

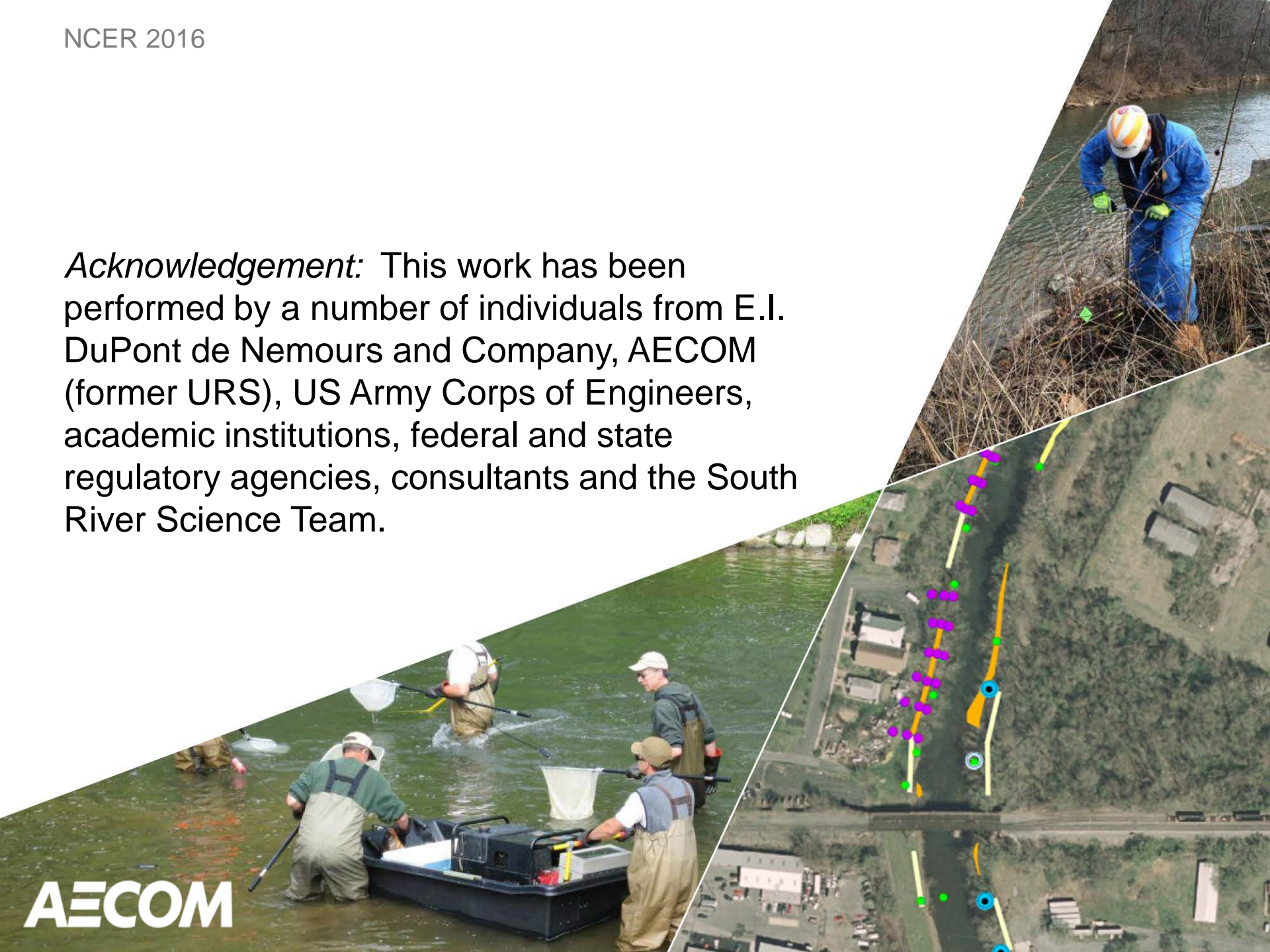
LEARNINGS FROM IMPLEMENTATION OF A COMPREHENSIVE MONITORING PROGRAM IN THE SOUTH RIVER, VA

National Conference on Ecosystem Restoration
April 20, 2016

Nancy R. Grosso, DuPont
Christy M. Foran, USAERDC
Ceil Mancini, AECOM



Acknowledgement: This work has been performed by a number of individuals from E.I. DuPont de Nemours and Company, AECOM (former URS), US Army Corps of Engineers, academic institutions, federal and state regulatory agencies, consultants and the South River Science Team.



