

Developing Tools for Hydromodification Management and Assessment



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Take Home Messages

- Solutions to hydromodification are most appropriate at the planning level
- Need to manage both water and sediment
- Management response will vary based on specific characteristics of stream and catchment
 - ▶ Need a toolbox approach for solutions

Effect of Increased Impervious Cover



Effects of Hydromodification

- Infrastructure damage
- Instream habitat loss
- Coastal erosion

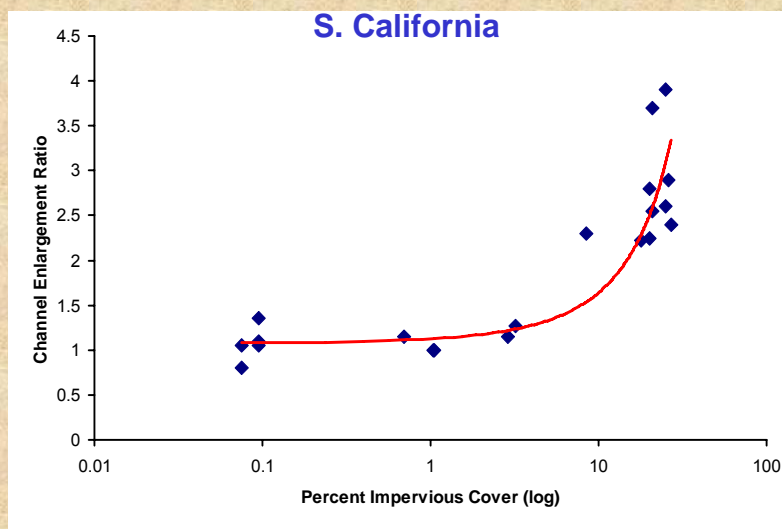


Conclusions of Past Studies

- Semi arid (Ca) streams appear to be more sensitive to changes in impervious cover than streams in other areas of the country
 - Estimated response \approx 5% TIMP
- All streams studied are adjusting to flow conditions on an annual basis
 - Rate of change differs between natural and developed areas
- Management approaches will differ depending on stream type, drainage area and amount of impervious cover

SCCWRP Technical Reports #450 and #475 – www.sccwrp.org

S. Ca. Streams React Quickly

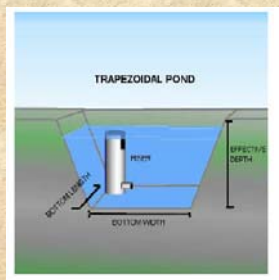


Challenges in Managing Hydromodification

- Change can occur rapidly
- Streams are highly variable
- May be dealing with legacy effects
- Responses are difficult to predict

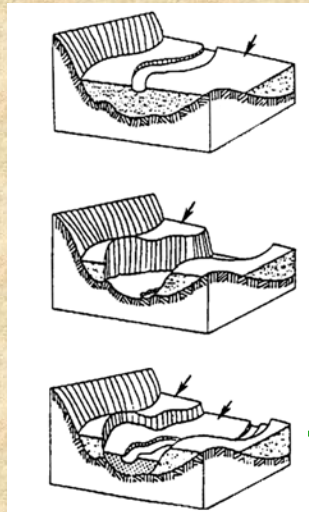
Current Strategies

- Flow Control Standards
 - ✓ For flow rates from 20% of the pre-project 5-year runoff event ($0.2Q_5$) to the pre-project 10-year runoff event (Q_{10}), the post-project discharge peaks and durations shall not deviate above the pre-project conditions.



