INLAND NAVIGATION ECONOMICS WEBINAR SERIES

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Inland Navigation Economics 101

LRD-PD-S

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US Army Corps of Engineers

BUILDING STRONG®

Corps Inland Navigation Mission

Provide a safe, reliable, efficient, effective and environmentally sustainable waterborne transportation system for movement of commerce, national security needs, and recreation.

Federal interest in navigation derives from the Commerce Clause of the Constitution

Corps Inland Navigation Role

- Plan, design, construct, operate and maintain infrastructure to support inland navigation.
- Locks & dams, channel dredging, river training works, bank protection, electronic charting (inland); cargo data collection and analysis, etc.

Public Law 95-502 describes the waterways and Corps role

Inland Waterway System

- *Nearly 12,000 miles 9 ft & over*
- *192 lock sites / 238 chambers*
- *Moving about 600 million tons*
- *About 2/3 cost of rail and 1/10 cost of truck*

LRD Nav Center to PCXIN

- 1982 ORD/LRD Regional Center for Inland Navigation Planning
  - System benefit estimation
  - Common data sets & models
  - 13 authorized/constructed; 3 lock rehabs author/construct
- 2003 USACE PCXIN
  - Support feasibility-level studies in other basins
  - PA class sponsorship
  - Model certification
  - Peer Review (RMO)
- Other areas of support
  - Dam Safety/ Levee Safety
  - Asset Management
  - Special Operational Studies

PCXIN Technical Skills

- LRH-NC
  - 9 economists, 2 engineers, 1 operations analyst, 1 program analyst
  - 1 review manager, 1 statistician, 4 statistical assistants
- Other LRH offices – 2 PD, 2 PM, 2 OPs
- Other LRD economists – 2 LRB, 1 LRE, 1 LRC, 1 LRP, 1 LRL, 1 LRN
- Other Corps economists - IWR, MVS, MVP, MVN, MVR, NWP
- Regional Universities (Marshall, Tennessee, Toledo, Texas A&M, North Dakota State, Oregon)
- Oak Ridge National Labs & AE firms

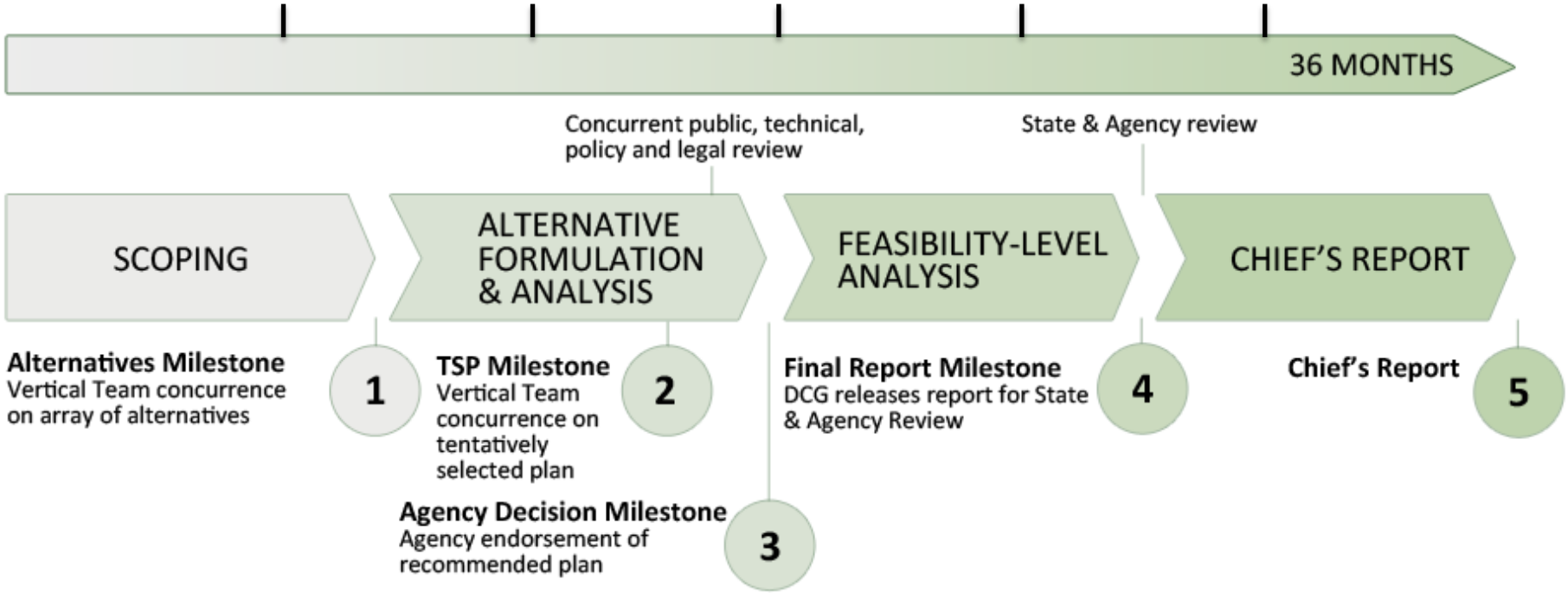
Six Step Planning Process

1) Identify Problems & Opportunities - Scoping
2) Inventory & Forecast Critical Resources*
3) Formulate Alternative Plans – Nonstructural, Structural
4) Evaluate Alternative Plans – NED, EQ, RED, OSE
5) Compare Alternative Plans
6) Select Recommended Plan – NED, NER, Combined