Agenda

- Background
 - Adaptive Management
 - Project
- Stakeholder Involvement
- EAM Framework
- Monitoring
 - Objectives
 - Elements
- Benefits
 - Present
 - Future



Adaptive Management Process

Plan

- Determine management options
- Define key desired outcomes
- Identify performance indicators
- Develop management strategies/actions

Do

- Monitor selected performance indicators
- Implement strategies and actions to achieve objectives

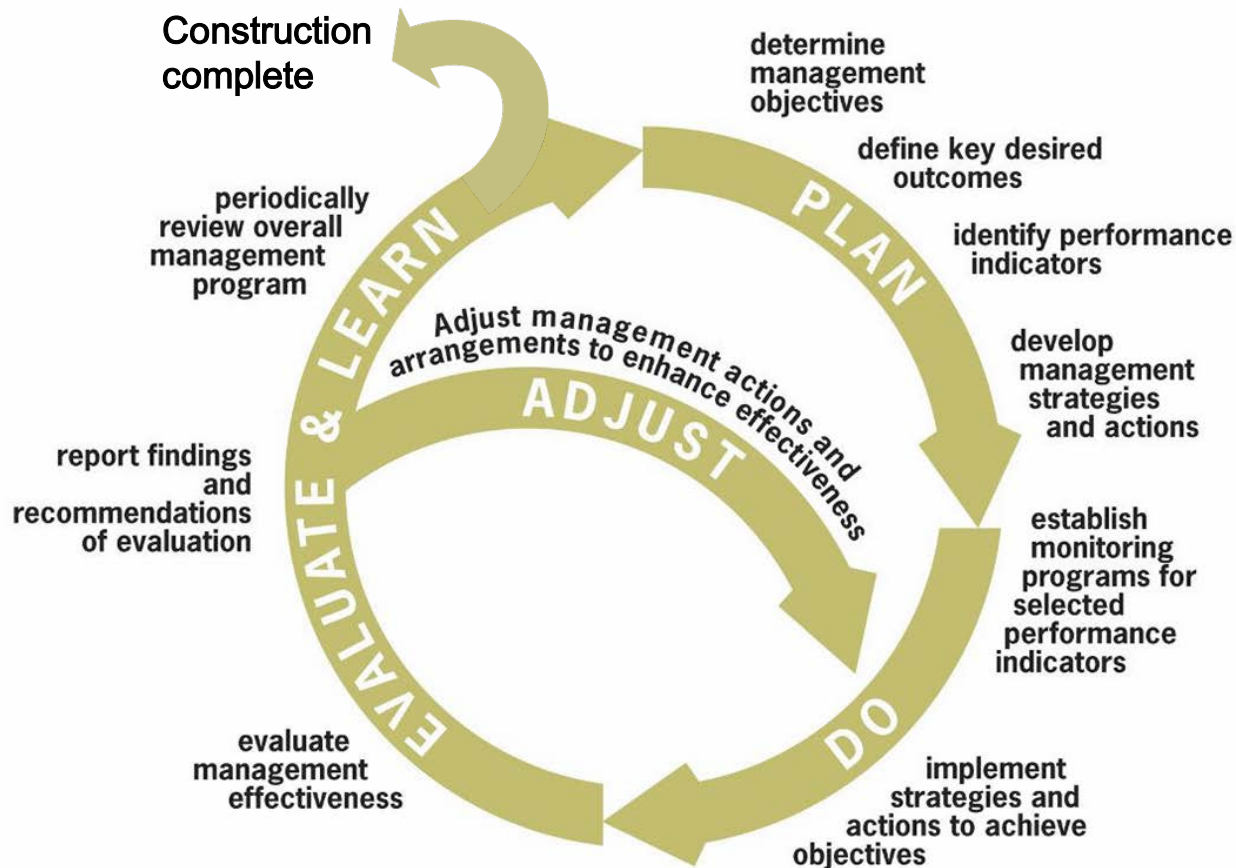
Evaluate and Learn

- Evaluate management effectiveness
- Discuss findings and recommendations

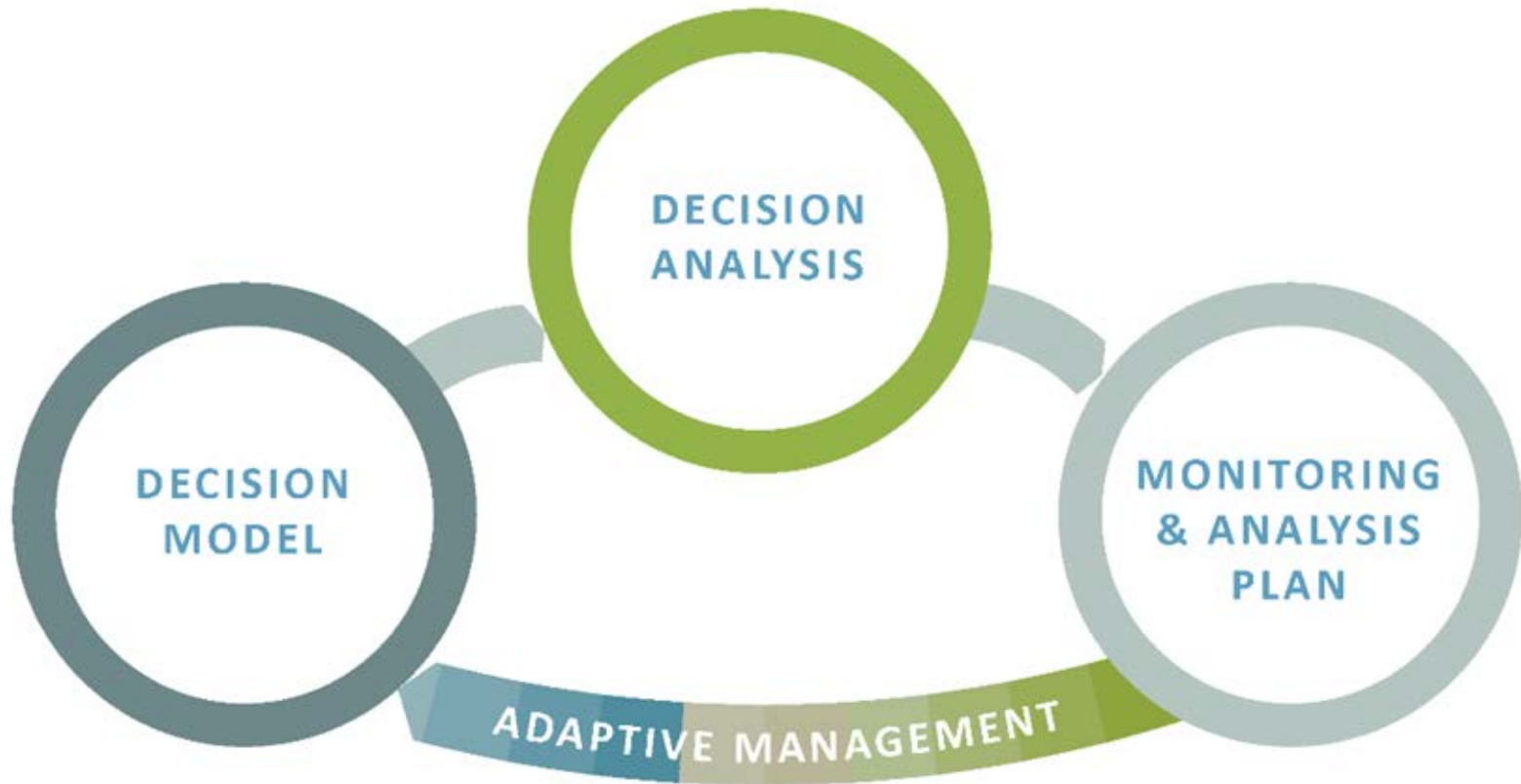
Adjust

- Adjust management actions to enhance effectiveness
- Periodically review overall management program