- **Does not account for sediment**
- **One size fits all approach**

Strategy Varies Based on Conditions



Protect

- manage runoff
- buffer stream

Restore

- stabilize
- recontour

Manage for New Condition

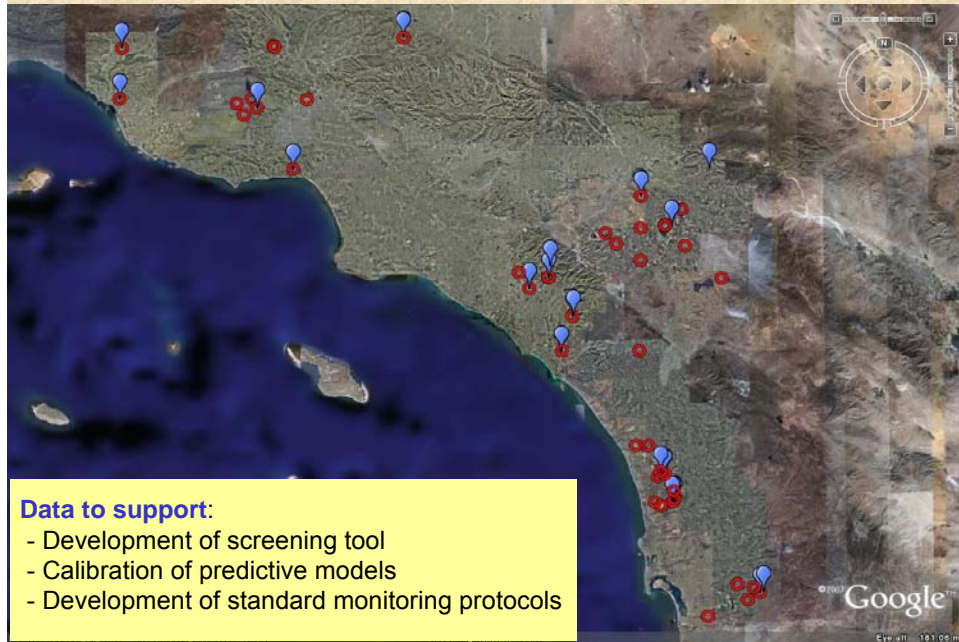
- alternate stream type

**How do you
make these
decisions?**

Current Study: Tool Development

1. Which streams are at the greatest risk of effects of hydromodification? ➡ *Screening Tool*
2. What are the anticipated effects in terms of increased erosion, sedimentation, or habitat loss, associated with increases in impervious cover? ➡ *Modeling Tools*
3. What are some potential management measures that could be implemented to offset hydromodification effects? ➡ *Management Tools*

Study Sites



Screening Tool *Guiding Principles*

- Classify streams by expected response
- Determine level of subsequent analyses
- Hierarchical (office + field)
- Probabilistic – risk categories driven by statistical analysis of regional data
- Rapid / parsimonious

Hierarchical Screening

- Watershed
 - ▶ Basin characteristics - shape, slope, size
 - ▶ Expected sediment yield – coarse vs. fine material
 - ▶ Infiltration capacity
 - ▶ Recent watershed history – urbanization, fire, etc.