Planning Guidance Notebook ER 1105-2-100 22 Apr 2000

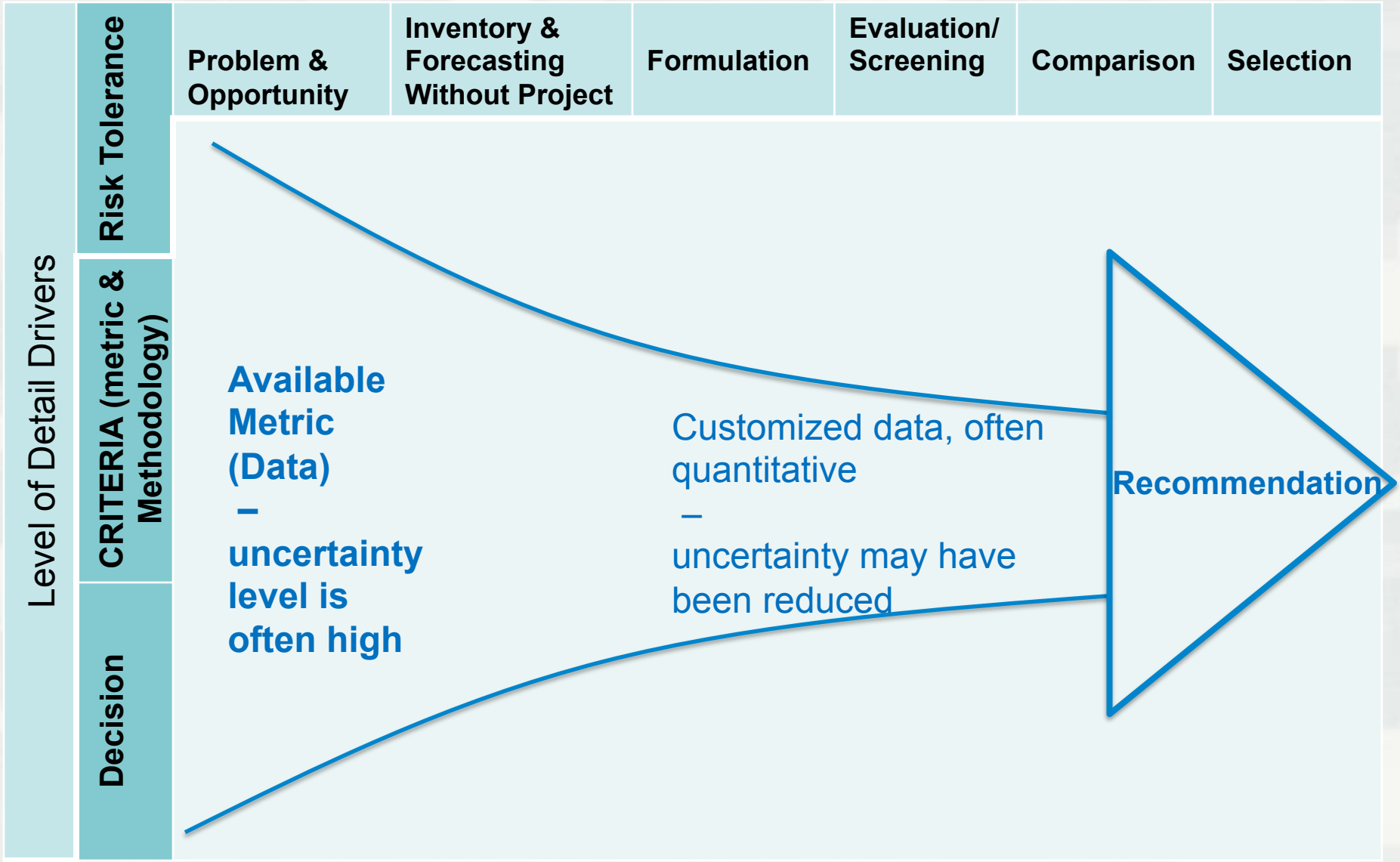
* **Involves readying the economic model(s) too!**

SMART Feasibility Study Process



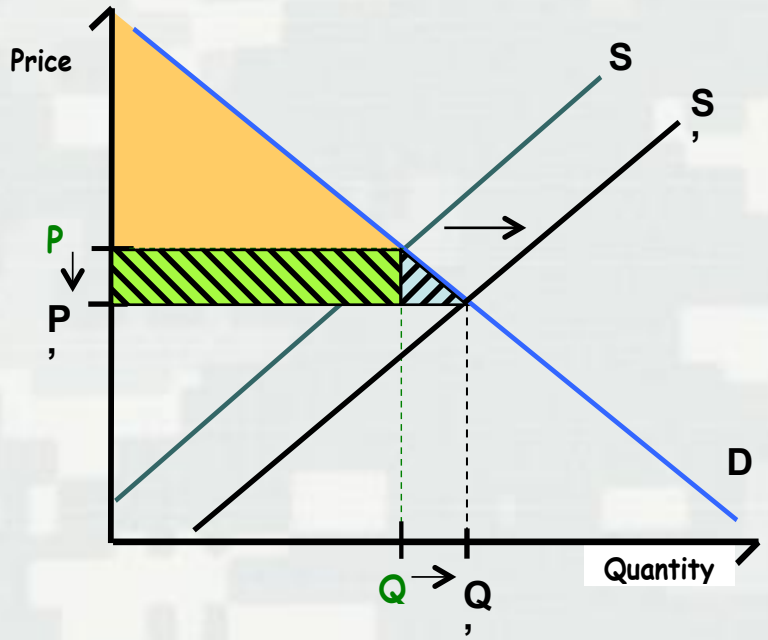
In-Progress Reviews (IPRs) as needed

Right Level of Detail at Right Time



PCXIN & SMART Planning

- Data – current and consistent
  - Traffic Projections
  - Transportation Rates
  - Operating Costs
  - Commodity Value
- Models – certified/approved
  - System Model (NIM)
  - Capacity Model (WAM)
  - Port Model (GLSAND)
  - Lock Closure Model (SCC)
- Study Ready
- LRD Mandatory