The adaptive management cycle



Enhanced Adaptive Management Components



Applications

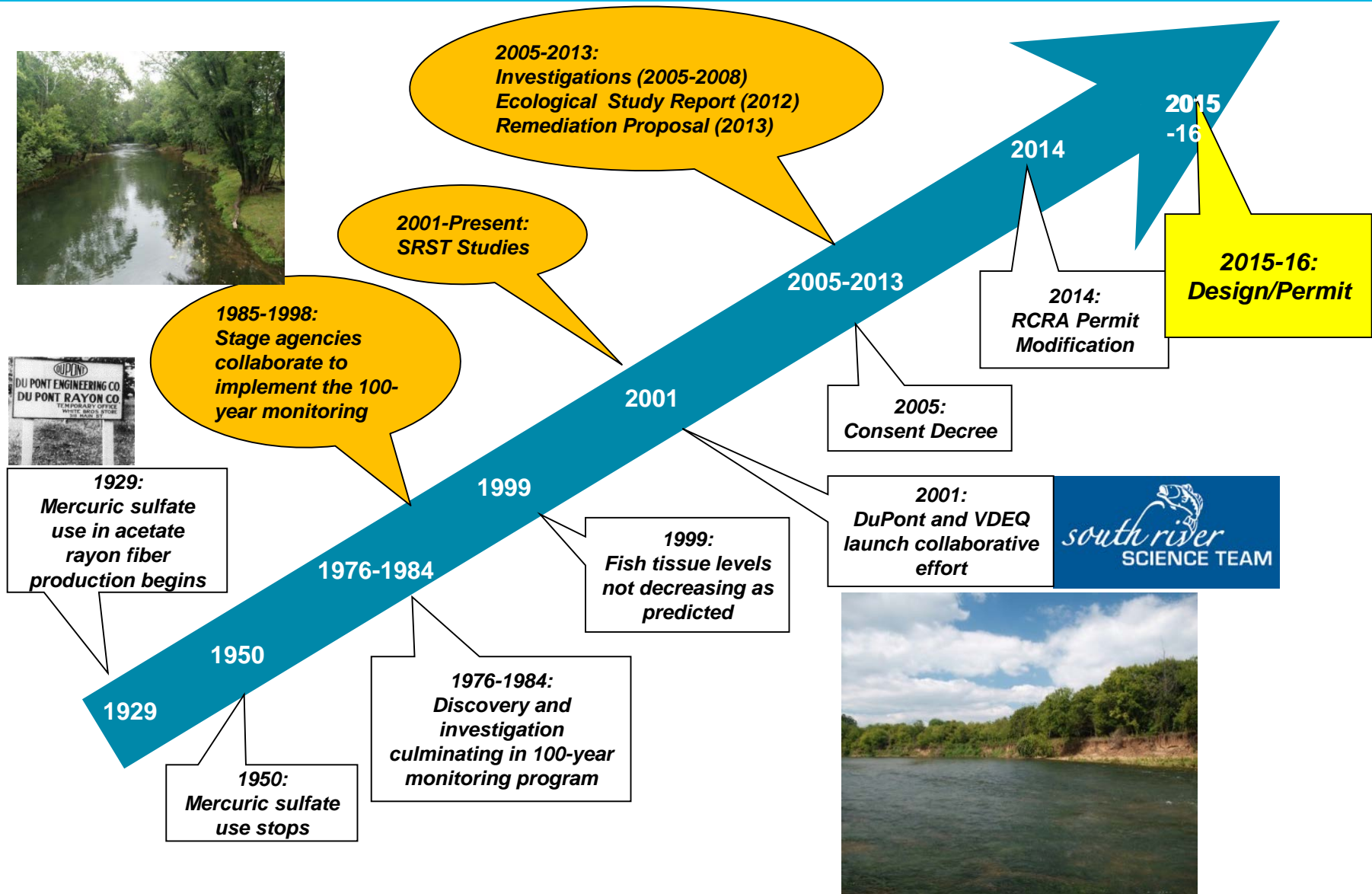
– Adaptive Management

- Promotes flexible decision-making
- Allows for iterative learning through monitoring of the effects of management options
- Advances understanding of chemical, biological, and social processes in light of specific actions

