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Managing Water in the West

Colorado River Basin Water Supply and Demand Study

WRRC 2013 Conference
University of Arizona
Tucson, AZ
March 5, 2013

U.S. Department of the Interior
Bureau of Reclamation

Colorado River Basin Water Supply and Demand Study

- Study Objective
  - Assess future water supply and demand imbalances over the next 50 years
  - Develop and evaluate opportunities for resolving imbalances
- Study conducted by Reclamation and the Basin States, in collaboration with stakeholders throughout the Basin
- Began in January 2010 and completed in December 2012
- A planning study – does *not* result in any decisions, but will provide the technical foundation for future activities

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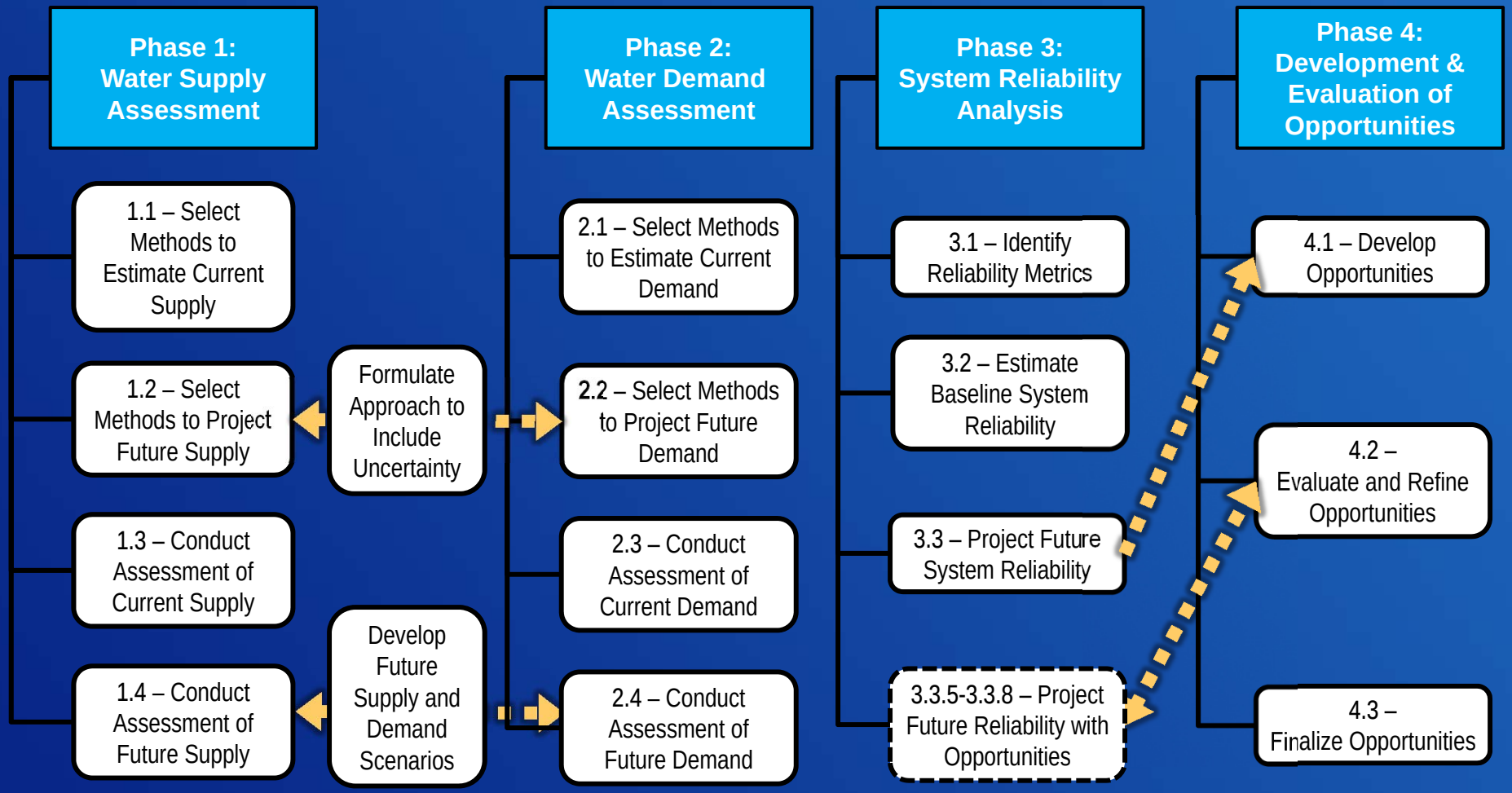
Study Phases and Tasks