- Valley

- ▶ Tributaries
- ▶ Existing infrastructure

	Vertical Susceptibility	
Horizontal Susceptibility	High	Low
	Low	High

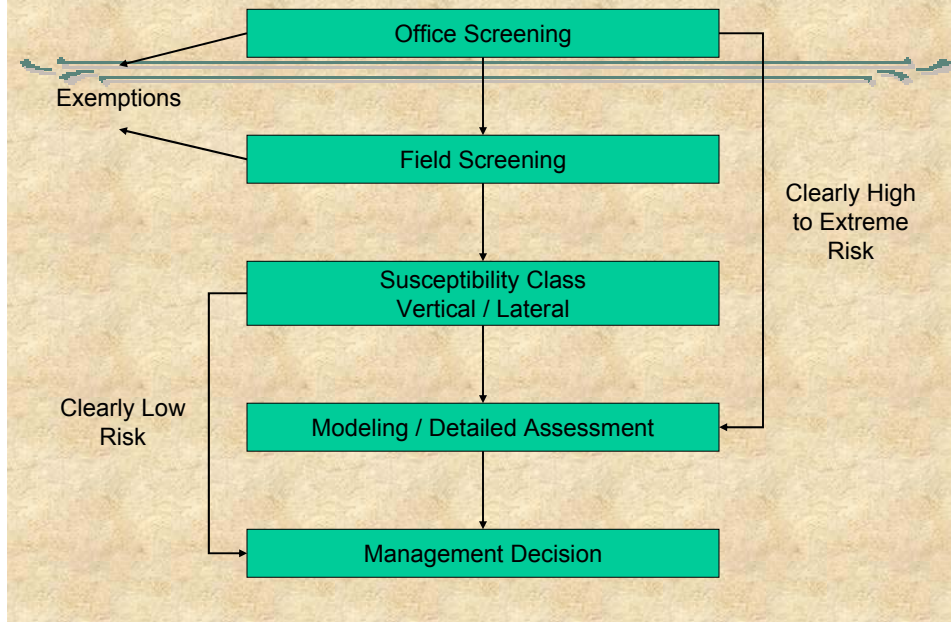
- Reach

- ▶ Vertical susceptibility
- ▶ Horizontal susceptibility

Examples



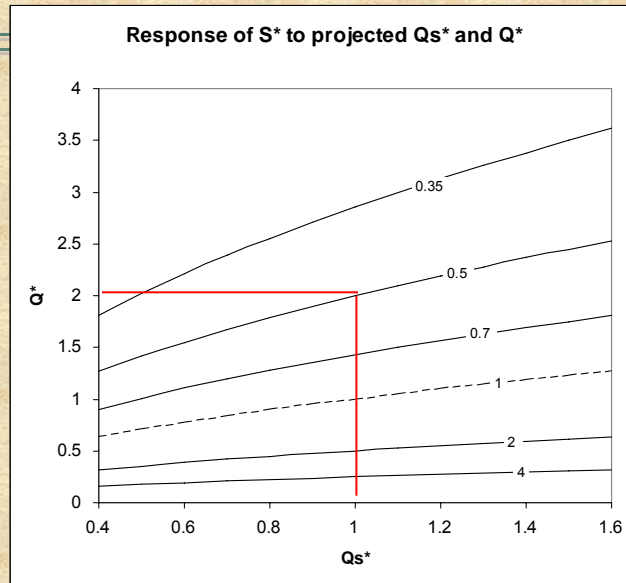
DECISION PROCESS



Modeling Tool: *Guiding Principles*

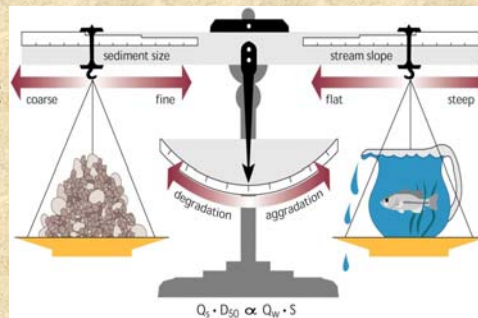
- understand long-term “equilibrium” condition
 - ▶ Not a design tool
 - ▶ Ultimate target period beyond most typical monitoring
 - ▶ Increase confidence in expected channel response to changes in flow and sediment
 - ▶ Identify flow/sediment regimes that are likely components of channel protection
 - ▶ *Not a single tool, but a “toolbox” that combines model outputs, statistical analysis, and expert opinion*
- translate model results into tools for planners & managers

Phase Diagram



Balancing Management Responses

- Hydromodification control requires management of water AND sediment
- Management response varies:
 - ✓ Existing channel condition
 - ✓ Proposed land use change
- Most important to maintain coarse sediment transport
- Important to capture of fine sediments for pollutant control