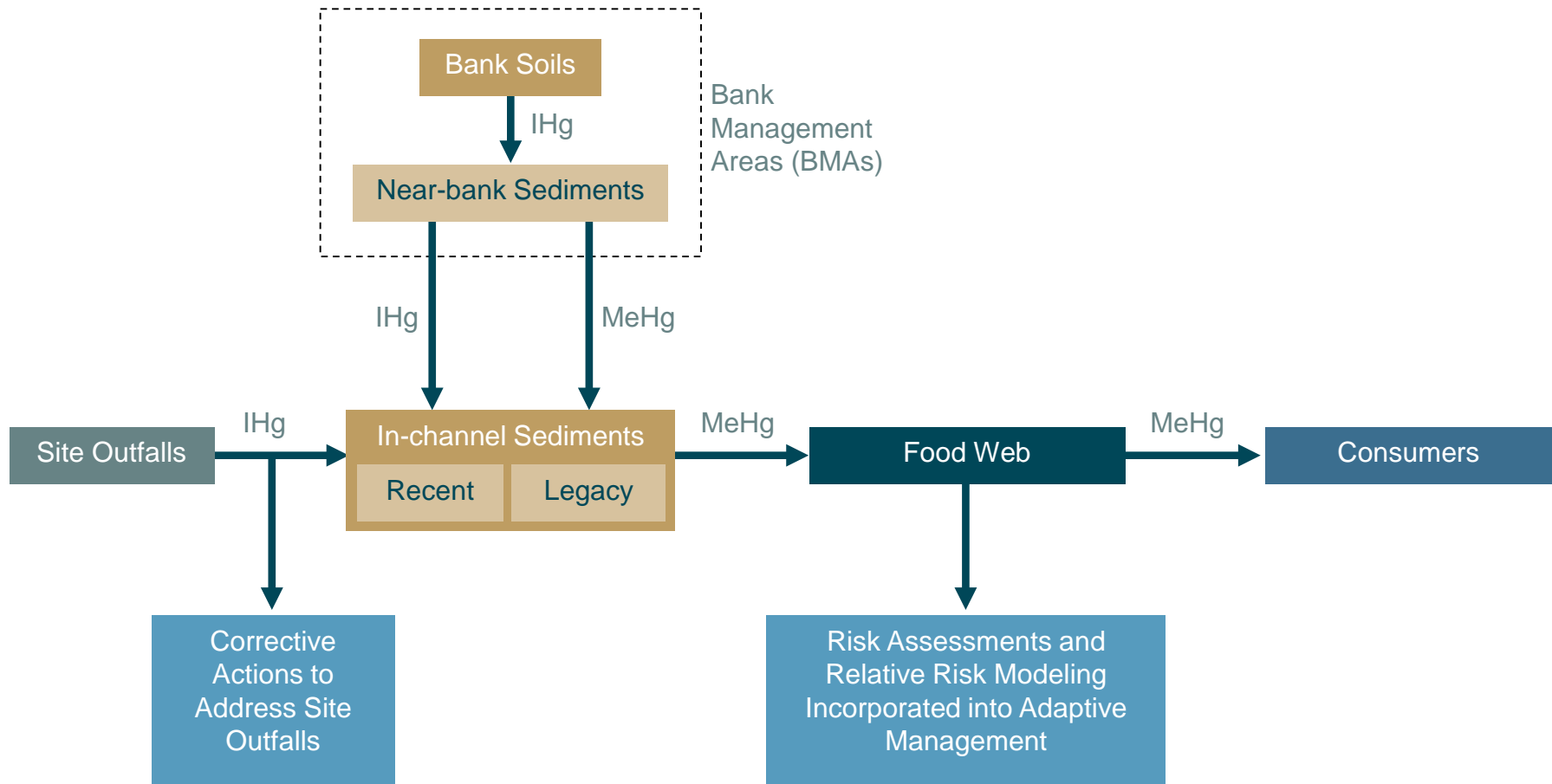
– Enhanced Adaptive Management (EAM)

- Provides framework for the reduction of uncertainty through iterative actions
- Allows prediction of range of outcomes from remedial actions
- Documents (and archives) assumptions
- Ensures that adaptive management is not “trial and error”

Project Background



Planned Interim RCRA Corrective Actions



Notes:

IHg – inorganic mercury

MeHg – methylmercury

Remedy Based on Mercury Loading

- Phased approach in an *adaptive management framework*
- Approximately 23% of banks contribute 90% of mercury
- Removal and stabilization
- Public Participation



Goals and Objectives of Monitoring

– Goal:

- Assess efficacy of remedy to reduce transport and exposure pathways
- Secondarily to improve WQ and bank habitat

– Objectives are to monitor:

- Human and ecological exposure to mercury
- System responses to remediation
- Integrity of corrective action; and
- Provide input to adaptive management framework and relative risk models



