

EAM Model Utilization*

21 October 2015

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*reaping the benefits of development of a formal decision model

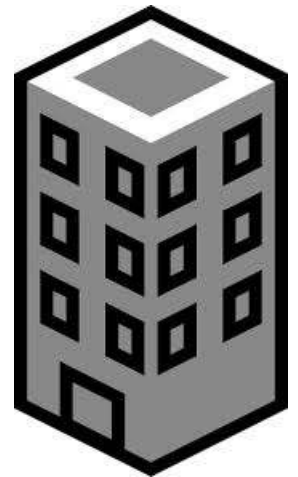
Simple Model - Morning Commute

- It is something we will do repeatedly, in succession and would like to learn to make more effective.
- We have different opinion about what is important

» Predictability

» Time

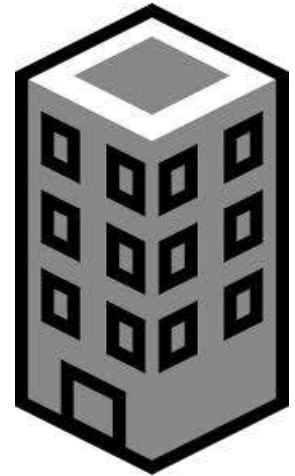
» “Movement”



Commute EAM



Identify **criteria** for successful commute from objectives (predictable, short, inexpensive, little waiting) – and **metric(s)** that inform each.



Criteria:

Duration

Cost

Wait time

Variability

Metric:

Average time

\$/month

Time sitting still (daily)

Max- Min time/month, freq

Value Function:

30min – 2hrs

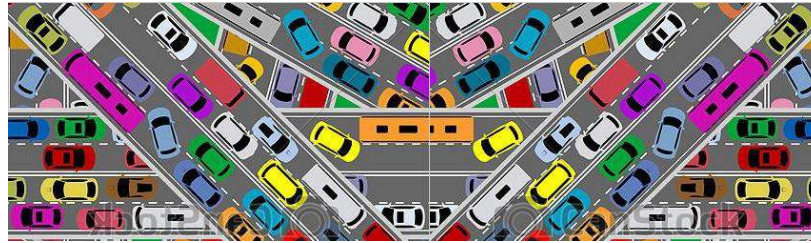
\$50-\$250

20min - max

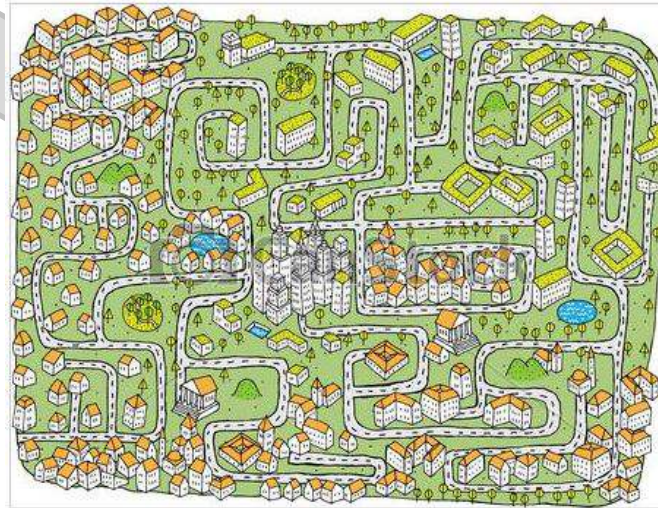
15min – max, 1/week

Select initial set of **alternatives** that you want to compare.