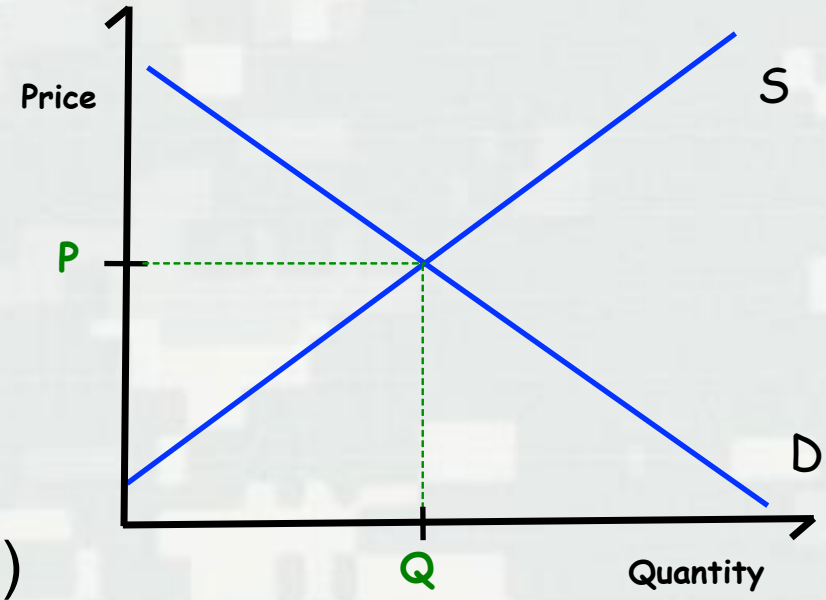


Problems & Opportunities

- Reliability – Aging Infrastructure
- Asset Management – Infrastructure Strategy
- Ecosystem Restoration – Watershed Approach
- World Trade – Economic Growth

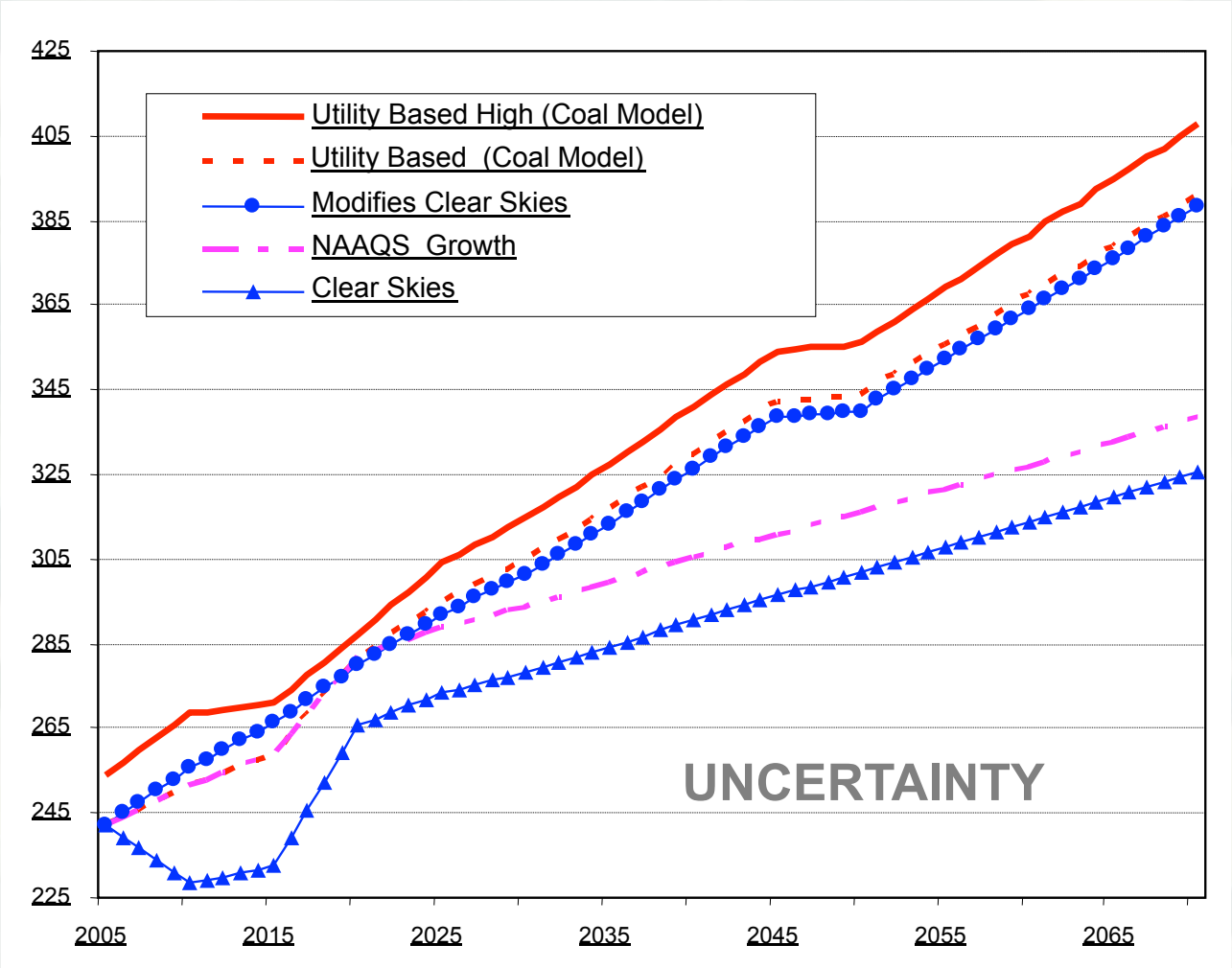
Inventory and Forecast

- Study Area
  - Resources
  - Industries
  - Commodity Traffic
  - Transportation Systems
- Shippers (Demand)
  - Traffic Demand*
  - Transportation Rates*
  - Willingness to Pay*
- Project Performance (Supply)
  - Reliability*
  - Capacity*