South River Science Team: Stakeholder Input

State



VDEQ
VDGIF
VDH

Federal



EPA
USF&WS

City



City of
Waynesboro

NGOs



Friends of the Shenandoah
Virginia Conservation Council
Trout Unlimited
Shenandoah River Keeper

Academia



College of William and Mary
James Madison University
Virginia Tech
University of Delaware
University of Waterloo
Colorado State University
Western Washington University
Texas Tech University

Expert Panelists



Will Clements
Dave Hirschman
Ralph Turner

DuPont



Engineers
Geologists
Risk assessors

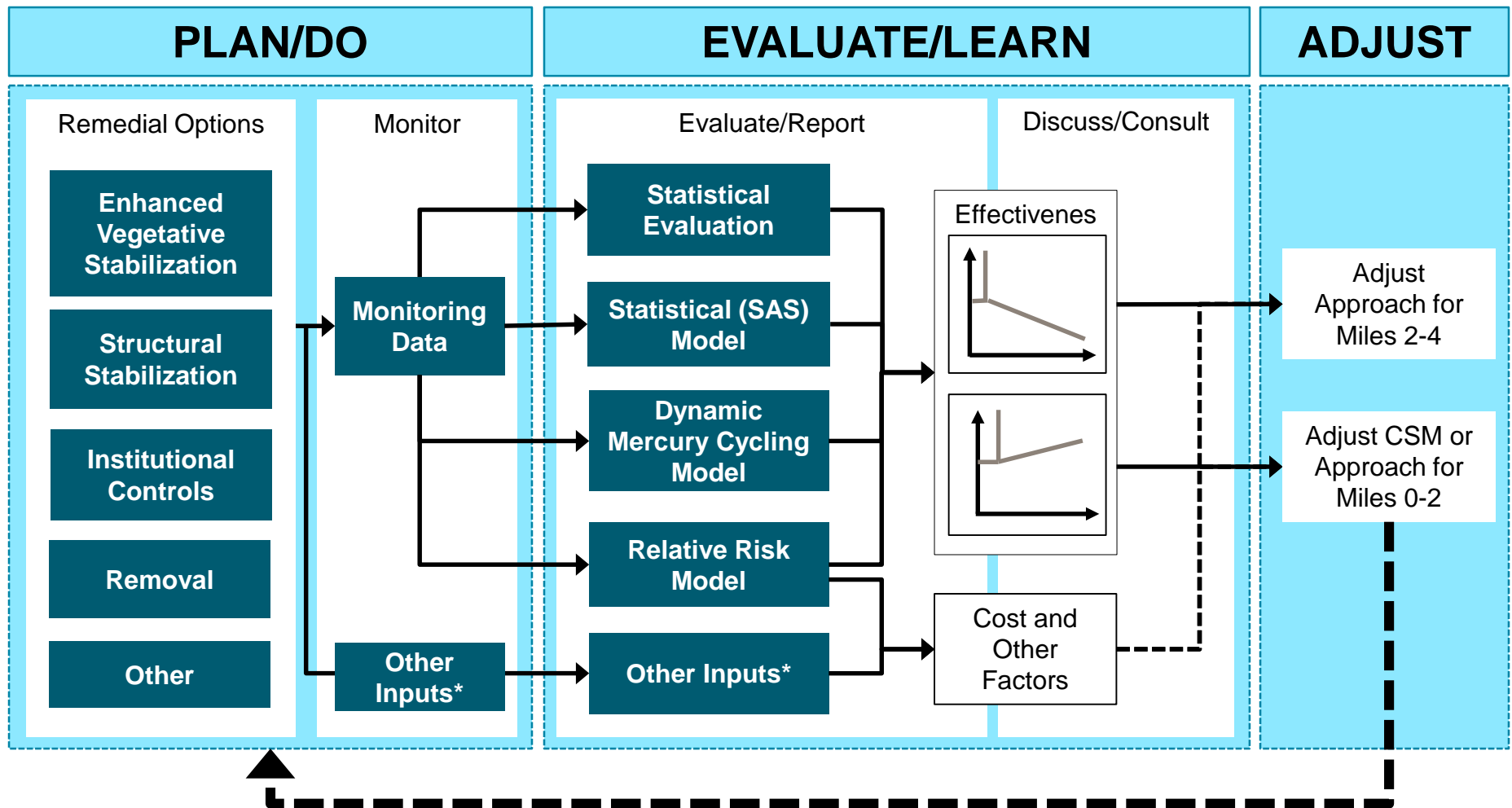
Consultants



AECOM
Anchor QEA



Phase 1 Enhanced Adaptive Management



*Other Inputs include: Habitat condition improvements, permitting and implementation issues encountered and actual costs, etc.

