Monitoring and Adaptive Management

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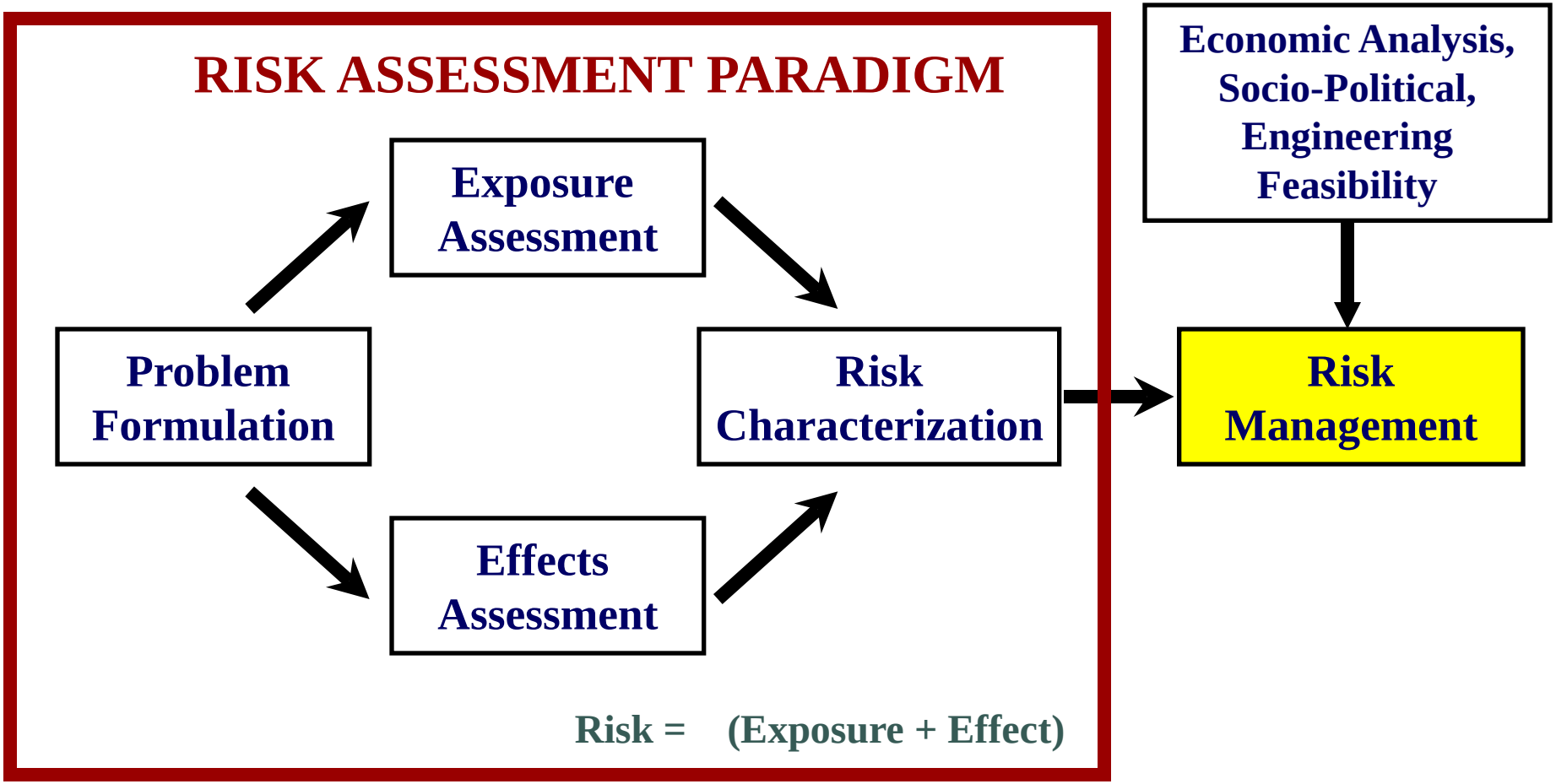
RISK FRAMEWORK



Topics

- Uncertainty and the Role of Monitoring
- Compliance Monitoring and Adaptive Management
- Development of a Monitoring Plan
- Monitoring Considerations
- Monitoring Components
- Adaptive Management
- Adaptive Management Components
- Example Case Study

Roles of Monitoring

- **Traditionally**
  - To assure compliance with regulatory requirements
  - Water and air sampling at points of compliance for comparison with water and air quality standards

Roles of Monitoring

- **Adaptively**
  - To support the risk paradigm
  - To address uncertainties in exposure data and source strength
  - To address uncertainties in effects data
  - To learn from the project and provide data for future assessments
  - To support adaptive risk management alternatives
  - To assure effectiveness of control measures
  - To assure compliance with risk goals and regulatory requirements

Development of a Monitoring Plan

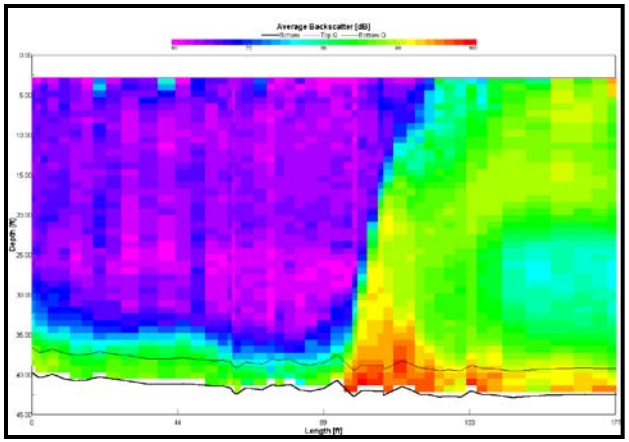
- **What?** Parameters to be Monitored
- **Where?** Locations
- **When?** Frequency
- **How?** Techniques
- **Who?** Resources: budget, equipment, time and skills
- **Why?** Data Calibration, Processing and Analysis and Reporting
- **OK?** Does it satisfy the objectives?