** major data inputs to the Navigation Investment Model (NIM)*

Inventory and Forecast

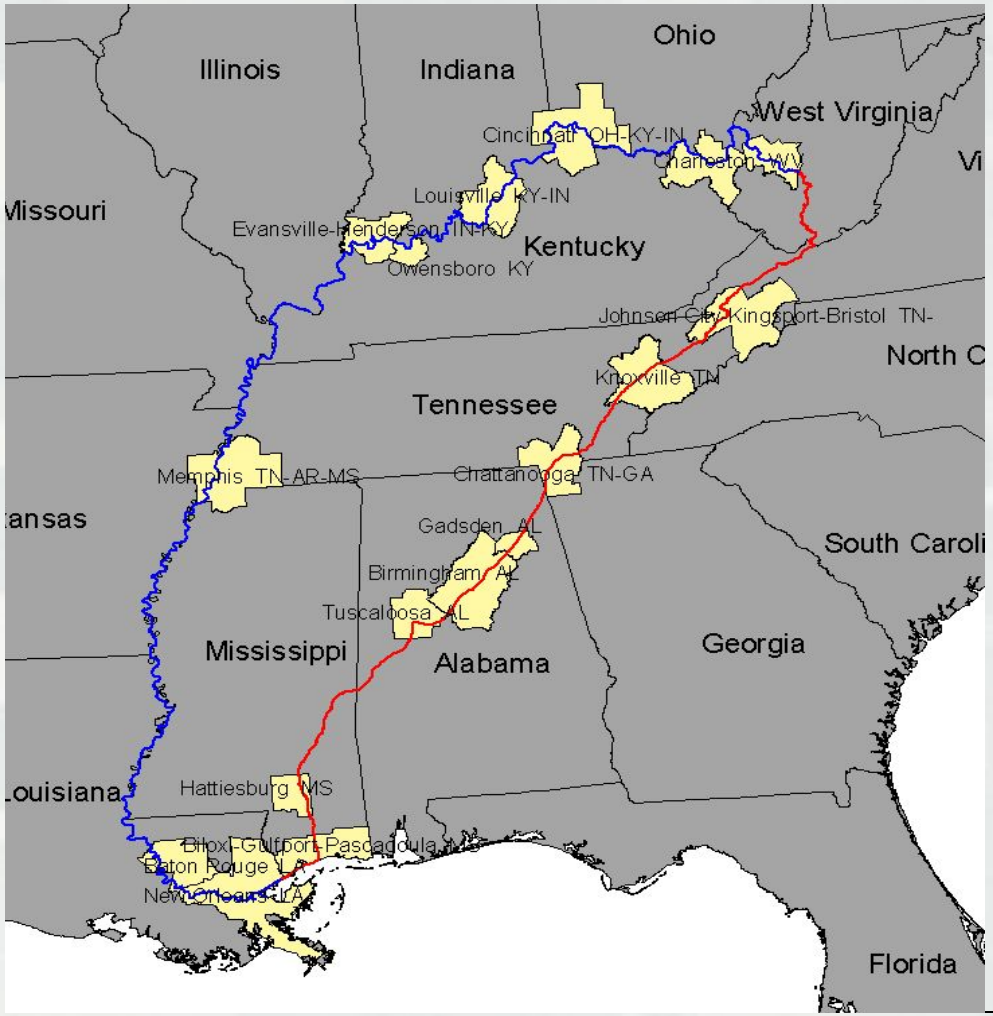


Forecast Waterway Demand

WCSC Data

Base Year

Inventory and Forecast



Transportation Rates Waterway & Overland

Base Rate Savings

	Current	Future
Waterway Cost:	$ 10	$ 16
Overland Cost:	$ 20	$ 20
Savings/Ton:	$ 10	$ 4

