

Risk-informed Decision Process

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Traditional Planning

- It's largely deterministic
- Process relies on a single most likely alternative future forecast
 - Desire for single right answer
 - Often anchored in present
 - Adversarial--legitimate differences in views of uncertain future

Traditional Planning

- Principles and Guidelines
 - Economic efficiency of investment decision approach
 - Choose the plan that most reasonably maximizes net NED consistent with protecting environment
 - Identify and describe areas of risk and uncertainty to provide knowledge of the degree of reliability of the estimated benefits and costs and of the effectiveness of alternative plans.

Risk in P&G

- Assumption that risk arises from benefits and costs
 - Economic risk
- No explicit consideration of human health and safety or other non-monetary risks
 - Only inferential in flood damage reduction
 - Number of units by activity

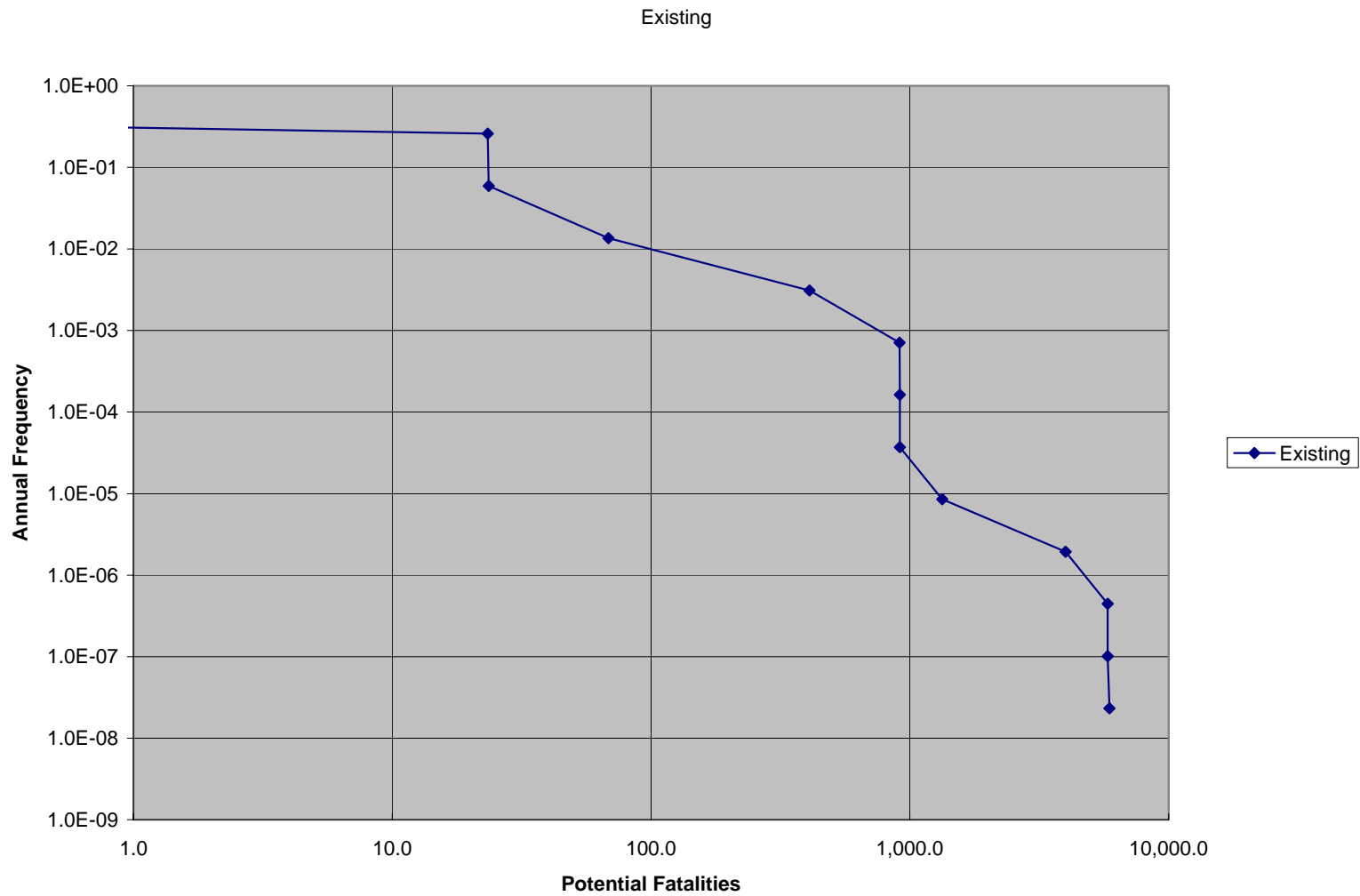
Classic Risk Assessment Framework