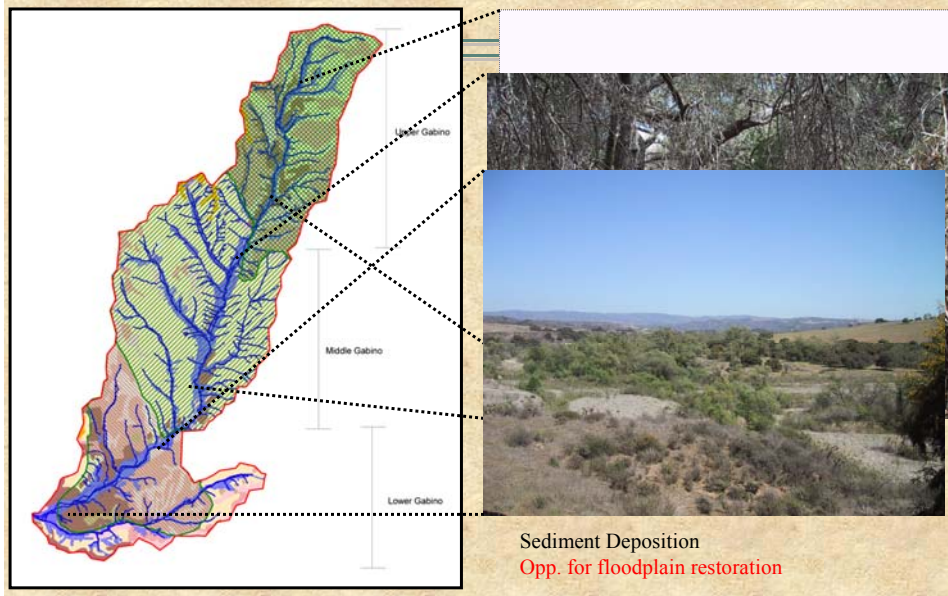


New Management Approaches



- Site planning in context of the landscape
- Protect floodplains
- Restore streams
- Minimize runoff
- Maximize infiltration
- Manage sediment yield
- Manage for alternate channel type