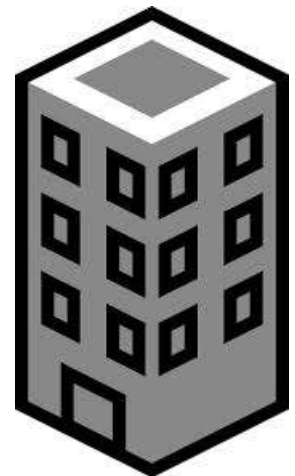
highway



urban maze

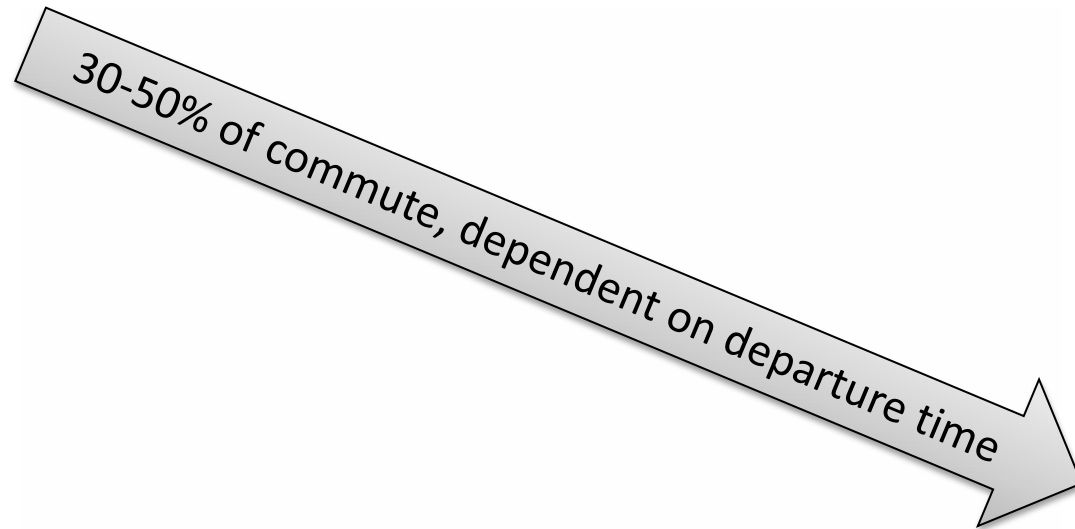


commuter rail



Use mechanistic and conceptual models, empirical relationships, experience, etc. to predict*:

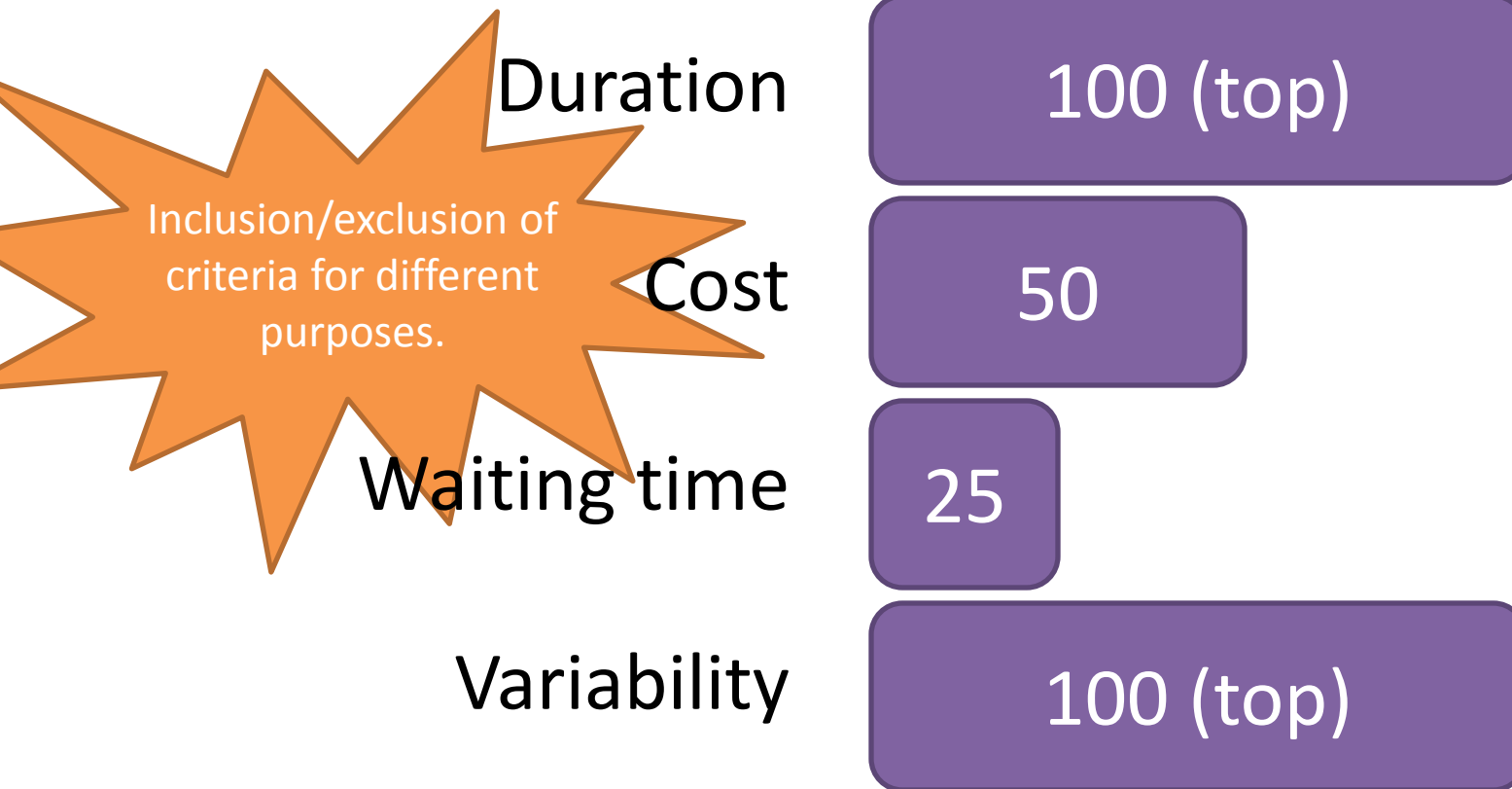
- the anticipated outcome
- the external or intermediate factors that the outcome is dependent on (monitoring plan)
- predicted relationship between the factors



*basis of “learning”

In order to compare the alternatives, we also need to characterize the preferences or trade-offs between criteria(**weights**).