INITIATING EVENT	NATURAL SYSTEM RESPONSE	ENGINEERED SYSTEM RESPONSE	SYSTEM OUTCOME	EXPOSURE	CONSEQUENCES
HURRICANES WITH DIFFERENT TRACKS AND INTENSITIES	SPATIALLY DISTRIBUTED STORM SURGE AND WAVES	<ul style="list-style-type: none"> • OVERTOPPING • CRACKING • PIPING • FOUNDATION FAILURE • SLOPE FAILURE 	<ul style="list-style-type: none"> • BREACH • PARTIAL BREACH • NO BREACH 	<ul style="list-style-type: none"> • LOCATIONAL DEPTH AND SPEED OF FLOODING • WARNING TIME • EVACUATION EFFECTIVENESS • RESCUE • AMOUNT AND LOCATION OF RESIDENTIAL AND BUSINESS DEVELOPMENT 	<ul style="list-style-type: none"> • HUMAN HEALTH AND SAFETY • PROPERTY • REGIONAL INCOME • ENVIRONMENTAL • SOCIAL AND CULTURAL • NATIONAL INCOME
?	<ul style="list-style-type: none"> • DEPENDENT ON INITIAL NATURAL AND MAN-MADE FEATURES, SEA LEVEL, ETC. • UNCERTAIN 	<ul style="list-style-type: none"> • DEPENDENT ON ENGINEERING RELIABILITY • EACH COMPONENT MAJOR FEATURE • UNCERTAIN 	<ul style="list-style-type: none"> • LOCATIONAL • UNCERTAIN 	<ul style="list-style-type: none"> • UNCERTAIN 	<ul style="list-style-type: none"> • SHORT TERM • LONG TERM • UNCERTAIN