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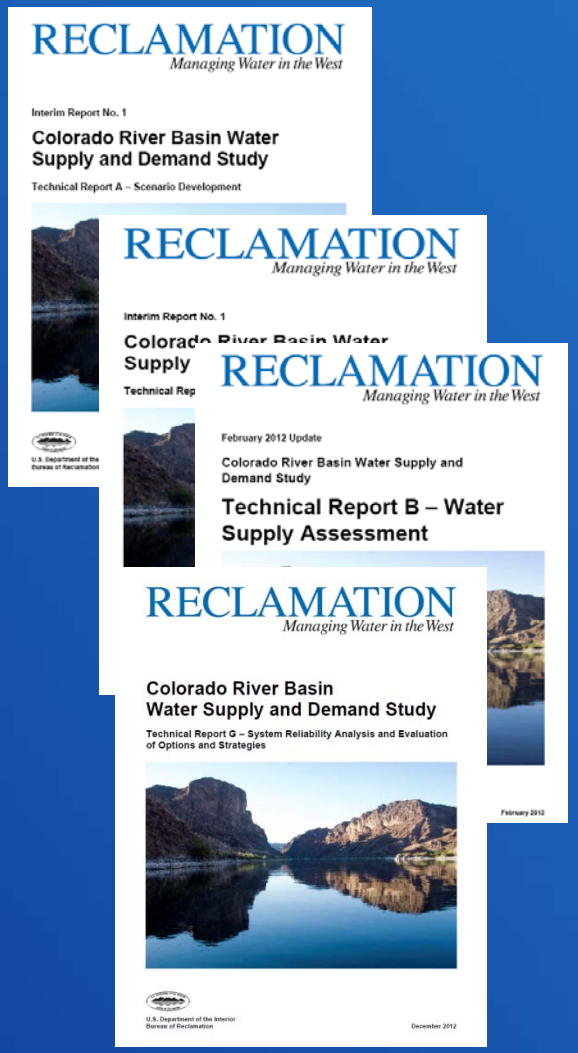
Final Study Reports

- The final Study is a collection of reports available at: http://www.usbr.gov/lc/region/programs/crbstudy/report1.html

Executive Summary
Study Report
Technical Report A – Scenario Development
Technical Report B – Water Supply Assessment
Technical Report C – Water Demand Assessment
Technical Report D – System Reliability Metrics
Technical Report E – Approach to Develop and Evaluate Opportunities to Balance Supply
Technical Report F – Development of Options and Strategies
Technical Report G – System Reliability Analysis and Evaluation of Options and Strategies



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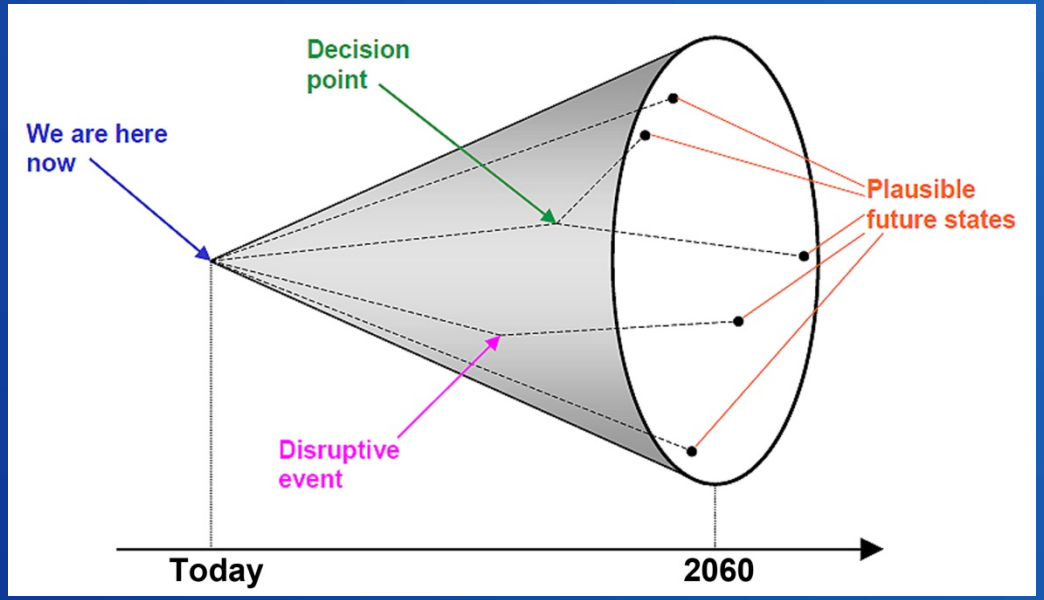
Scenario Planning: Addressing an Uncertain Future