Criteria:



Putting the pieces together:

Alternatives

Criteria

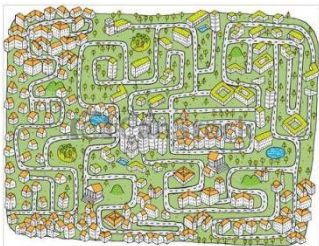
Weights

Scores

highway



urban maze



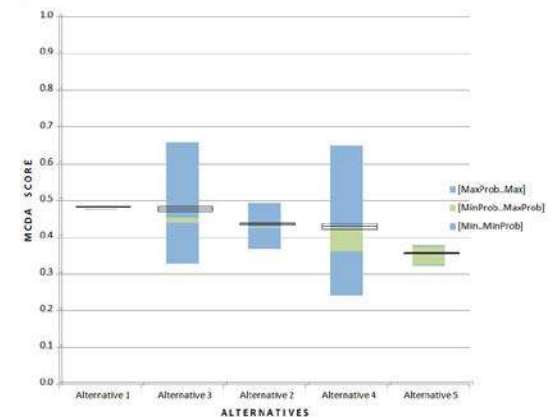
commuter rail



	Duration	Cost	Waiting time	Variability
highway	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
urban maze	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
commuter rail	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$

Value Function 0 - 1 $X_2 - y_2$ min-max etc.

Value
visualization(s)



Application to the South River:

Criteria
Alternatives



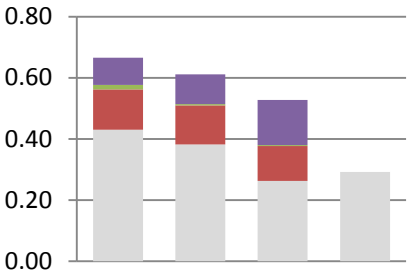
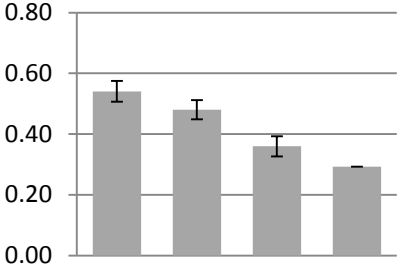
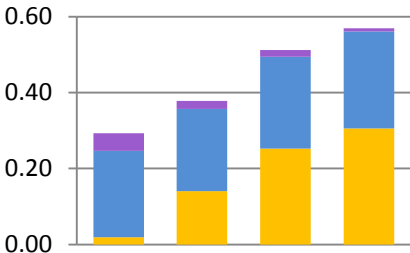
Protect Human Health & Environ	Short-term Effect	Long-term Effect	Implementability	Cost
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Weights

$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$

Scores

Value visualization(s)

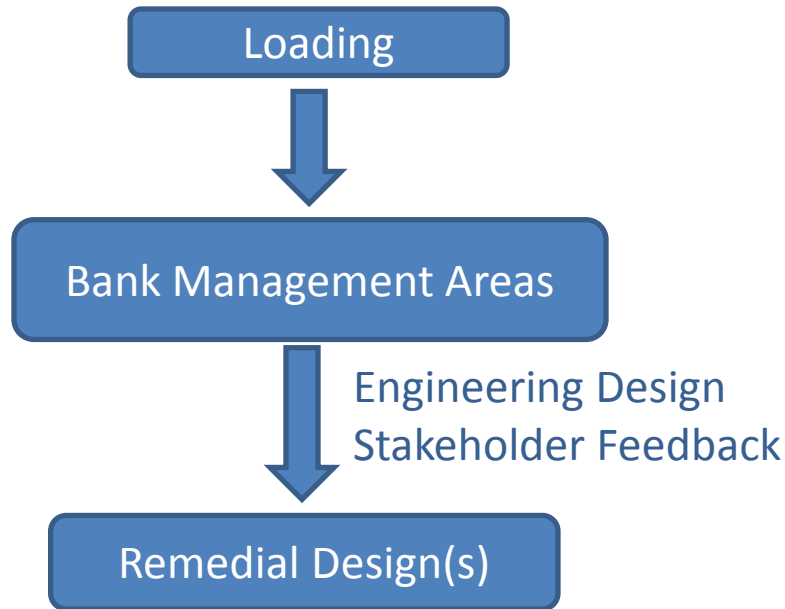


Value Function 0 – 1 $X_2 - y_2$ min-max etc.