Water Routing

Land Routing

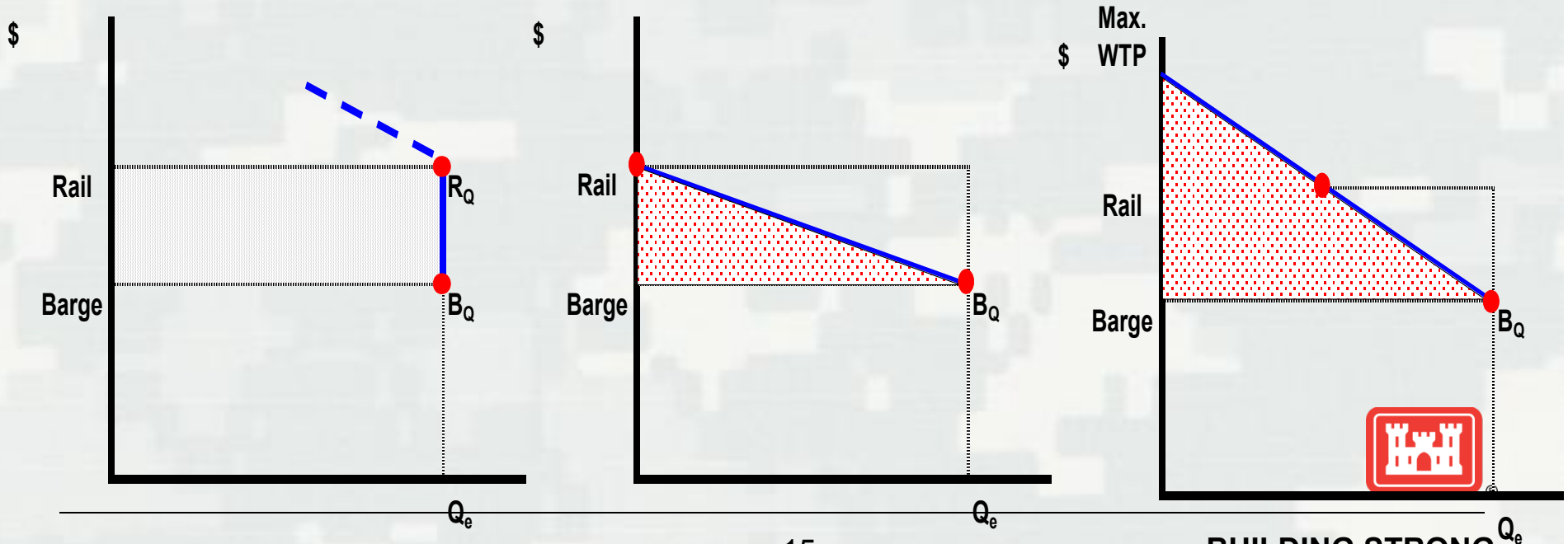
Metropolitan Statistical Area

Inventory and Forecast

Willingness-to-Pay for Barge Transportation

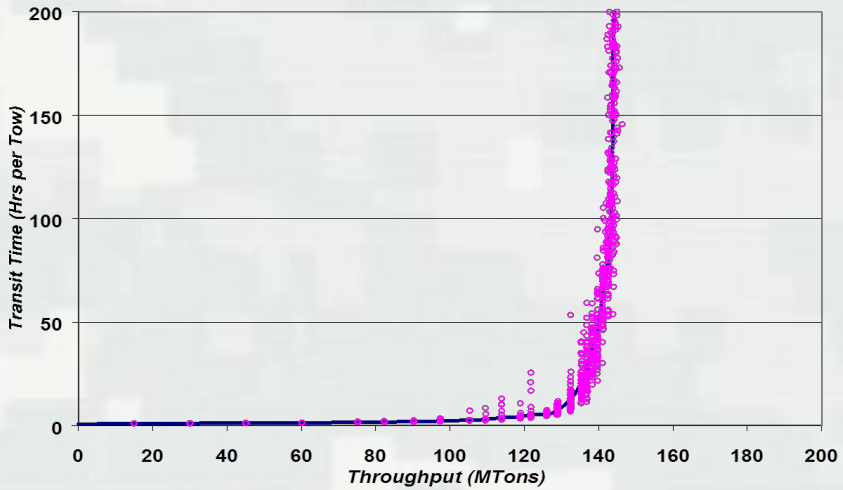
Price Elasticity of Demand – Shipper Stated Preference Curve

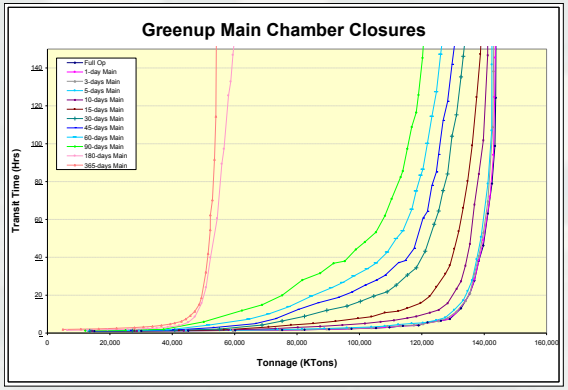
$$\varepsilon_{pq} = \%\Delta p / \%\Delta q$$



