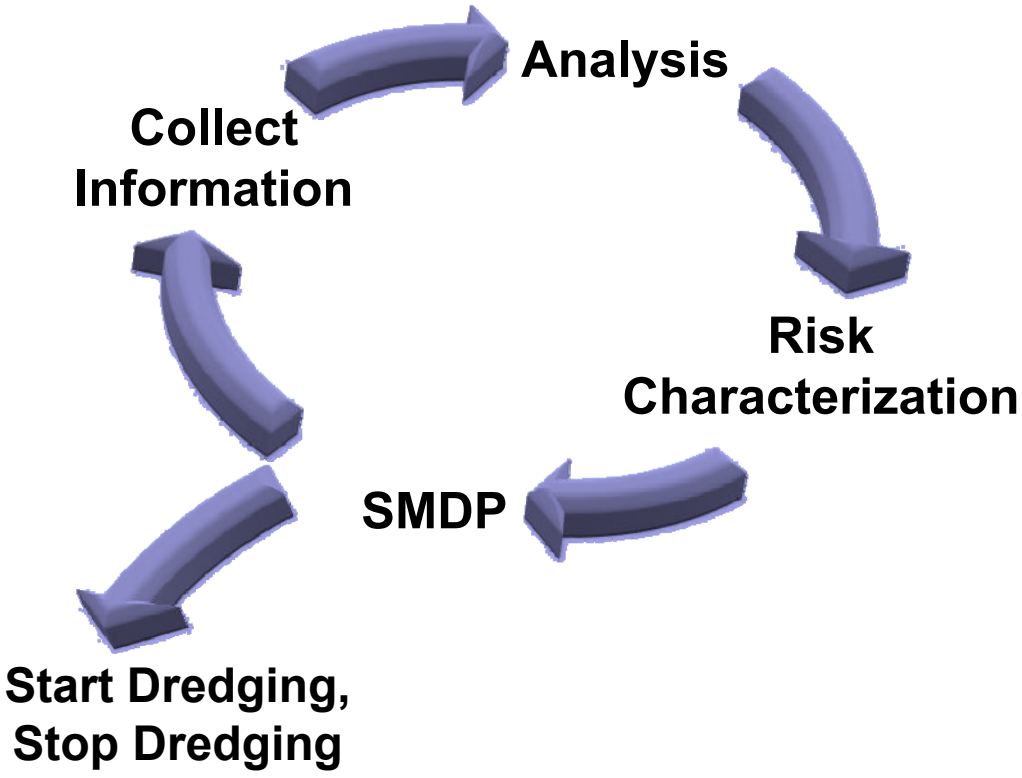
Flooding Risks

- HEC-RAS hydrology model
- 100-yr flood 5’ – 8’ higher
- Extends ~11 miles upstream
- ~100 structures at risk
- Risks evident and immediate

Time Critical Removal Action

Risk Assessment and Management

- Emory blocked by ash
- Risks concerns were immediate
  - Rapid collection and analysis of data
  - Screening risk assessments for surface water during dredging
- Time Critical Removal Action in Emory River
  - Temporary Weir #1
  - Temporary Dike #2
  - Dredge channel
  - Dredge ash deposits