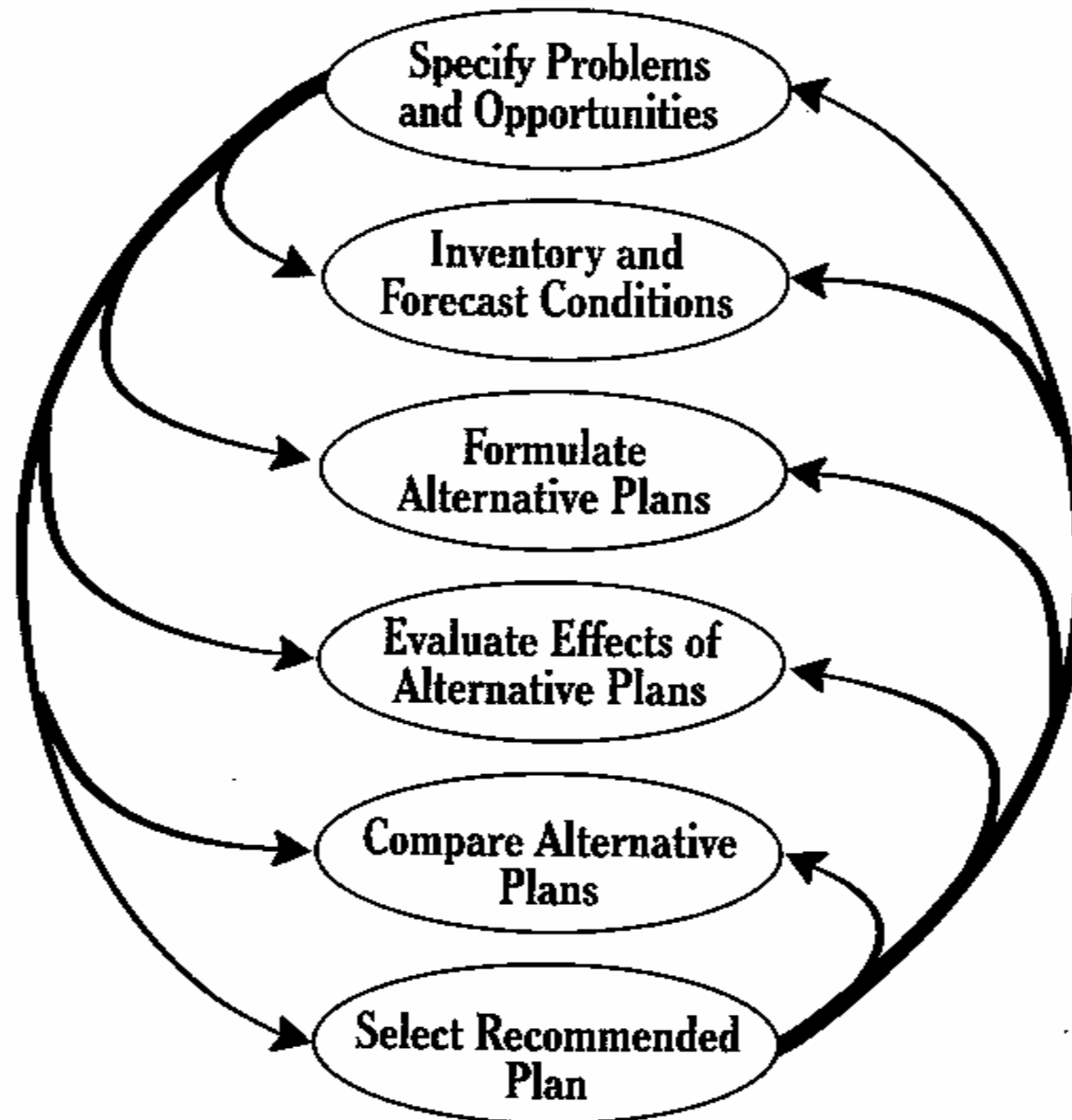
Considerations in Risk Assessment for LA

- Geographical heterogeneity of resources/assets?
- Interdependence with risk reduction
- Spatial independence of alternatives?
 - Separable parts
 - Prioritization

Notional Risk



PLANNING PROCESS



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Most Likely Future Condition

- We labor in uncertainty
- A single forecast of the future will be wrong
- Thus, planning is based on what could be not necessarily what will be
- What could be is wide open to debate
 - We cannot ignore it