South River EAM

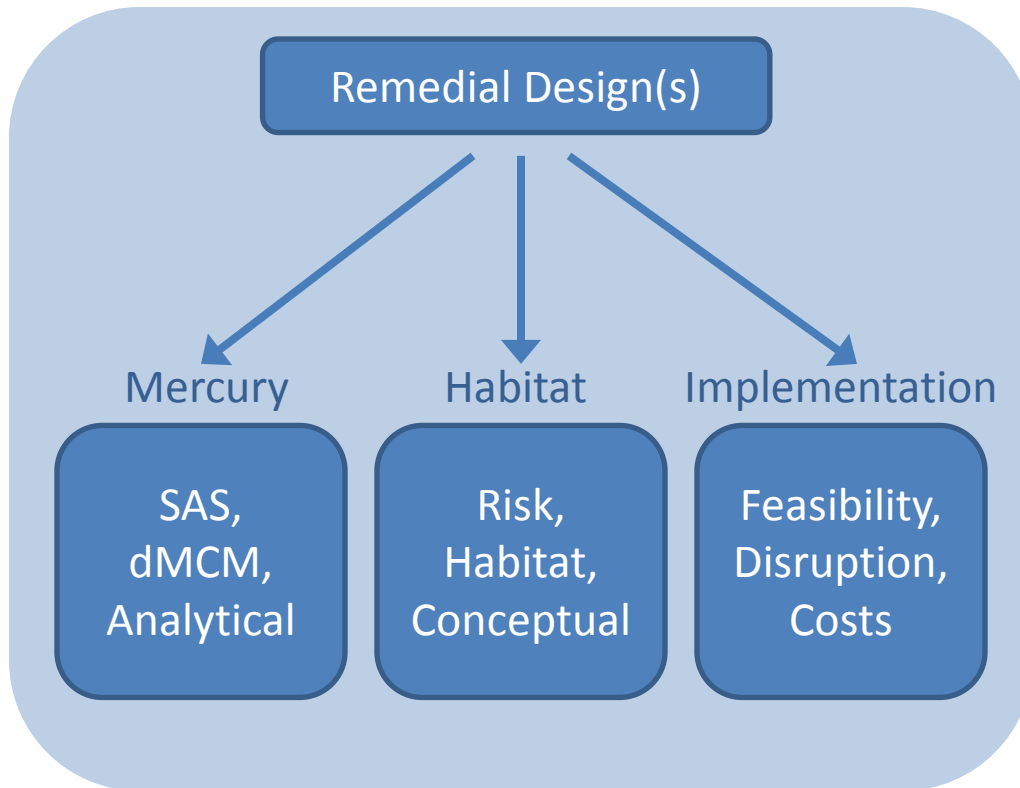
- Two functions:
 - Archive the predictions and uncertainty expected from each remedial alternative
 - Provide a way to visualize how different alternatives perform for different objectives and when trade-offs
- “Decision models”:
 - Provide transparency
 - Support communication and learning
 - Don’t make decisions

How is this likely to be used in Phase 1?



- BMA location and design to be considered for approval based on loading, landowner objectives and regulatory approval.
- There may be “alternatives” under consideration, including issues such as what activities should occur concurrently.
- The reason behind the decision(s) should be captured in a prediction of the outcome.....

Effects Analysis



- Models can be used to anticipate short and long term impacts
- Noted are when specific impacts are unknown or uncertain, e.g. “Is there any impact of shading on temperature?”
- Anticipated values for implementation metrics should be recorded, as these are critical factors not predicted by models, e.g. “As designed, the plan is expected to be resistant to XXX-year storm standards.”

Pre-Implementation Visualization

Alternatives Criteria



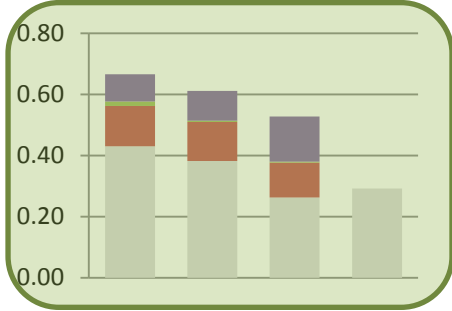
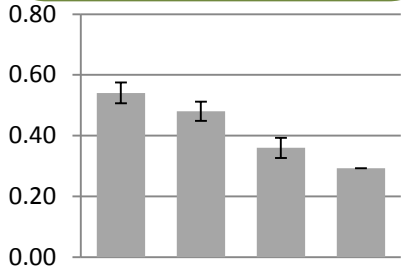
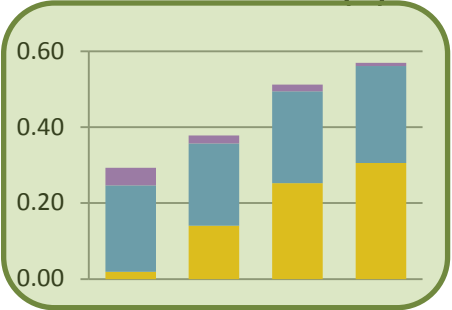
Protect Human Health & Environ	Short-term Effect	Long-term Effect	Implementability	Cost
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Weights