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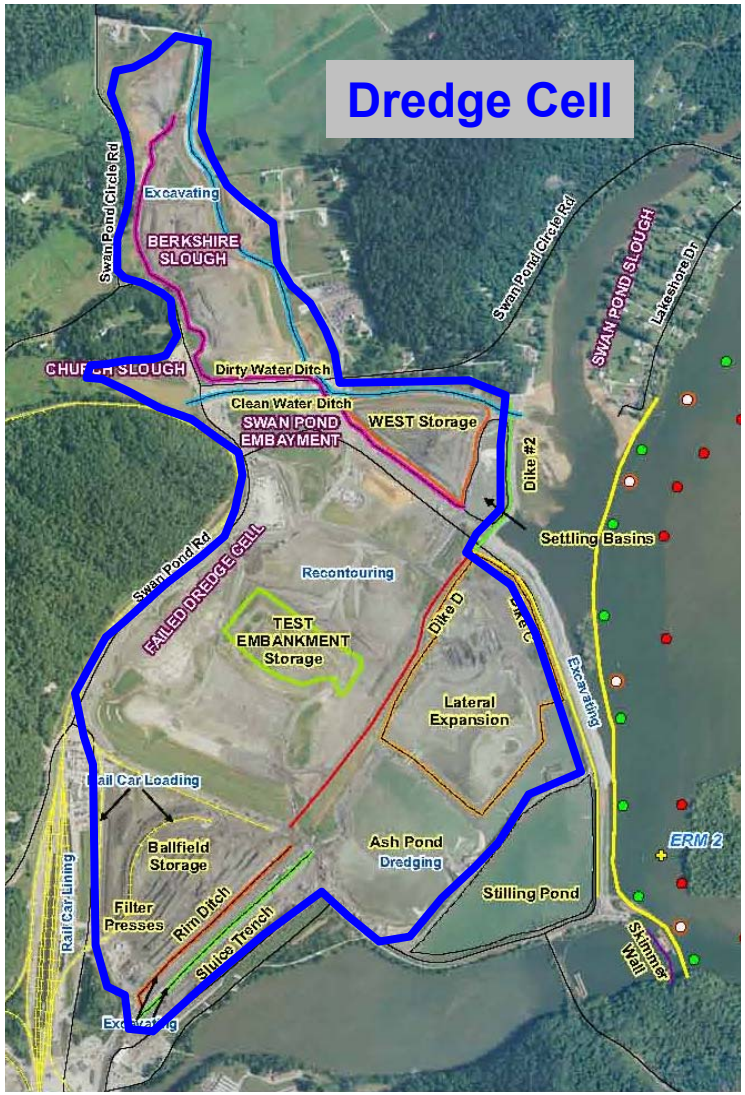
Non-Time Critical Removal Action

Dredge Cell & Embayment

- Swan Pond Embayment(s) filled with ash
- Failed dredge cell
- Stabilized by Dike #2

Engineering Evaluation/ Cost Analysis (EE/CA)

- Risk assessments
- No action alternative



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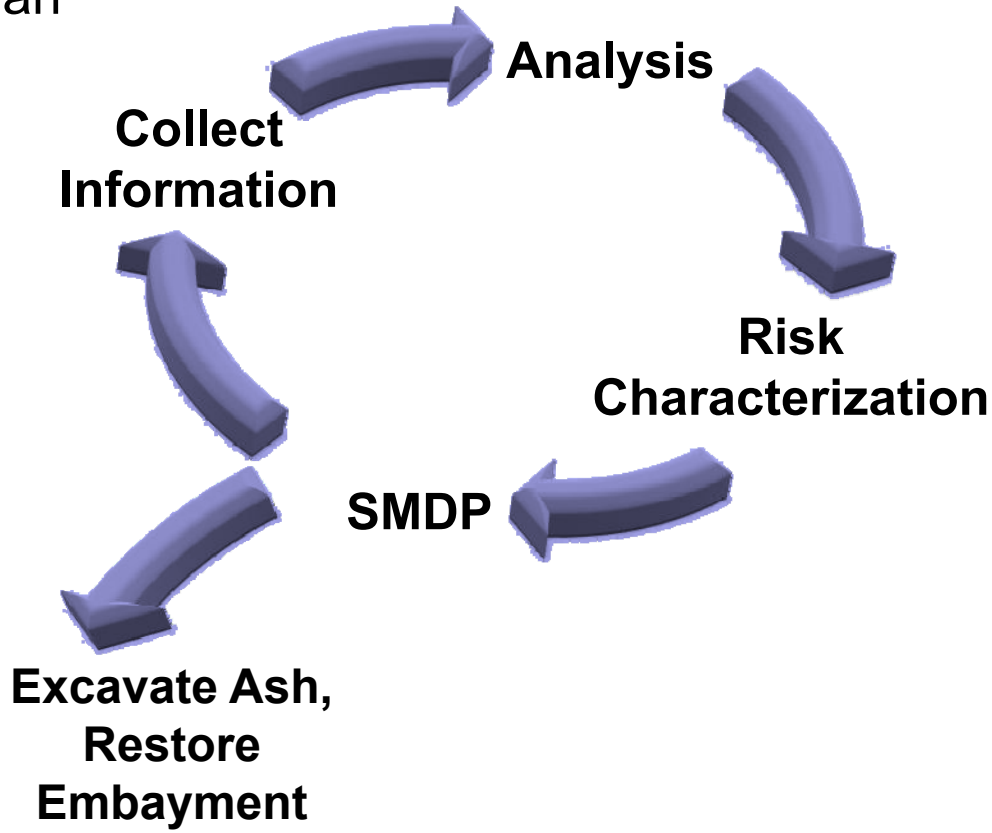
Non-Time Critical Removal Action