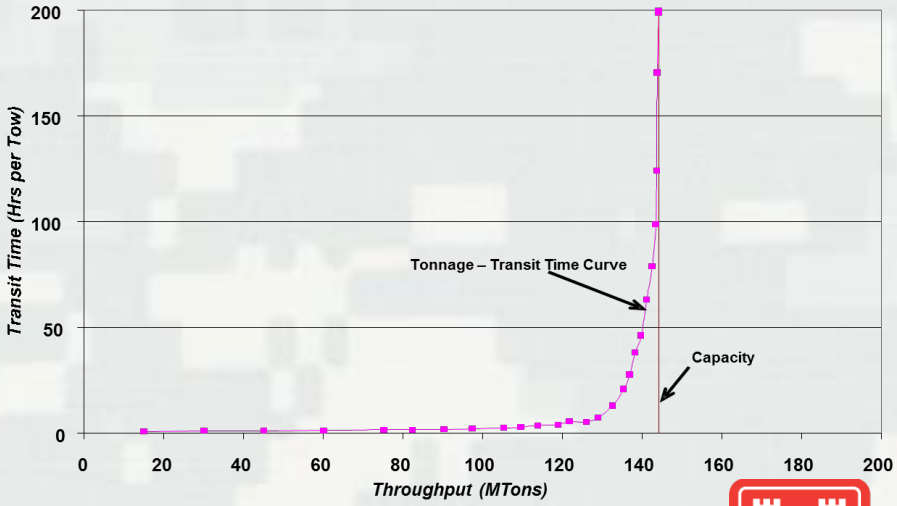
Inventory and Forecast

Modeling Lock Performance - Capacity





- Tonnage-Transit (Supply) Curve
- WAM uses LPMS data to simulate Supply

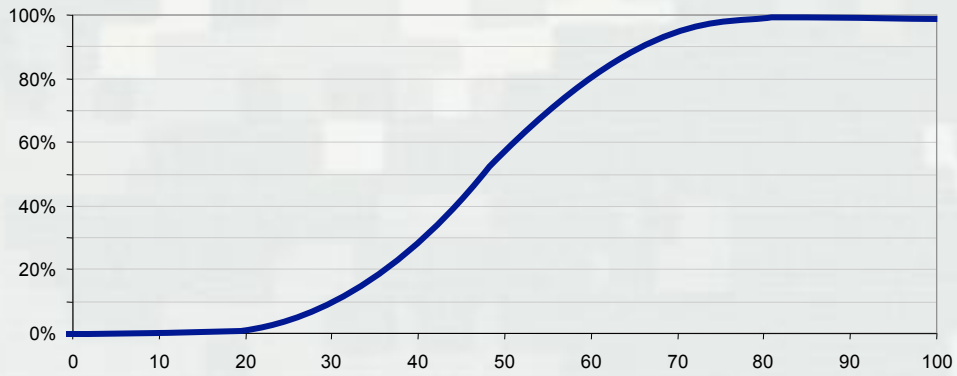


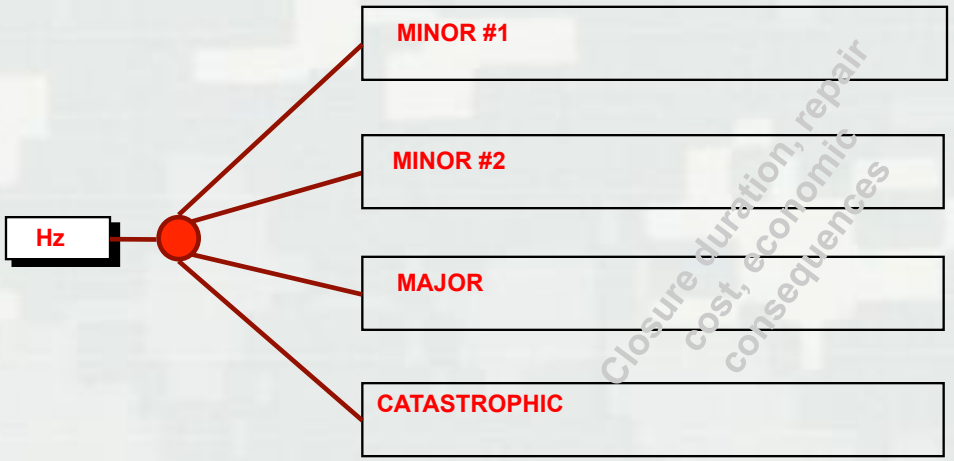
Family of Curves – set of curves for different closure durations

Inventory and Forecast

Component Engineering Reliability - RISK

- Hazard Function
- Event Tree

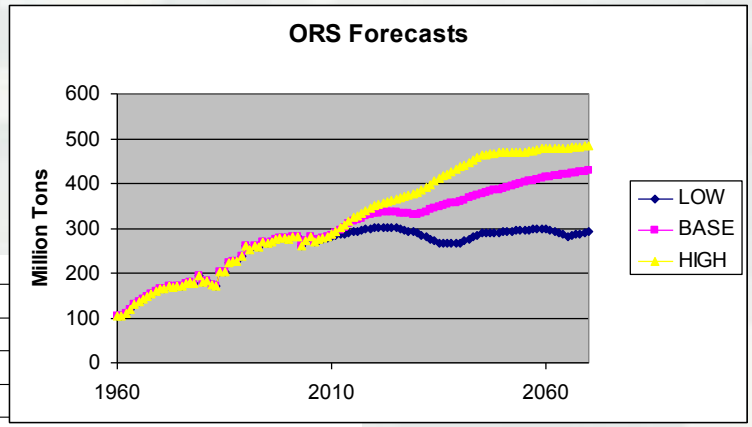


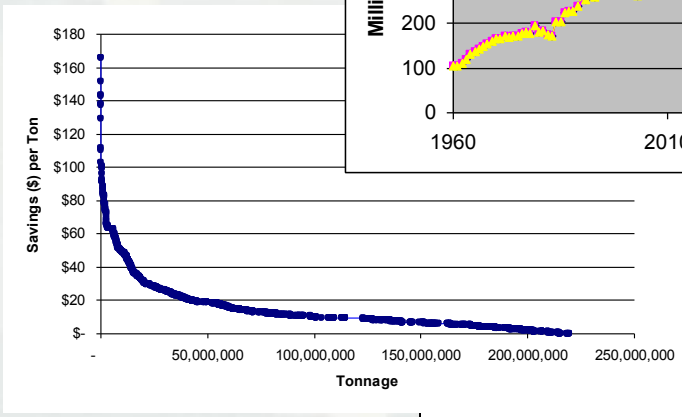


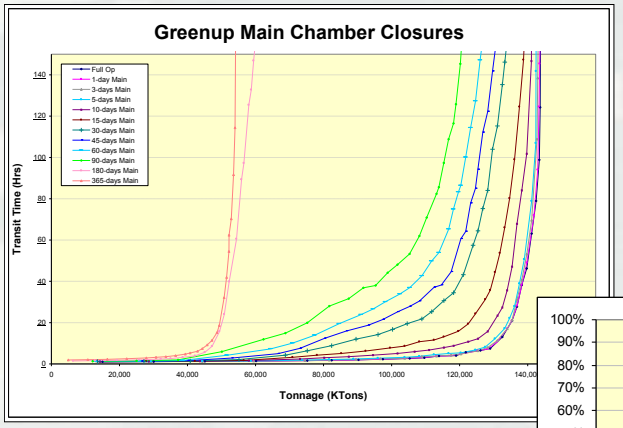
- **Performance over time**
- **Non-Price Determinant of Supply**

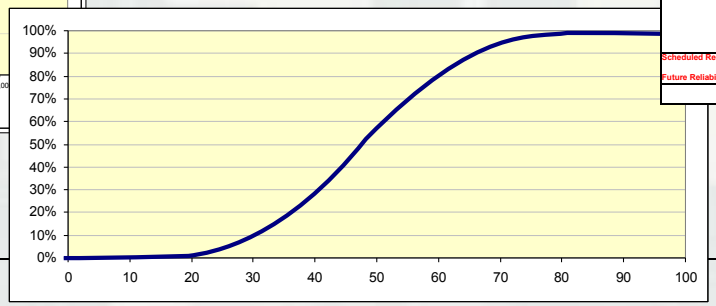
Inventory and Forecast

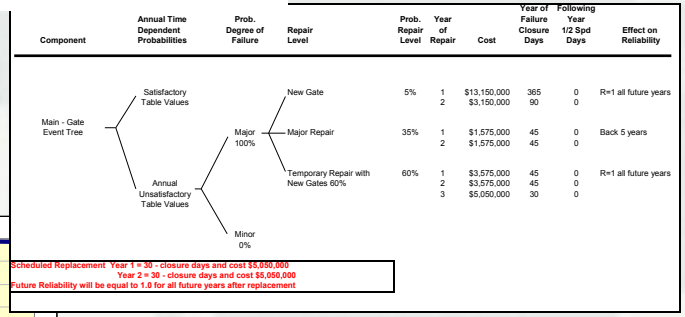
- Demand
  - Forecast (Uncertainty)
  - Rates (Cost)
  - Elasticity (Shape, Slope)
- Supply
  - Capacity (Ton-Transit)
  - Reliability (Risk)