$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$

Scores

Value visualization(s)



Value Function 0 - 1 $X_2 - y_2$ min-max etc.

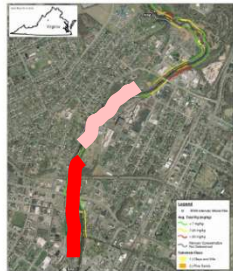
Implementation and Monitoring



Images from <http://southriverscienceteam.org/news/newsletters/2012/2012-FH-Newsletter.pdf>

Post-Implementation Visualization

Alternatives **Criteria**



Protect Human
Health & Environ.

Short-term Effect

Long-term Effect

Implementability

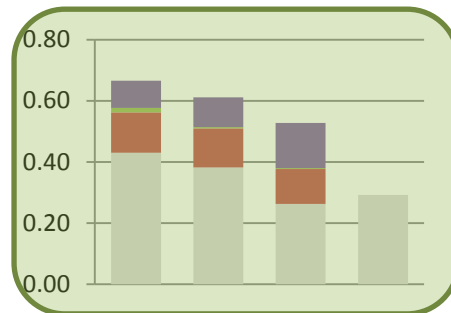
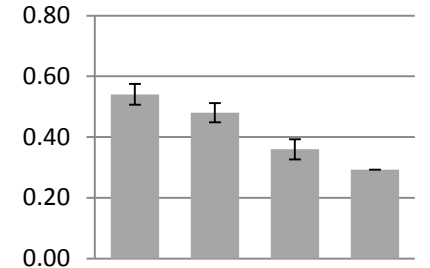
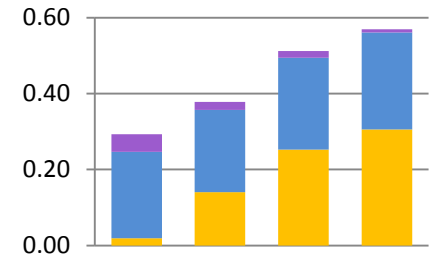
Cost