Risk Assessment Complexity Commensurate with Risk Management Needs

- Potential chemical risks to human health and environment
- Screening-level ecological assessment
  - Ash as “soil”
  - Max concentrations
  - Conservative criteria
  - Significant risks
- Baseline human health assessment
- Parameter Selection
  - EPA default
  - Region 4 recommended
  - Scenario specific parameters



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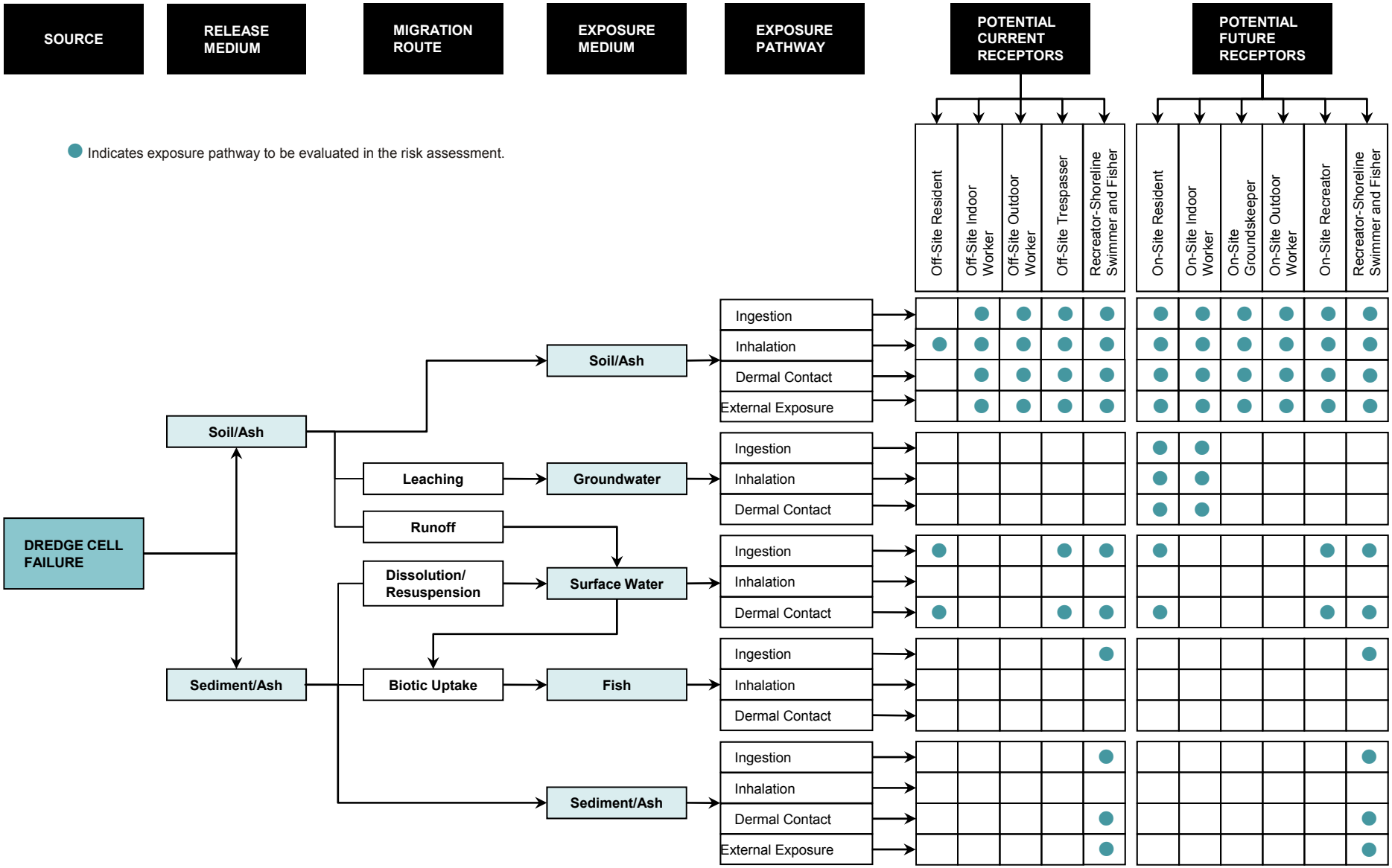
Dredge Cell - Human Health Conceptual Site Model