- The path of major influences on the Colorado River system is uncertain and can not be represented by a single view

- An infinite number of plausible futures exist

- A manageable and informative number of scenarios are being developed to explore the broad range of futures



(adapted from Timpe and Scheepers, 2003)

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Water Supply Scenarios

Observed Resampled:

- future hydrologic trends and variability will be similar to the past 100 years

Paleo Resampled:

- future hydrologic trends and variability are represented by the distant past (approximately 1250 years)

Paleo Conditioned:

- future hydrologic trends and variability are represented by a blend of the wet dry states of the paleo-climate record but magnitudes are more similar to the observed period

Downscaled GCM Projected:

- future climate will continue to warm with regional precipitation trends represented through an ensemble of future GCM projections

Water Demand Scenarios

Current Projected (A):

- growth, development patterns, and institutions continue along recent trends

Slow Growth (B):

- low growth with emphasis on economic efficiency

Rapid Growth (C1 and C2):

- economic resurgence (population and energy) and current preferences toward human and environmental values
  - C1 – slower technology adoption
  - C2 – rapid technology adoption

Enhanced Environment (D1 and D2):

- expanded environmental awareness and stewardship with growing economy
  - D1 – with moderate population growth
  - D2 – with rapid population growth

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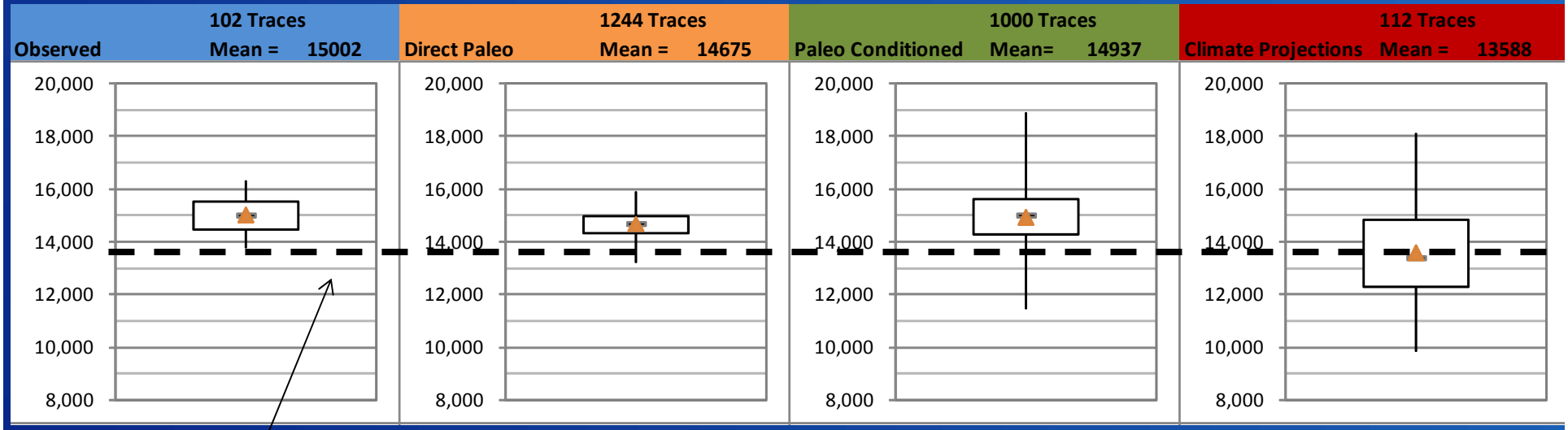
Quantification of Water Supply Scenarios