Example - Managing Sediment Processes





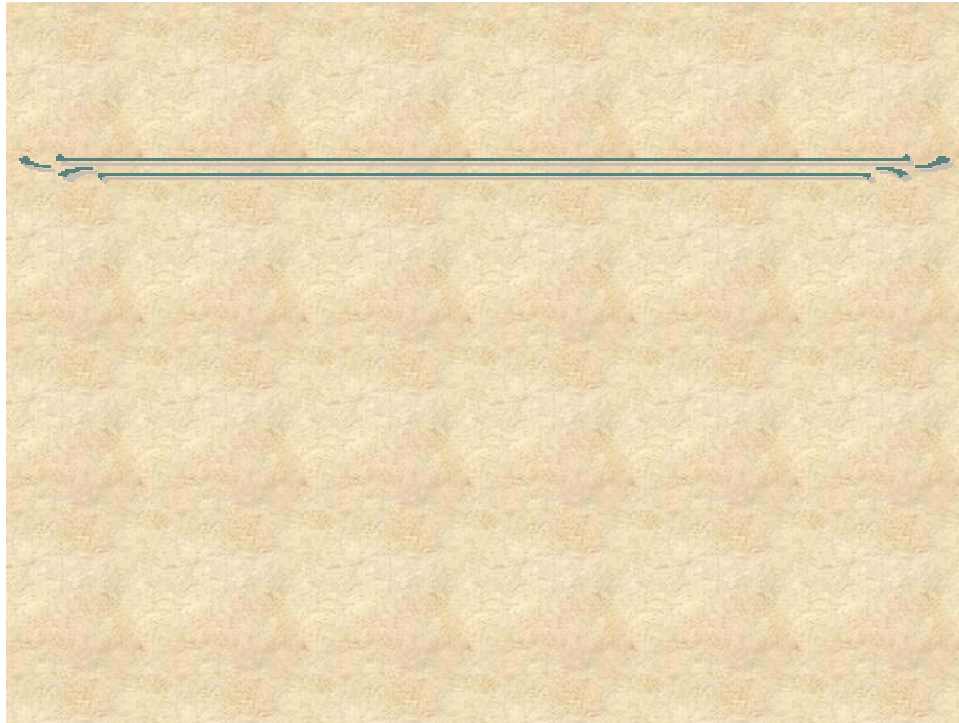
Planning is key

Choose the right tool for the job

Manage sediment and water

THANK YOU

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Legacy Effects of Grazing



Site Data Collection

- Total station survey
 - ✓ Longitudinal profile
 - ✓ Channel cross-sections
- Bed material sampling
 - ✓ Pebble count/sieve analysis
 - ✓ Soil cohesion & consolidation
- Hillslope characteristics
- General floodplain features
 - ✓ Physical conditions
 - ✓ Biological conditions



Traditional Post-Development BMPs



Effect of Single Storm
Dec. 2007, (0.3" rain)