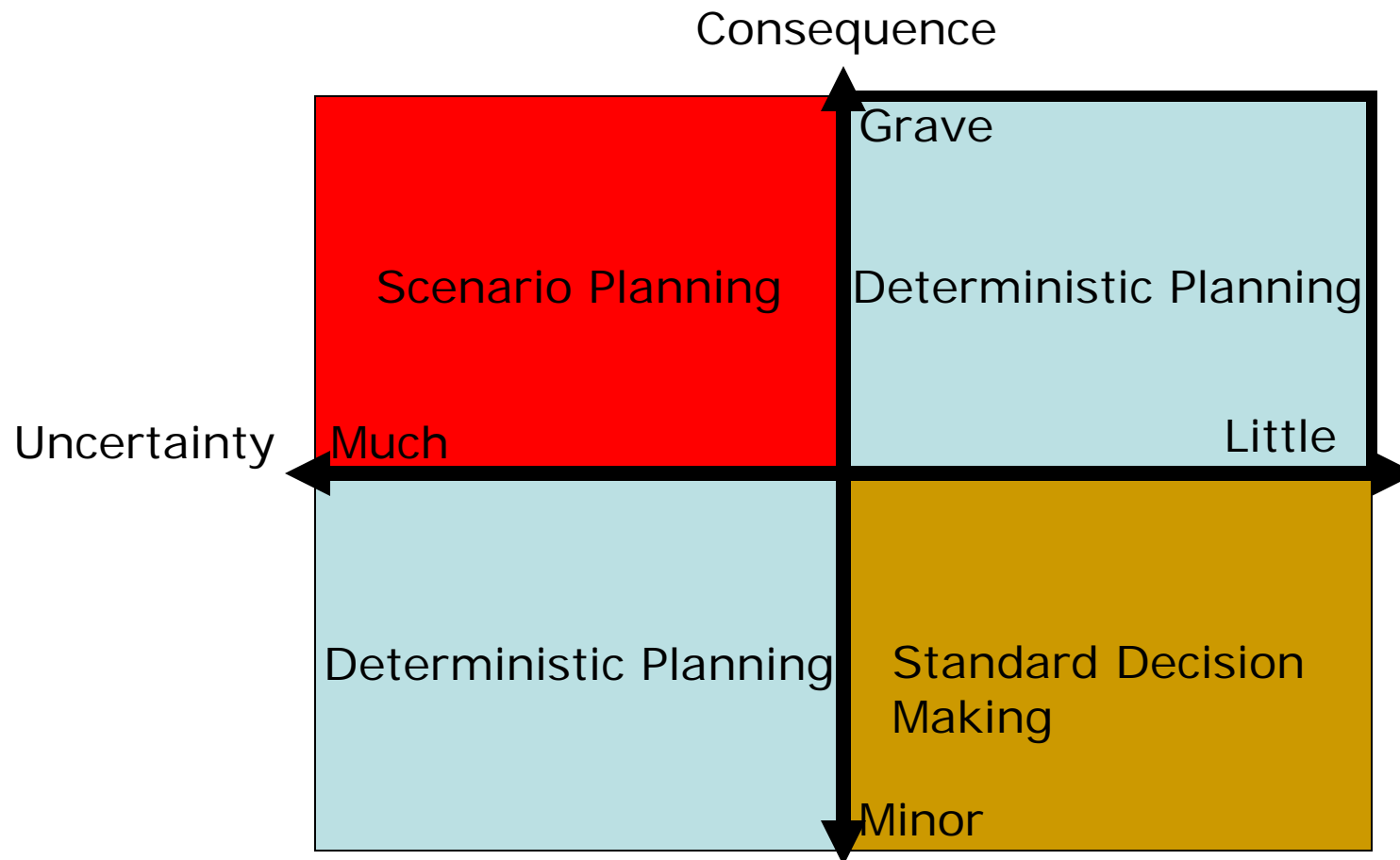
Complex Studies

- Need planning framework that addresses uncertainty explicitly
- Wide variety of ecosystem restoration issues face large uncertainties
 - Natural causes
 - Global warming
 - Storm regimes
 - Anthropogenic disturbances
 - The “with condition”
- Scenario planning can help

Scenario Planning

- Developed in second half of 20th century (Europe)
- Result of failure of traditional planning
 - Deterministic view of future
 - Forecasts were wrong

When to Use Scenario Planning



- Much uncertainty
 - ID drivers
- Identify future scenarios
- Use scenarios to aid formulation
- Maybe be scenarios (assumptions) in “with” plan that influence plan performance
 - Response to plan may be uncertain
- Do analysis
(good science)
- Evaluate plans against all scenarios