Projections of 2011-2060 Average Natural Flow at Lees Ferry



1994 – 2013 average = 13.6 MAF

Box represents 25th – 75th percentile, whiskers represent min and max, and triangle represents mean of all traces

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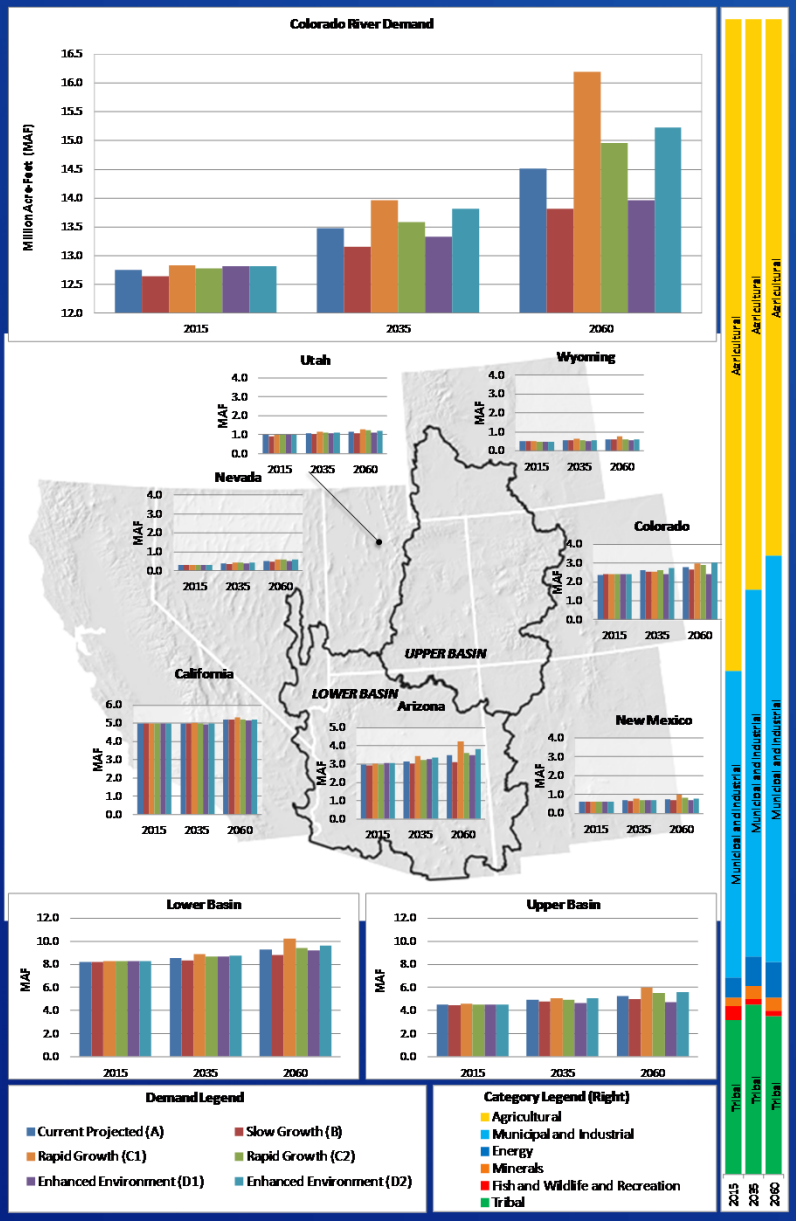
Water Demand Quantification Results



- Parameters driving demands include population, per capita water use, and irrigated acreage and are projected to change from 2015 to 2060:
  - Population increase from about 40 million people by 23% (49 million) to 91% (77 million)
  - Per capita water use decrease by 7% to 19%
  - Irrigated acreage decrease from about 5.5 million acres by 6% (5.2 million) to 15% (4.6 million)