Monitoring Considerations

- **Unsteady Source**
  - Dredging is intermittent, processes are cyclic
- **Moving Source**
  - Hopper dredge travels more than 5 miles in a 60-minute cycle
  - Cutterhead swings over a width of 22 - 250 ft at a rate of 0.5 - 1 ft/sec
  - Auger dredges advances about 500 ft/hr
- **Multiple Sources**
  - Dredgehead, overflow, props, anchors, etc.
  - Bottom and surface
- **Unsteady Flow**
  - Tides
  - Wind
- **Exposure Pathway for Receptors of Concern**

Stressors and Components

- **Turbidity and TSS**
  - Discrete samples from multiple depths and locations
  - Continuous discrete locations – OBS grid
  - Periodic transects – ADCP
  - Calibration samples to estimate TSS from OBS and ADCP
- **Total Mass Loss and Loss Rate**
  - TSS (requires background sampling as well)
  - Flow
    - ADCP
    - Gages
    - Current meter transects
    - Models



Stressors and Components

- **Deposition**
  - TSS
  - Settling characteristics
  - Shear stress characteristics
  - Sediment traps
  - Modeling
- **Total Contaminant Mass Loss and Loss Rate**
  - Discrete samples from multiple depths and locations analyzed for TSS, dissolved and total contaminant concentration
  - TSS
  - Flow
  - Sediment density, volume and bulk sediment contaminant concentrations

Adaptive Management

- **Traditional Approach**
  - Implement controls
  - Monitor to ensure risk goals are being attained
- **Adaptive approach**
  - Implement initial controls
  - Monitor
  - Assess impact/efficiency of controls
  - Adapt controls and possibly increase or reduce controls

Adaptive Management

- **Adaptive management should be used when:**
  - High degree of uncertainty in the risk characterization
  - High degree of uncertainty in the effectiveness risk management controls
  - High costs of risk management
- **Adaptive management leads to:**
  - Learning and a better explanation/understanding of the system
  - Increase effectiveness of risk management
  - Lower costs
  - Better decisions

Adaptive Management Approach

- **Develop short-term and long-term control alternatives**
  - Turbidity and TSS concentrations
  - Contaminants concentrations
  - Flux (flow augmentation)
  - Total loss
- **Establish action triggers for the risk management**
  - Effects-based criteria
  - Exposure modeling
  - Risk characterization

Adaptive Management Approach

- **Develop a control plan and implement**
- **Establish an active compliance monitoring plan and implement**
- **Establish a response plan for triggers**
  - Implement short-term control measures (such as stop overflowing or pause dredging)
  - Assess impacts
  - Analyze event data – cause and effect -- learn
  - Determine need for long-term controls
  - Implement long-term controls (such as slow production, install silt curtain, restrict overflow or seasonal restriction)
  - Assess impacts

Adaptive Management Approach

- Update control, monitoring and response plans
- Perform ecological response monitoring of environmental resources to ensure that effects-based triggers are effective at achieving risk goals

Toddistan Adaptive Management

- **Risk Characterization Results**
  - Low impact to juvenile salmonids
  - Potential shading and burial of SAVs
  - No exposure pathway to corals
- **Risk Management Control Options**
  - 15 minutes of overflow
  - No overflow in certain reaches of the channel
  - No overflow
  - Seasonal restriction / environmental window

Toddistan Adaptive Management

- **Action Triggers**
  - Turbidity greater than 10 NTU above background midway between channel and SAVs and between channel and corals
  - Turbidity greater than 100 NTU in upper 15 ft of channel bottleneck
- **Initial Controls**
  - 15 minutes of overflow

Toddistan Adaptive Management

- **Monitoring plan**
  - Six ADCP transects daily midway between channel and SAVs and midway between channel and corals for first 3 days throughout range of tidal cycle
  - TSS calibration sampling
  - Three transects twice a week thereafter during appropriate portion of tidal cycle
  - Additional transects if change in currents and wind
  - Surficial turbidity/TSS sampling in channel bottleneck

Toddistan Adaptive Management

- **Response Plan**
  - If turbidity is less than 25% of triggers, change control to 30 minute overflow.
  - If turbidity is greater trigger, change control to no overflow in adjacent reaches.
  - If turbidity is greater than 300% of triggers, change control to no overflow.
- **Update controls, monitoring and response plan**
  - If turbidity is still less than 25% of triggers, eliminate controls.
  - If turbidity is still greater than triggers without overflow, stop dredging and impose environmental window.

Questions?