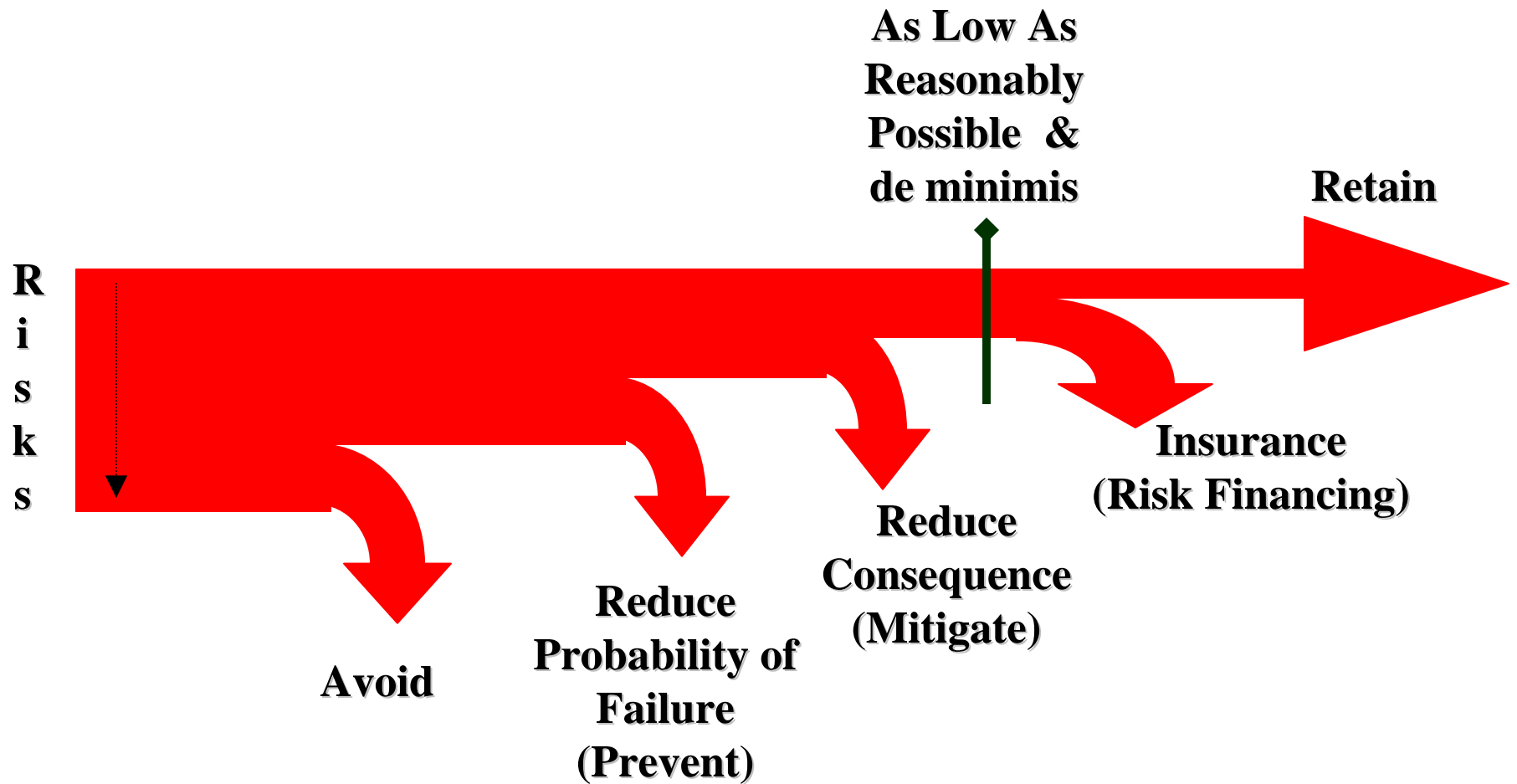
Risk-informed Decision Making

- Develop and use risk information to aid decisions
 - Decision metrics and rules developed by decision makers
 - Use risk assessment approach to develop science-based values of risk metrics