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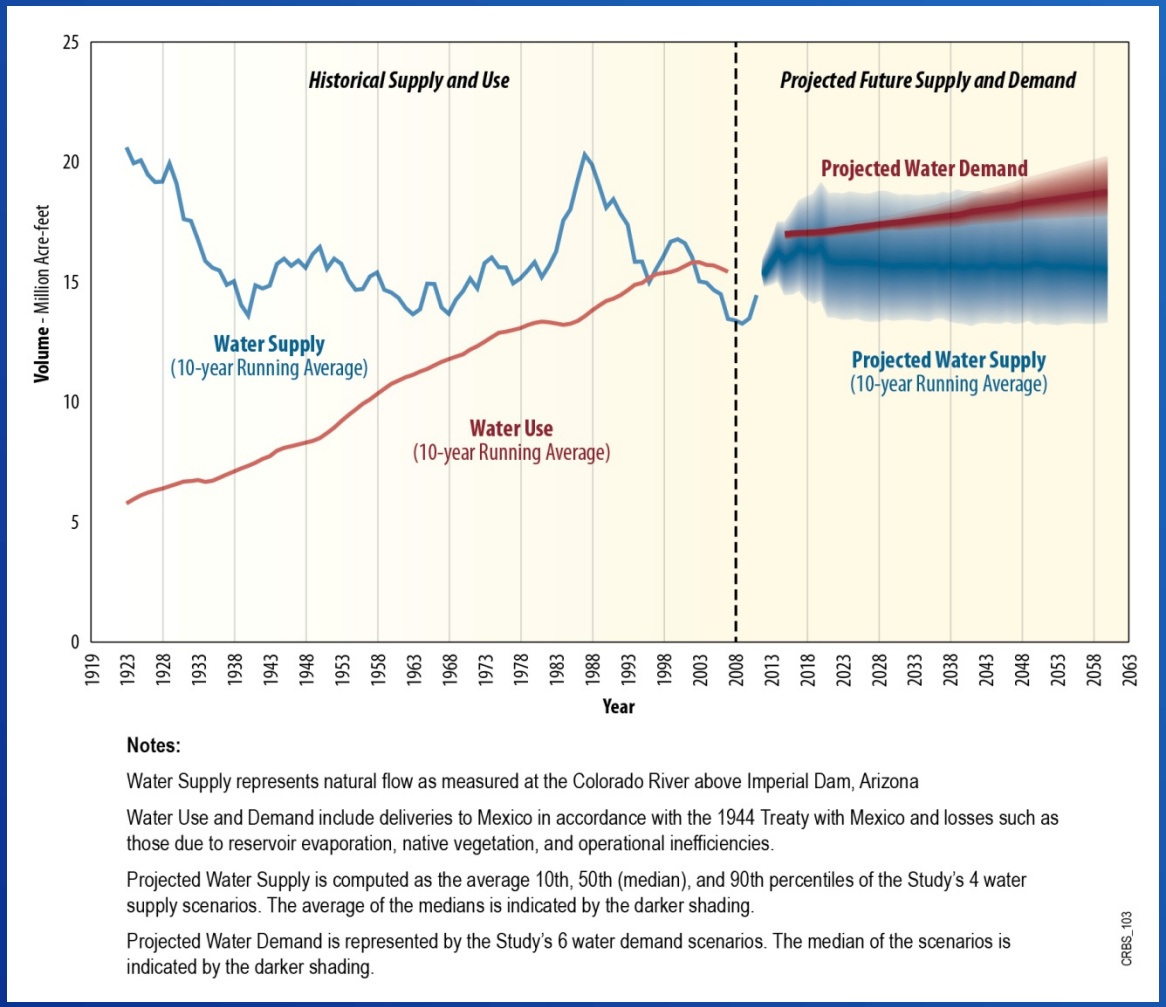
Projected Future Colorado River Basin Water Supply and Demand

- Average supply-demand imbalances by 2060 are approximately 3.2 million acre-feet
- This imbalance may be more or less depending on the nature of the particular supply and demand scenario
- Imbalances have occurred in the past and deliveries have been met due to reservoir storage



Notes:

Water Supply represents natural flow as measured at the Colorado River above Imperial Dam, Arizona

Water Use and Demand include deliveries to Mexico in accordance with the 1944 Treaty with Mexico and losses such as those due to reservoir evaporation, native vegetation, and operational inefficiencies.