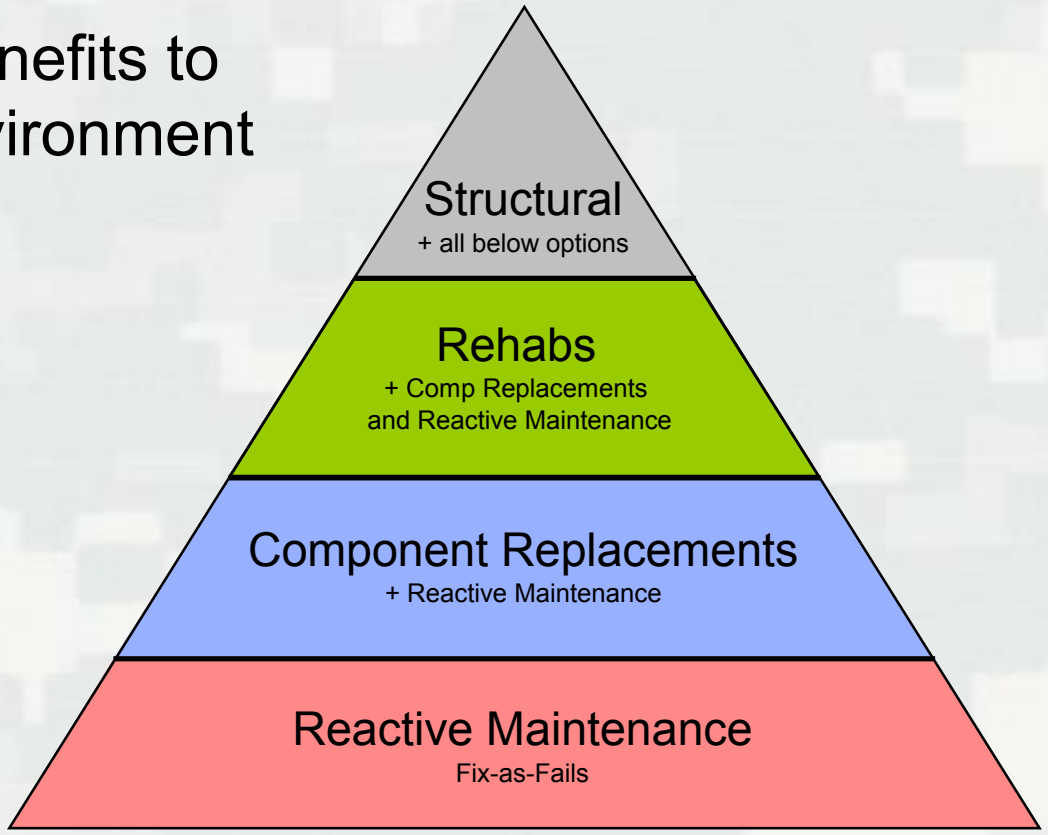




BUILDING STRONG®

Formulate Alternatives

- Management Measures
- Structural/Non-Structural
- Formulate to maximize benefits to national economy and environment
  - Completeness
  - Effectiveness
  - Efficiency
  - Acceptability



Formulate Alternatives

Without-Project Condition

- Most likely condition expected to prevail in the absence of additional project authorizations
- Baseline for evaluating investments in the with-project condition
- Determine life cycle costs and benefits of operating existing infrastructure (i.e. no scheduled replacements), focusing on critical components (Reactive Maintenance)
- Includes non-structural measures