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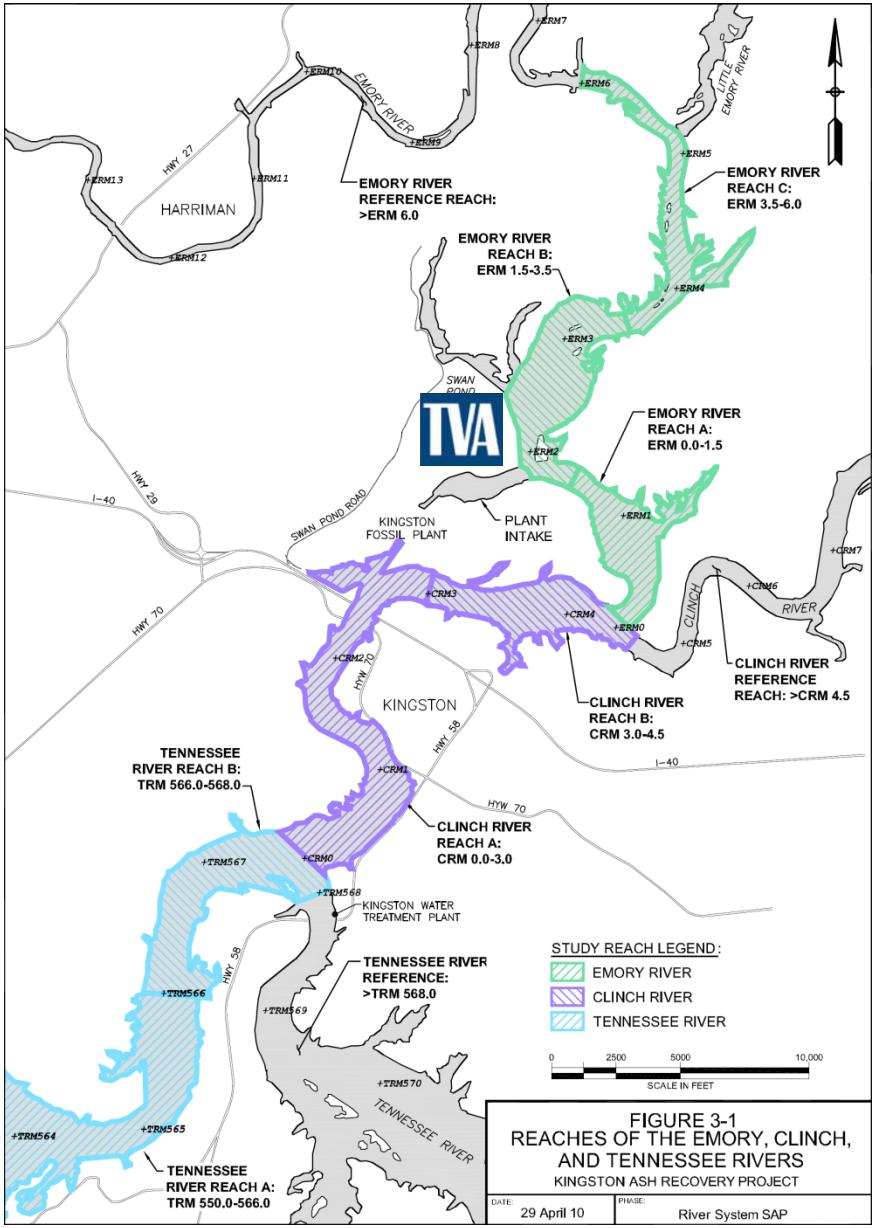
Non-Time Critical Removal Action