Projected Water Supply is computed as the average 10th, 50th (median), and 90th percentiles of the Study's 4 water supply scenarios. The average of the medians is indicated by the darker shading.

Projected Water Demand is represented by the Study's 6 water demand scenarios. The median of the scenarios is indicated by the darker shading.

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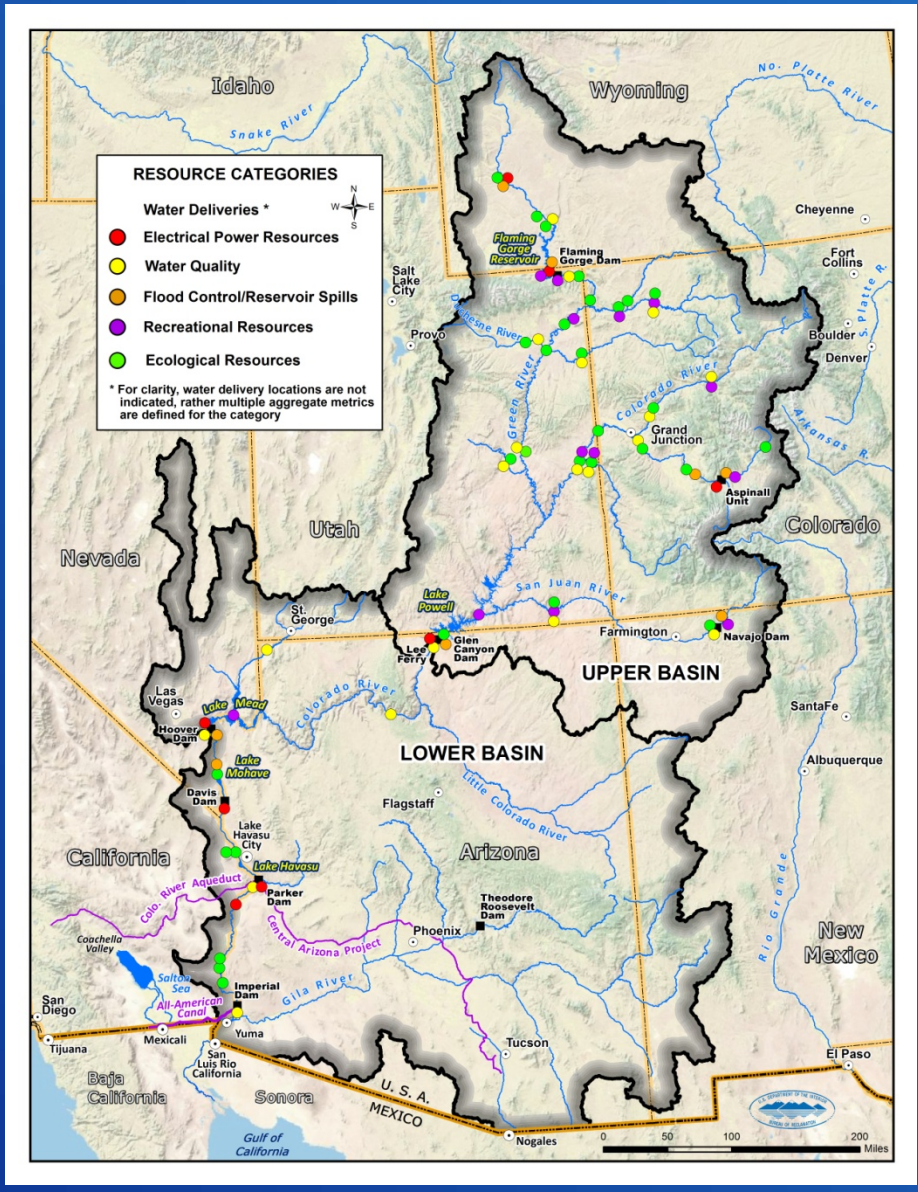
System Reliability Analysis

- Simulate the state of the system over the next 50 years for each scenario, with and without options and strategies
- Use metrics and vulnerabilities to quantify impacts to Basin resources
- **Resource Categories**
  - Water Deliveries
  - Electrical Power Resources
  - Water Quality
  - Flood Control
  - Recreational Resources
  - Ecological Resources