Before



After

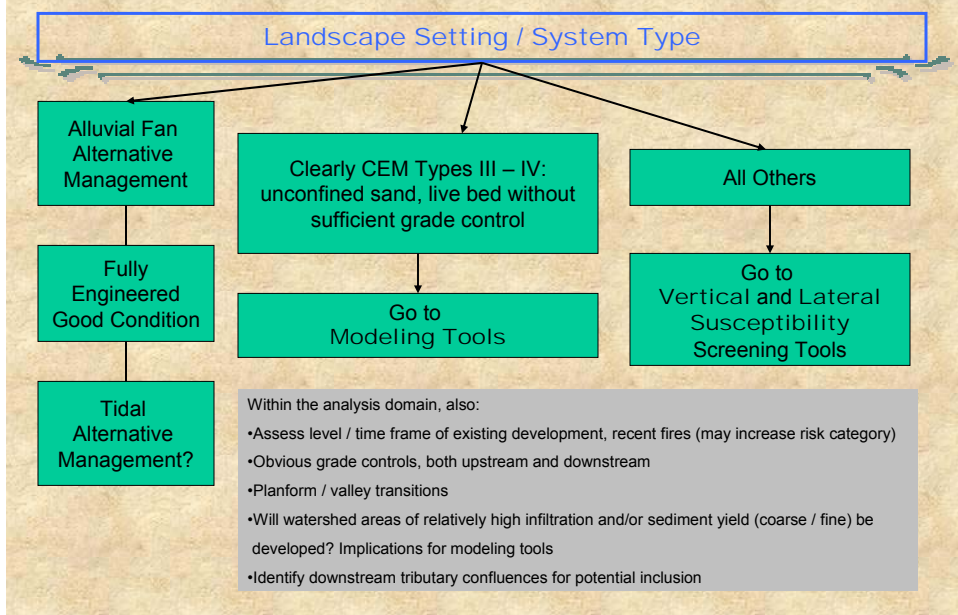
Avoid Building in the Floodplain



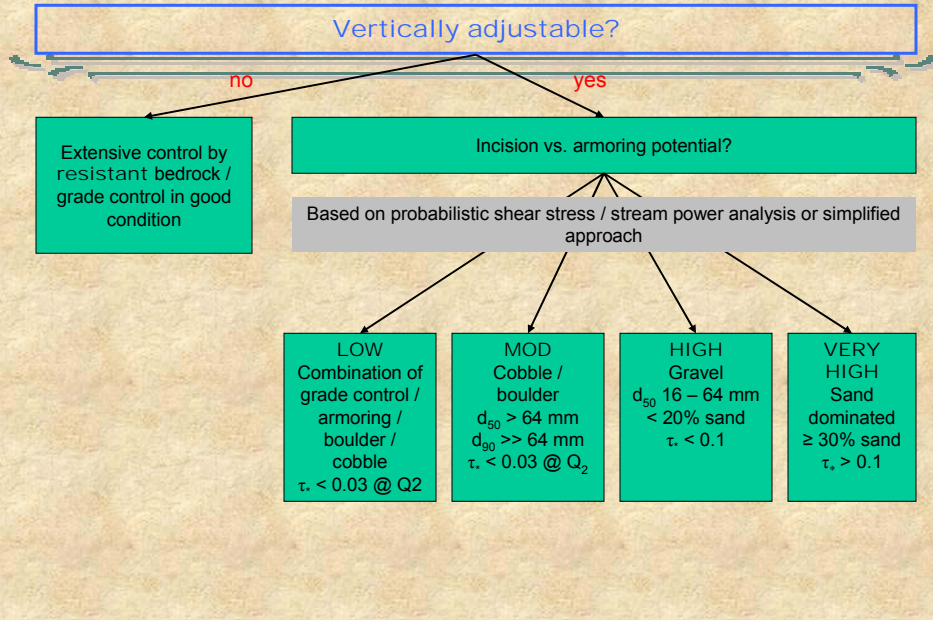
Alternative Channel Design



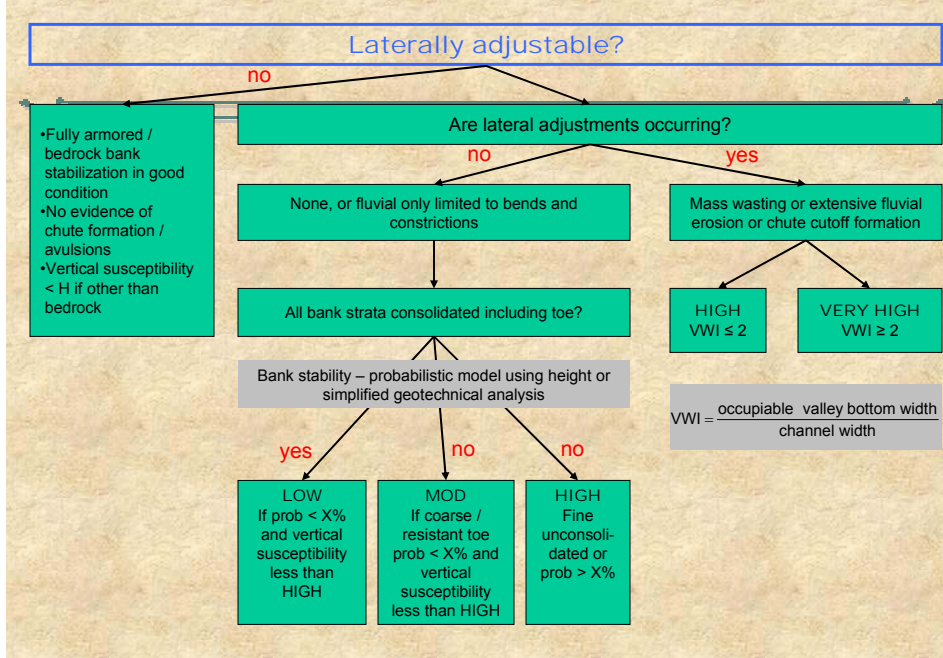
WATERSHED CONTEXT / CURRENT CONDITION



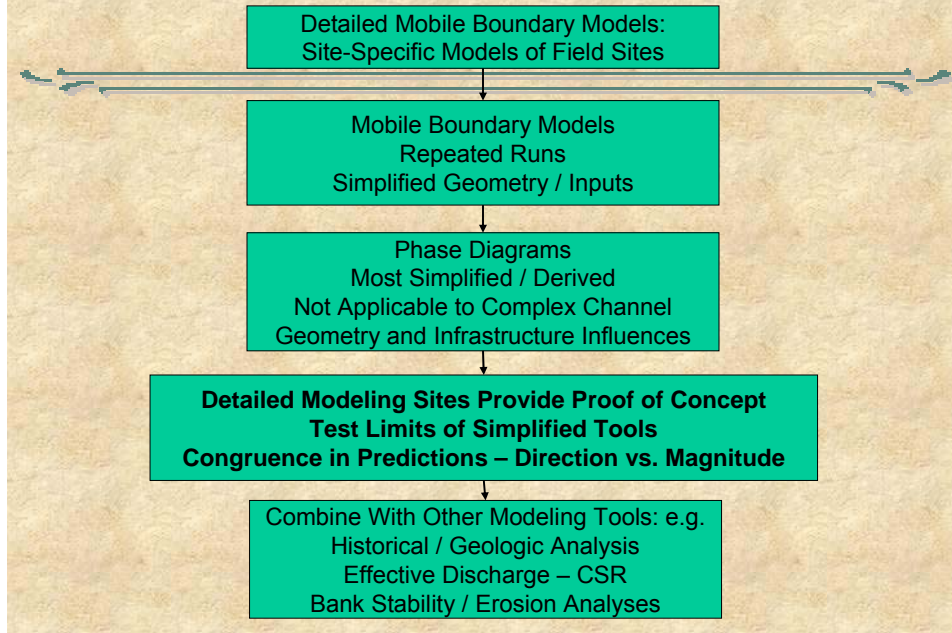
VERTICAL SUSCEPTIBILITY



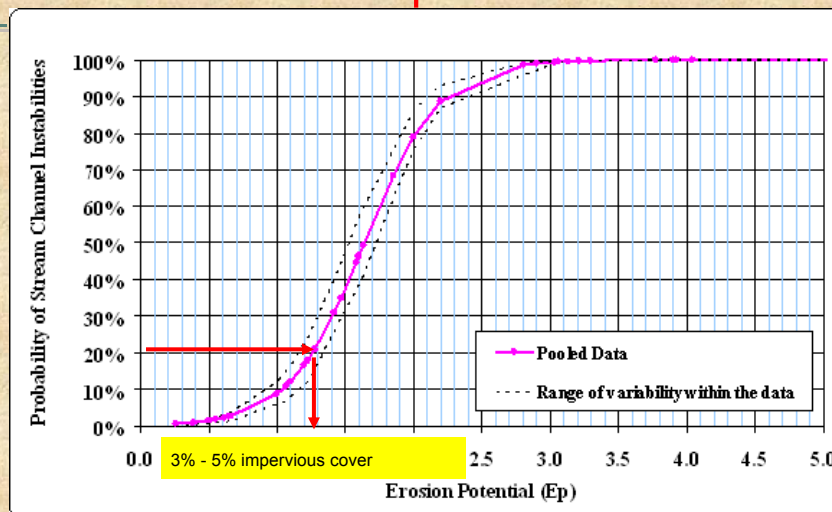
LATERAL SUSCEPTIBILITY



MODELING APPROACHES LEVELS OF COMPLEXITY

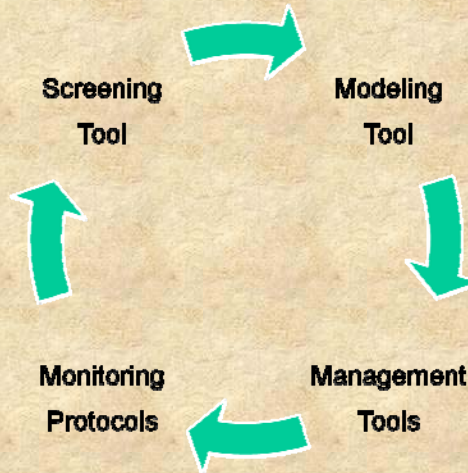


Predicting Channel Response



Monitoring Protocols *Guiding Principles*

- Parallel structure
- Iterative and adaptive
- Results of screening analysis guides choice of modeling tools
 - ▶ Higher susceptibility = more complex modeling



Next Steps

- Produce draft protocols & monitoring recs. – Spring 2008
- Produce draft screening tools – Fall 2008
- Modeling – 2009
- Final Products – Winter 2010
- Outreach- ongoing
 - ✓ Application of tools



Conclusions of Past Studies

Biological Effects

Puget Sound Region, WA