Weights

$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$

Scores

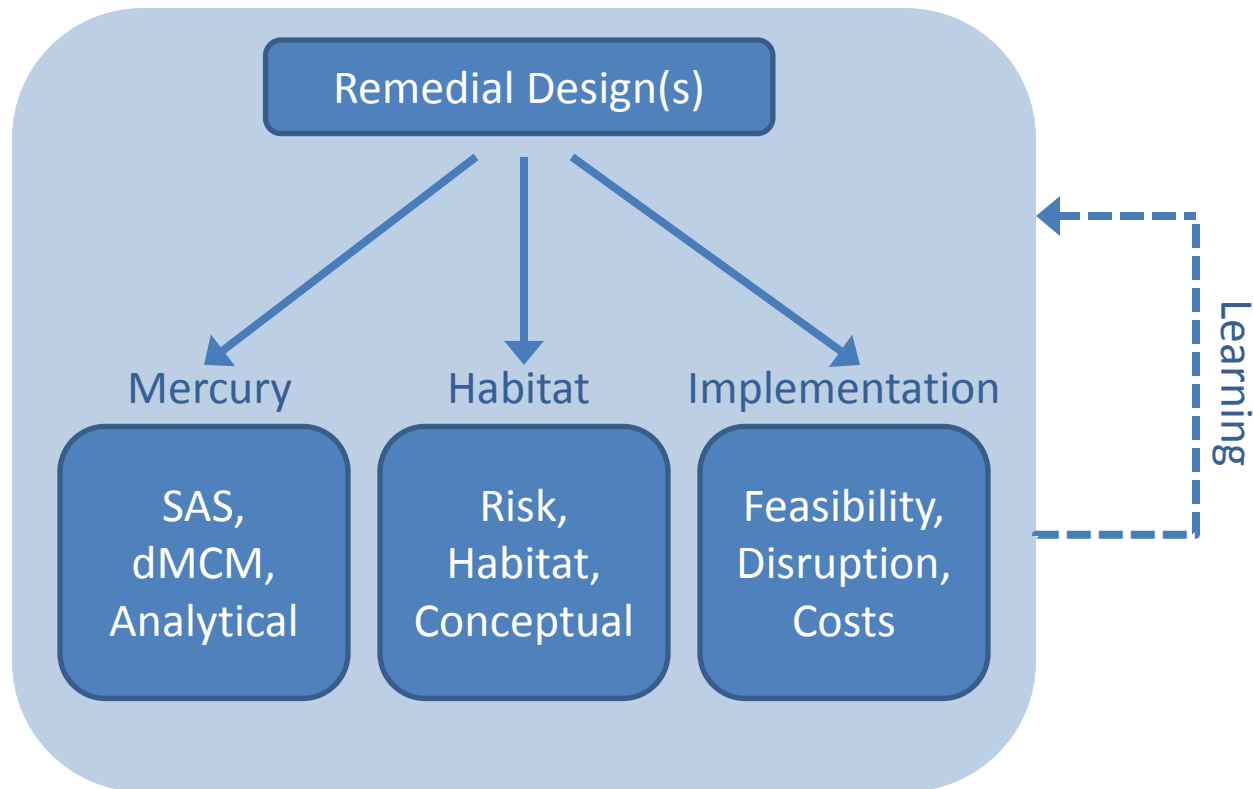
**Value
visualization(s)**



Value Function 0 - 1 $X_2 - y_2$ min-max etc.

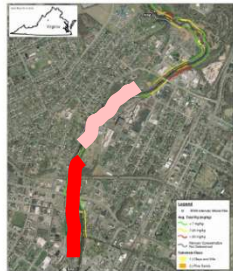
Effects Analysis

- Update models with monitoring results when they were not predictive
- Characterize impacts that were unknown
- Adjust anticipated values for implementation metrics with actual values



Post-Implementation Visualization

Alternatives **Criteria**



Protect Human
Health & Environ.

Short-term Effect

Long-term Effect

Implementability

Cost

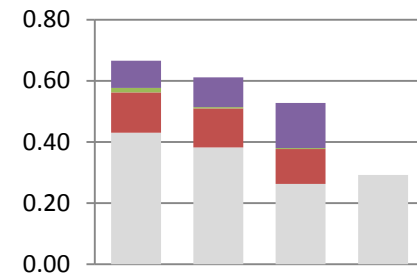
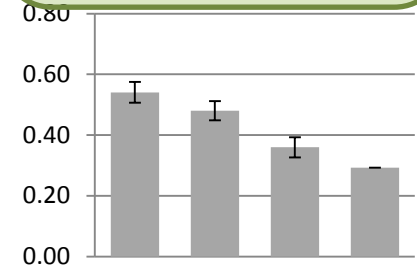
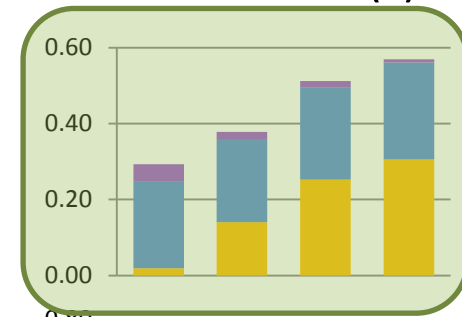
Weights