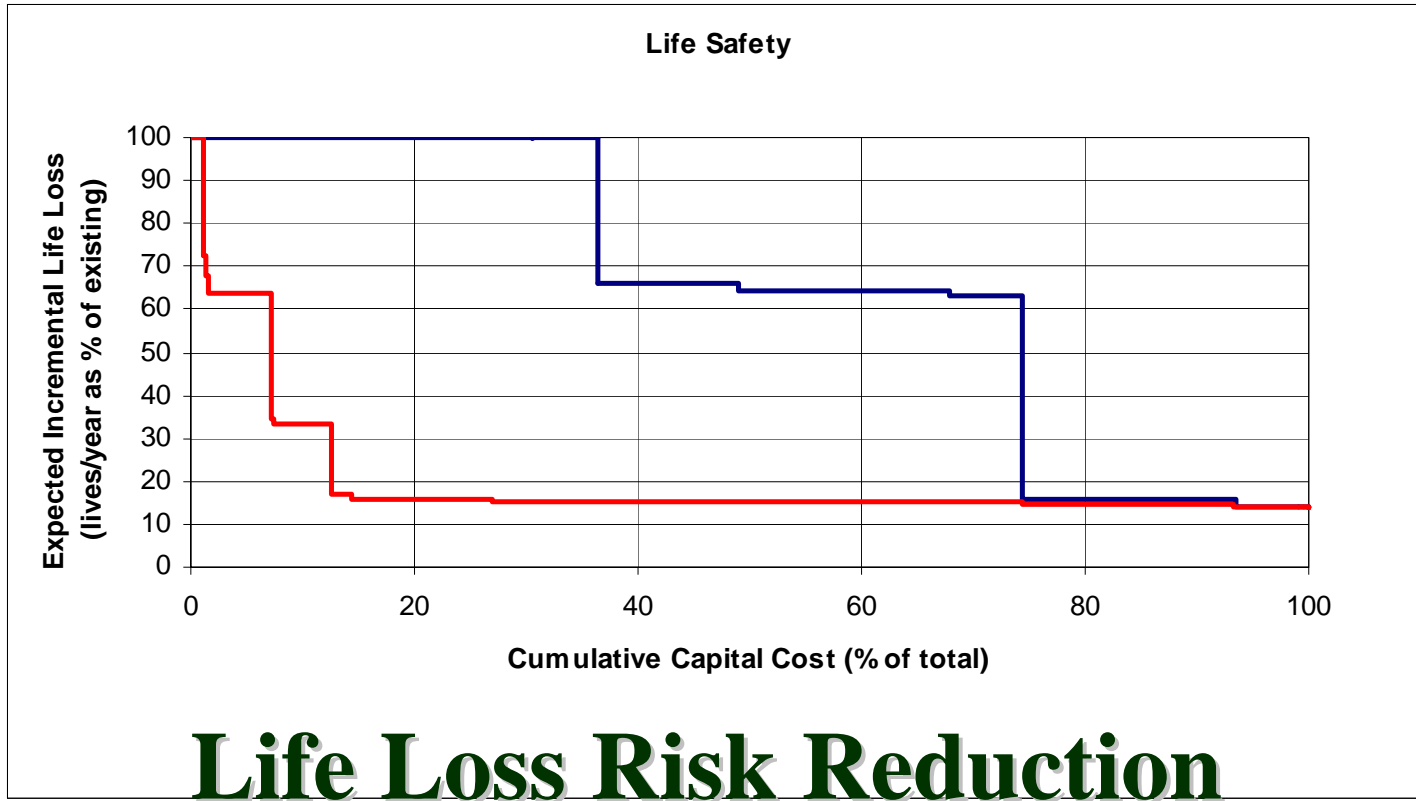
Risk-informed Decision Making

- Needs to convey information on residual risks
- Show risk metric values under all scenarios
- Develop useful tradeoff information
 - Incremental changes in metrics