Formulate Alternatives

With-Project Condition

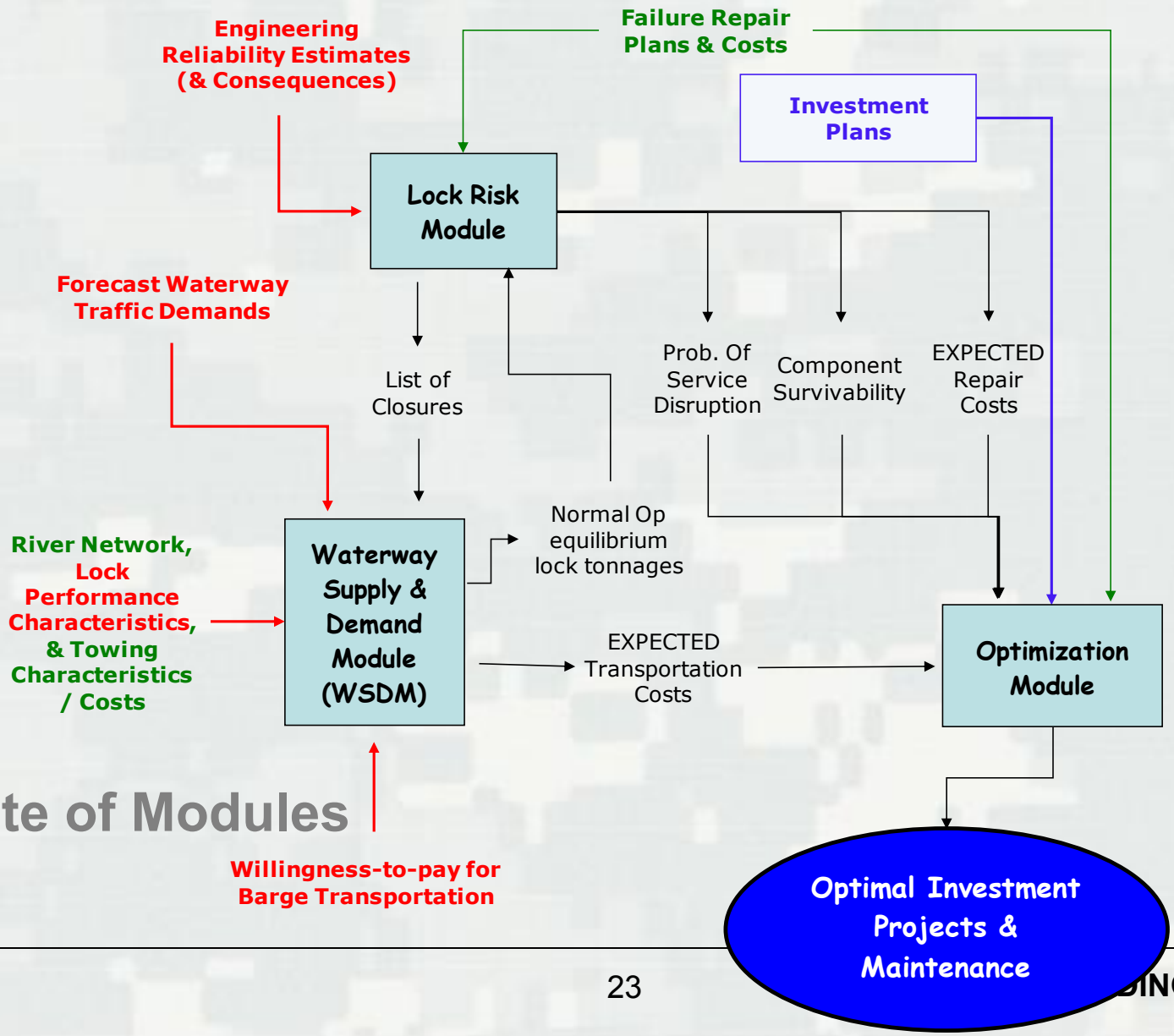
- Most likely condition expected to exist in the future with the implementation of a water resources development project
- Comparison to without-project conditions to identify effects of proposed plan
- The with and without-project comparisons provide framework for evaluating alternative plans

Formulate Alternatives

With Project Condition Environmental Features

- Ecosystem Restoration Projects
- Sustainability-based mitigation
  - Fish passage at dams
- Habitat mitigation for dam tail water impacts
  - Mussel bed degradation
- Beneficial use of disposal materials
  - Ohio River Islands National Wildlife Refuge

Evaluate Alternatives

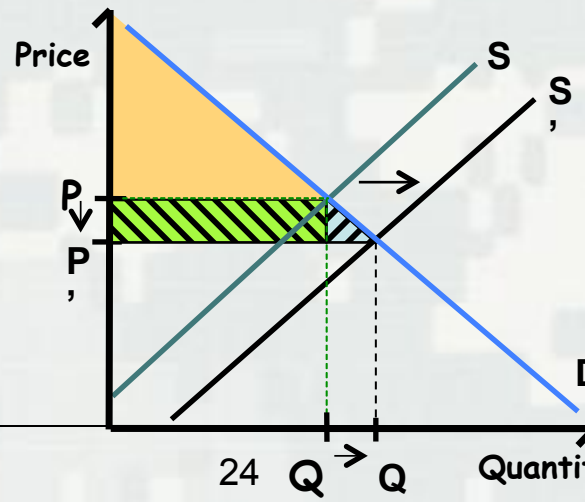


NIM Suite of Modules

Evaluate Alternatives

Four Accounts

- NED* – changes in economic value of the national output of goods and services
- EQ* – non-monetary effects on ecological, cultural, and aesthetic resources and effects of ecosystem restoration
- RED – changes in regional economic activity (income and employment)
- OSE – community impacts, health and safety, energy conservation, etc.



* required

Compare Alternative Plans

Formulation Criteria Matrix ranked by average annual net benefits

	Criterion / Plan	Efficiency	Effectiveness	Completeness	Acceptability
1.	New 600', Close Land After New Chamber Becomes Operational				
2	New 600', Close Land After Wall Failure				
3	New 600' Keep Land Open as FAF				
5	New 800', Close Land After New Chamber Becomes Operational				
7	New 800' Keep Land Open as FAF				
9	New 1200', Close Land After New Chamber Becomes Operational				
11	New 1200' Keep Land Open as FAF				
13	New Twin 600'				
13a	New 600' Deferred New 600' Land Chamber				
15	New 1200' and New 600'				
16	Advanced Maintenance				
17	Without Project, Reactive Maintenance				

Blue – superior, green-acceptable, yellow-questionable, red-unacceptable performance to meet study objectives

Select Recommended Plan

- Preferable to no action
- NED Plan – maximizes net benefits
- NER Plan – (for ecosystem restoration projects)
- Combined NED/NER Plan – optimum
- LPP - complicated

Navigation Economics Products/Review

- Appendix – Project Navigation Study Economics
  - Attachment 1 – Navigation Investment Model (NIM)
  - Attachment 2 – Lock Capacity Analysis
  - Attachment 3 – Traffic Demand Forecasts
  - Attachment 4 – Transportation Rate Analysis
  - Attachment 5 – Social Costs of Diverted Traffic

- Review Plan (EC - 214)
  - ATR – required
  - IEPR – mandatory if…

- Model Status (EC - 412)
  - NIM - certified
  - WAM - certified
  - BCM – approved for use
  - GEM (LTI) – proprietary*
  - Traffic Diversion Model - proprietary*

* Approval not necessary; HQ requests thorough review of product