$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
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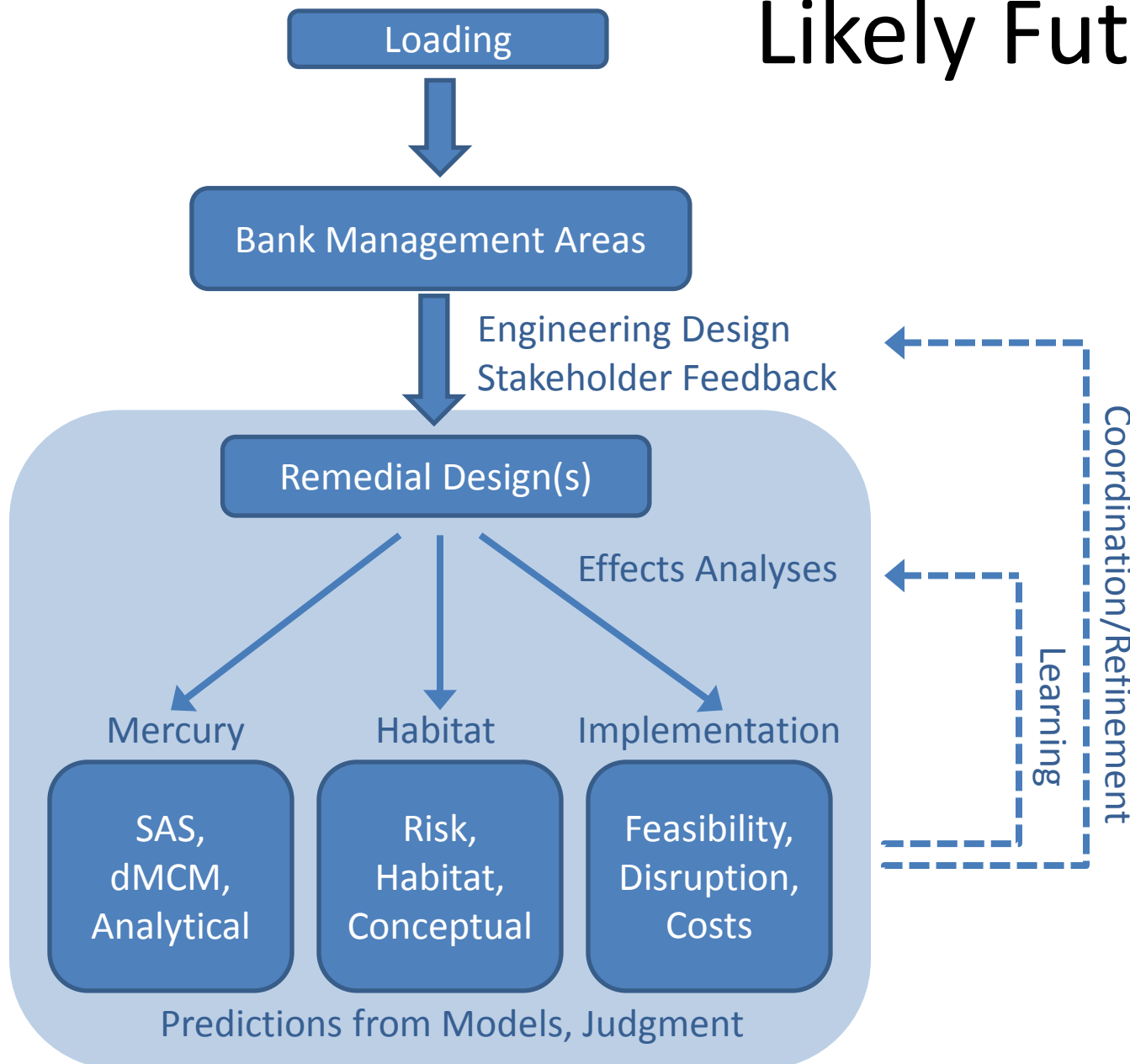
Scores

Value Function 0 - 1 $X_2 - y_2$ min-max etc.