Monitoring Features

- Monitoring is:
 - Front end loaded
 - Iterative, and may be modified pending results
- Contains short-term and long-term elements
 - Differ in terms of spatial and temporal scope
 - Similar overall goals



Endpoints



❖ Aquatic :

- Benthic macroinvertebrates
- Larval and emergent aquatic invertebrates
- Fish species [largemouth bass (*Micropterus salmoides*) and smallmouth bass (*Micropterus dolomieu*)]
- Aquatic plants

❖ Semi-Aquatic:

- Amphibians
- Piscivorous birds [belted kingfisher (*Megaceryle alcyon*)]
- Omnivorous birds [mallard duck (*Anas platyrhynchos*)]
- Piscivorous mammals [river otter (*Lontra canadensis*)]

❖ Terrestrial:

- Plants
- Invertebrates (earthworms)
- Invertivorous birds [Tree swallow (*Tachycineta bicolor*) and American robin (*Turdus migratorius*)]
- Carnivorous birds [Eastern screech owl (*Megascops asio*)]
- Invertivorous mammals [Big brown bat (*Eptesicus fuscus*), short-tailed shrew (*Blarina brevicauda*)]
- Herbivorous mammal [white-tailed deer (*Odocoileus virginianus*)]

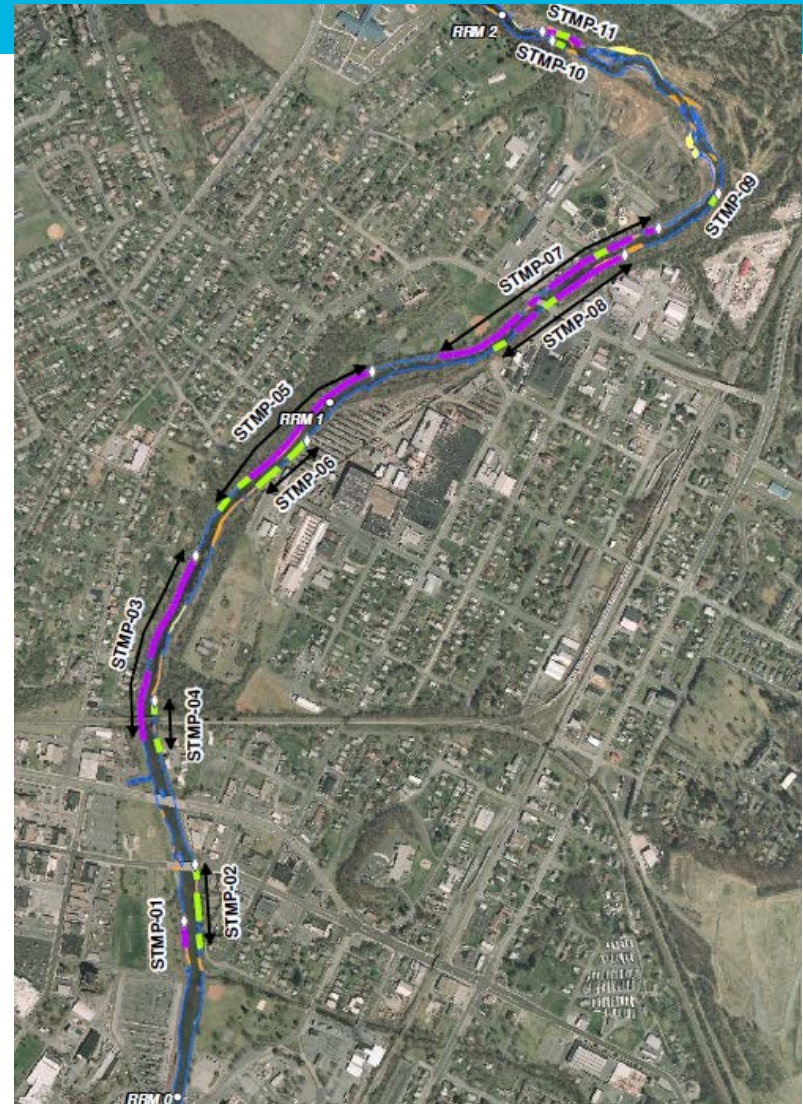
Short-term Monitoring Objectives

- Objective: test effectiveness of Phase I Interim Measure
 - Bank stabilization between RRM 0 to 2 to reduce:
 - Bank erosion
 - Mercury loading
 - In-channel mercury exposure
- Short time frame (2-10 years)
- Small spatial scale
- Remediation of downstream reaches informed by remedy success on RRM 0-2