River System

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

EE/CA Implementation

- Residual ash, larger area
- Numerous ecological receptors
- Risks are uncertain
- Cleanup is challenging



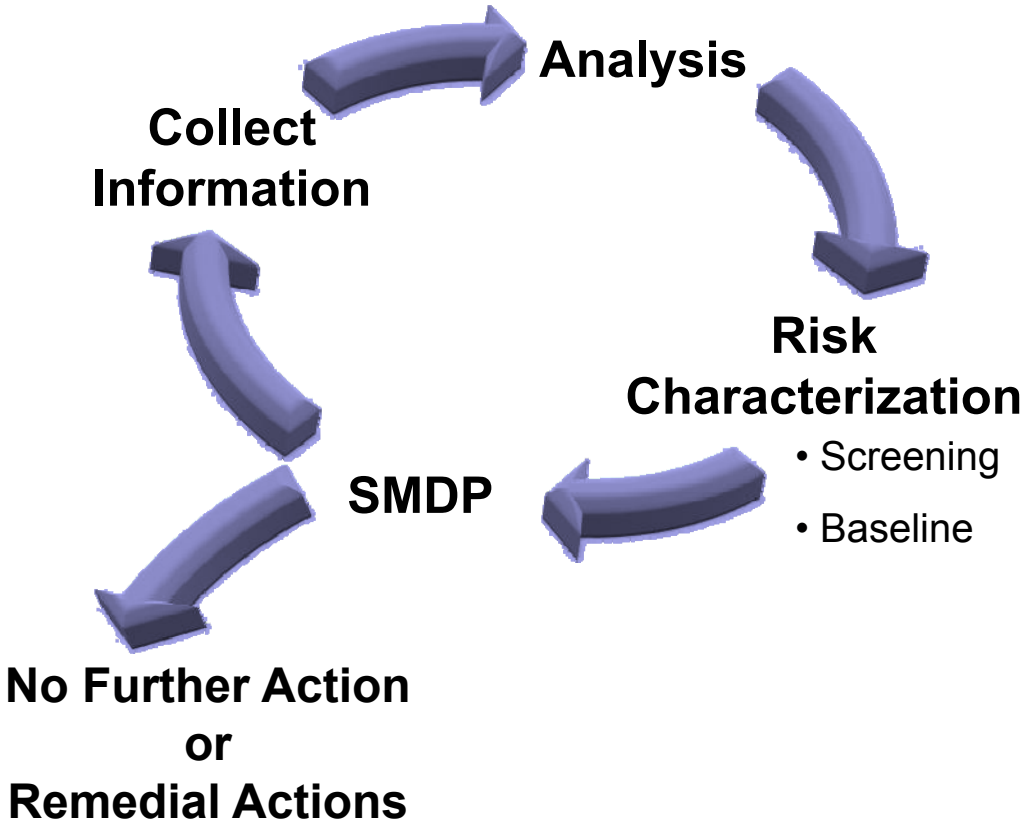
Non-Time Critical Removal Action

Non-Time Critical Removal Action

- Screening RAs done

Baseline RAs

- Ecological - Comprehensive, robust
- Human Health – Limited receptors and exposure routes
- Site-specific data
- Fewer assumptions
- Refined uncertainties
- Scientifically defensible
- Rational decisions