**Value
visualization(s)**

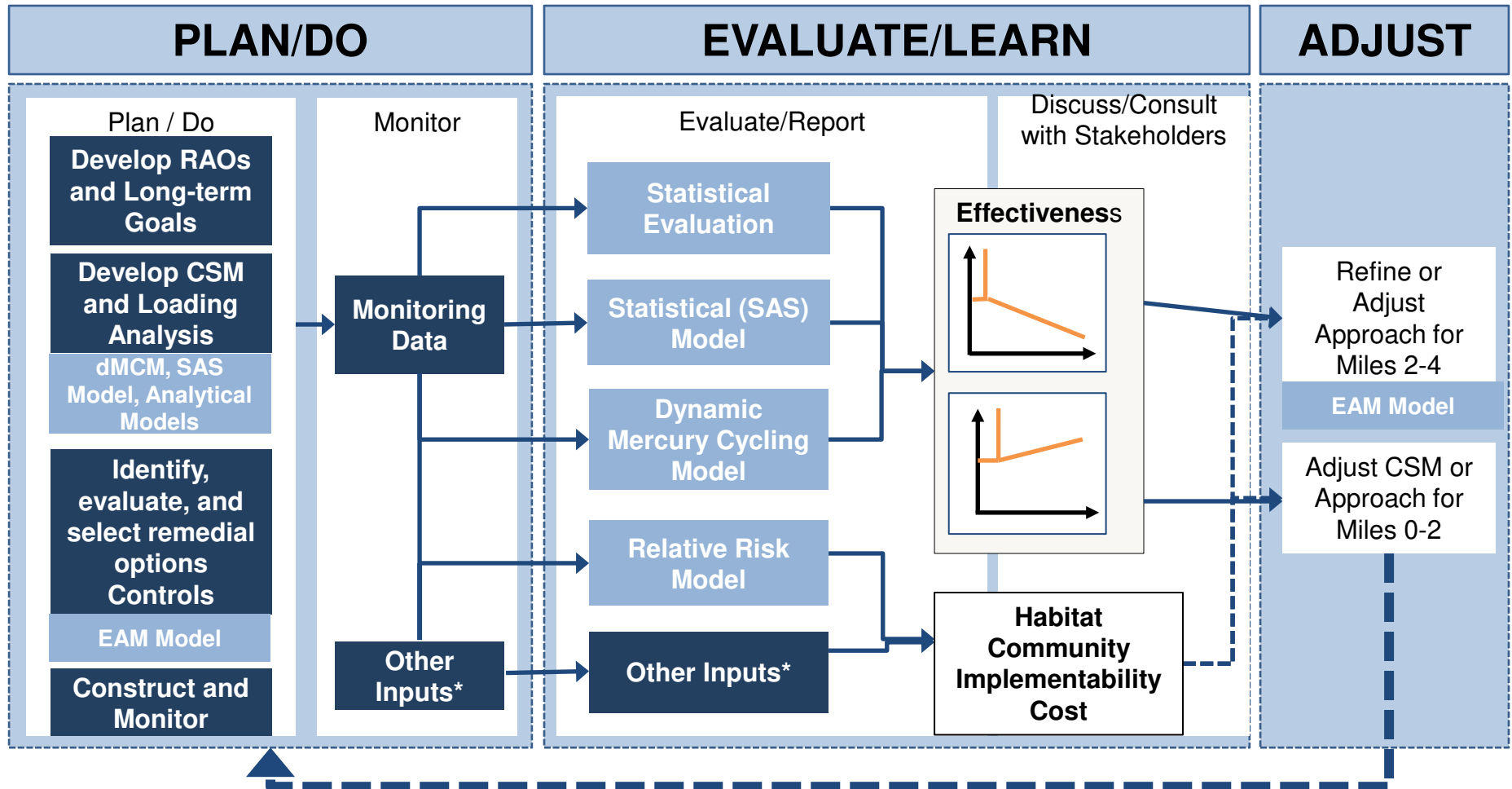


Likely Future Use



- BMA location and design still likely to be considered for approval based on loading, landowner objectives and regulatory approval.
- Better prediction of the likely outcomes based on refined models.
- Potential for alternative design and/or smoother implementation based on enhanced understanding.

South River Phase 1 EAM - Summary



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

Final Steps

- Criteria and Metrics to be finalized
- Correct/edit the macros
- Provide necessary documentation/manuals
- Distribute

Criteria and Metrics

Evaluation Criteria	Metrics
Protect human health and the environment	
Adult Small Mouth Bass Tissue MeHg	Mean Tissue MeHg Projected Tissue MeHg
Riparian & Aquatic Habitat Development	Riparian vegetation In stream habitat Unified Stream Model Fish functional capacity Benthic invertebrates
Achieve media cleanup objectives	
Surface Water Hg	Mean surface water Hg Mean surface water Hg Projected progress
Remediate the source(s) of release	
Reduction in Hg transport and Exposure	Sediment tHg at 1 Sediment MeHg at 1 Porewater tHg at 1 Porewater MeHg at 1 Asiatic Clam tHg at 1 Asiatic Clam MeHg at 1
Bank stability	Rate of erosion/deposition
Bank Loading Control	Estimated percent reduction
Long-term Effectiveness	
Long Term Maintenance	Risk of storm-induced erosion
Institutional Controls	Effectiveness of Outreach
Other	Metric

Evaluation Criteria	Metrics
Toxicity Mobility & Volume Reduction	
Reduction in Hg mobility from biochar	Estimated percent reduction
Off Site Soil Treatment	Percent contained
Other	Metric
Short-term Effectiveness	
Construction Duration	Area impacted
Management of construction during high flows	Estimated efficacy
Short Term Disruption	Water quality - turbidity Water quality - tHg exposure BMA vegetation loss Benthic invertebrates Quality of life disruption
Sustainability of Construction	Green house gas emissions Energy use
Other	Metric
Implementability	
Technical Feasibility	Accessibility Constructability Monitoring feasibility
Administrative Feasibility	Ability to obtain permits Ability to obtain land access Availability of services
Cost	
Construction	US\$
Short-term post-construction and maintenance	US\$
Long-term maintenance and monitoring (incremental)	US\$
Other	US\$

Criteria and Metrics

Evaluation Criteria	Metrics
Community Acceptance Criteria (Local Government, Landowners, and River Users)	
Fishing	Service risk
Swimming	Service risk
Boating	Service risk
Greenway Connectivity	Degree of integration
Tree Development	Percentage of trees (> X d) preserved
Upland Disruption of Riverview	Relative amount
Aesthetics	Relative approval
Other	Metric
State Acceptance Criteria (Technical and Administrative Issues)	
Water Quality	Temperature
	Total Suspended Solids
	Phosphorous
	E. coli
	Dissolved O2
Small Mouth Population	Population risk
White Sucker Population	Population risk
Carolina Wren Population	Population risk
Belted Kingfisher Population	Population risk
Other	Metric

South River EAM

- Designed to have two functions:
 - Archive the predictions and uncertainty expected from each remedial alternative
 - Provide a way to visualize how different alternatives perform for different objectives and when trade-offs between objective add value
- Comments/Questions?