Short-Term Monitoring Elements

- 11 locations within RRM 0-2
- Exposure media:
 - Near-bank Sediment
 - Periphyton
 - Transplanted Asiatic Clams
 - Pore Water
- Vegetation/Habitat Monitoring
- Baseline data collection initiated in 2015



Long-term Monitoring

- Timeframe is >10 years
- Focus is South River and SFS River
- Objectives to monitor:
 - Human exposure to MeHg in food
 - Ecological exposure to MeHg in aquatic and terrestrial food web
 - Potential improvements to water quality and benthic habitat
- Three main components
 - Human exposure
 - Ecological exposure
 - Aquatic and terrestrial
 - Habitat quality

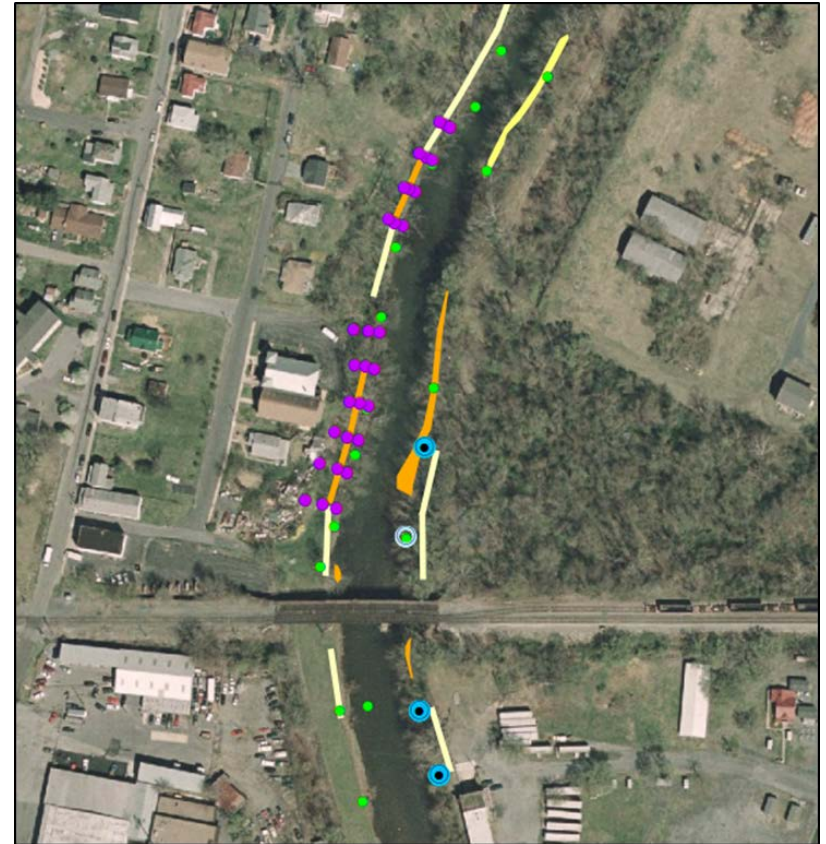
A photograph of a person wearing a cap and sunglasses, standing in a river and fishing. The person is holding a fishing rod and reel. The background shows a rocky riverbank with green foliage.

*Should I eat
the fish I
catch?*

*A Guide to
Safely Eating Fish
from the South River
and the South Fork and
Main Stem
Shenandoah Rivers*

Enhanced Adaptive Management Cycle-Benefits/Lessons Learned

- Early/on-going planning
- Document relative importance of project objectives and components
- Project framework
 - Owner
 - Stakeholders
 - Regulators
- Consensus-based decision making
- Monitoring Plan



Future Questions

- Remedy effectiveness
- Innovative remedial approaches
- Monitoring strategy
- Stakeholder considerations



Questions?

Ceil Mancini
Global Risk Lead, AECOM
Ceil.Mancini@AECOM.com