Dam Safety Risk Management Philosophy

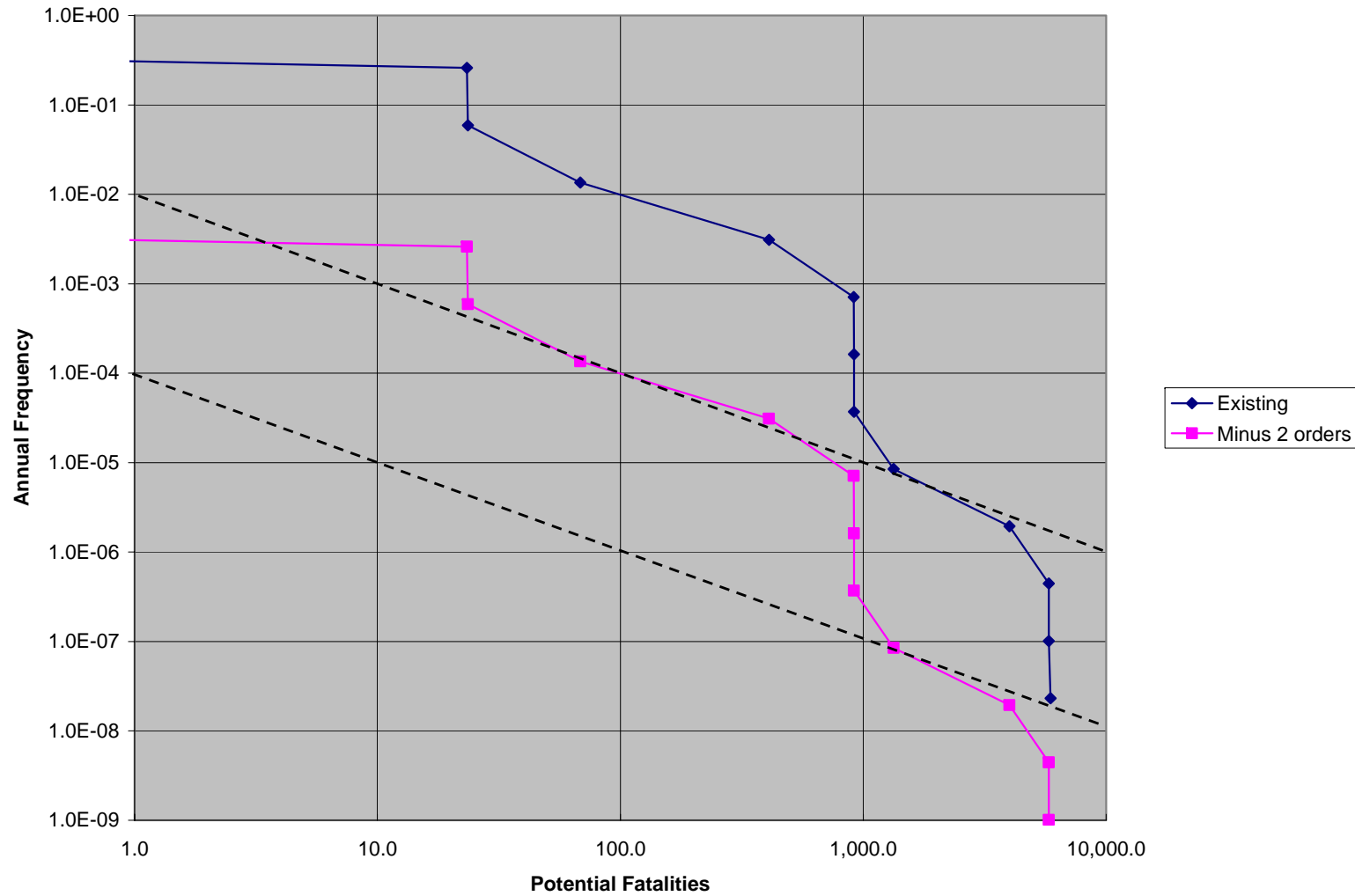


Risk Reduction Prioritization



— *Best Return on investment scenario*

Notional Risk Reduction



Possible Metrics

- Life safety risk
 - Tolerated residual risk
- Economic risk
 - Net economic benefits
- Combined
 - Net cost per life saved