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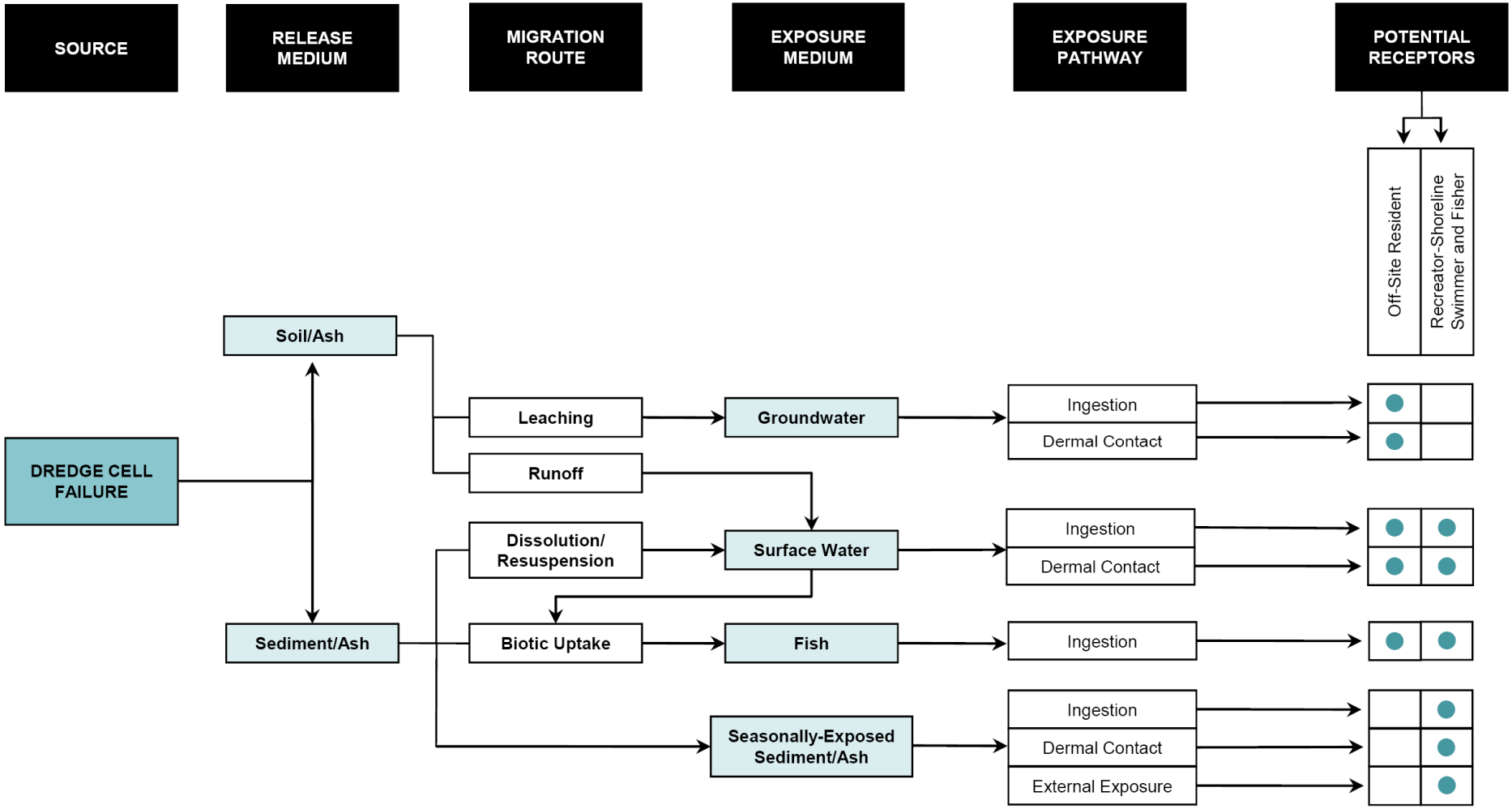
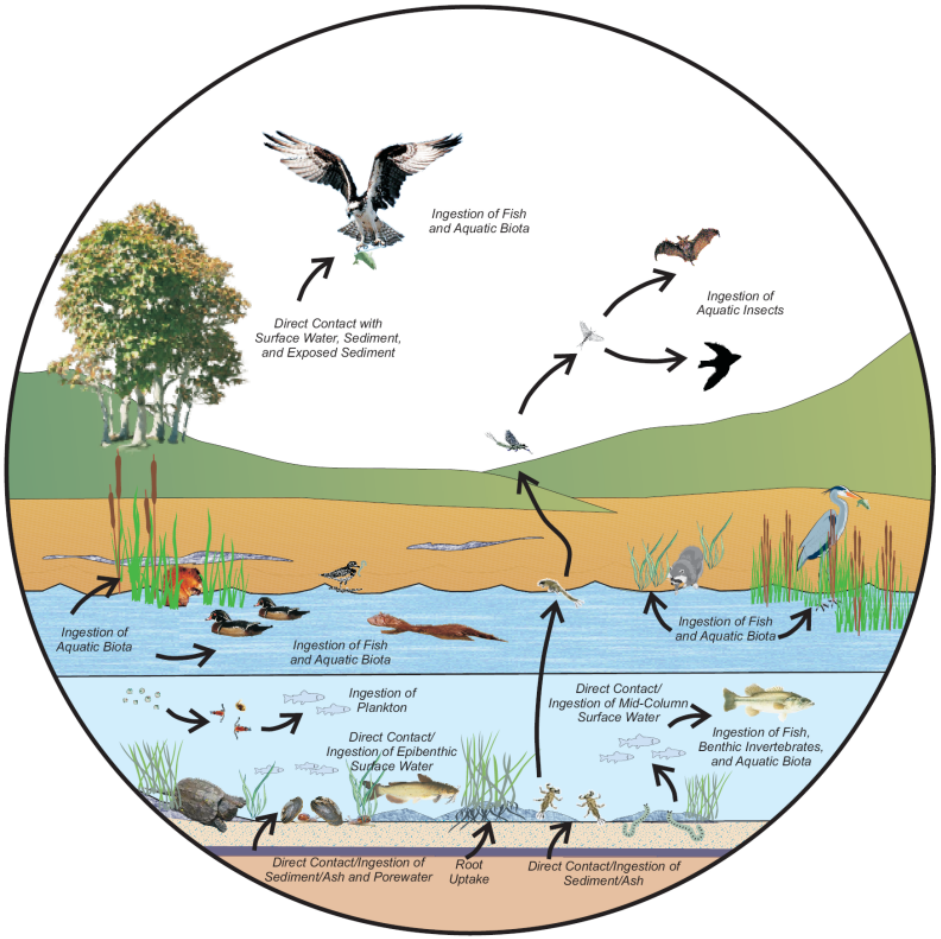
River System - Human Health Conceptual Site Model



● Indicates exposure pathway to be evaluated in the risk assessment.

River System: Ecological Receptors

- **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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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

Environmental Management

Three Primary Components

- Remediation, Restoration, and Stewardship

Ultimately about Making Decisions

- Assessments must support the decision-making process for EM components

Zero-Sum Enterprise

- Resources are finite
- Time, money, effort and expertise spent on one question or action are not available for other environmental activities
- Investments must be made wisely!

QUESTIONS?

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