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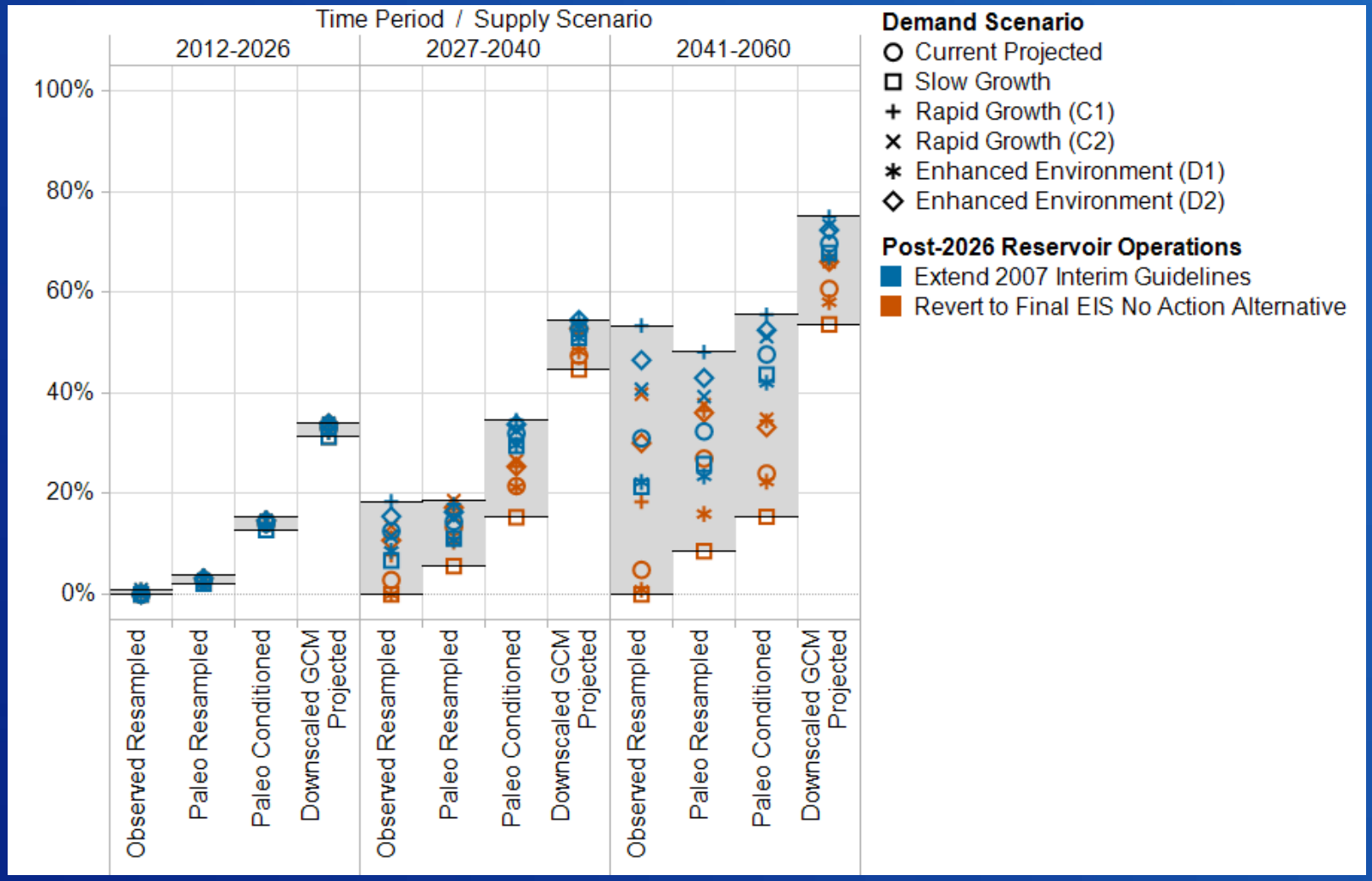
Lake Mead Pool Elevation < 1,000 feet
Percent of Traces Vulnerable



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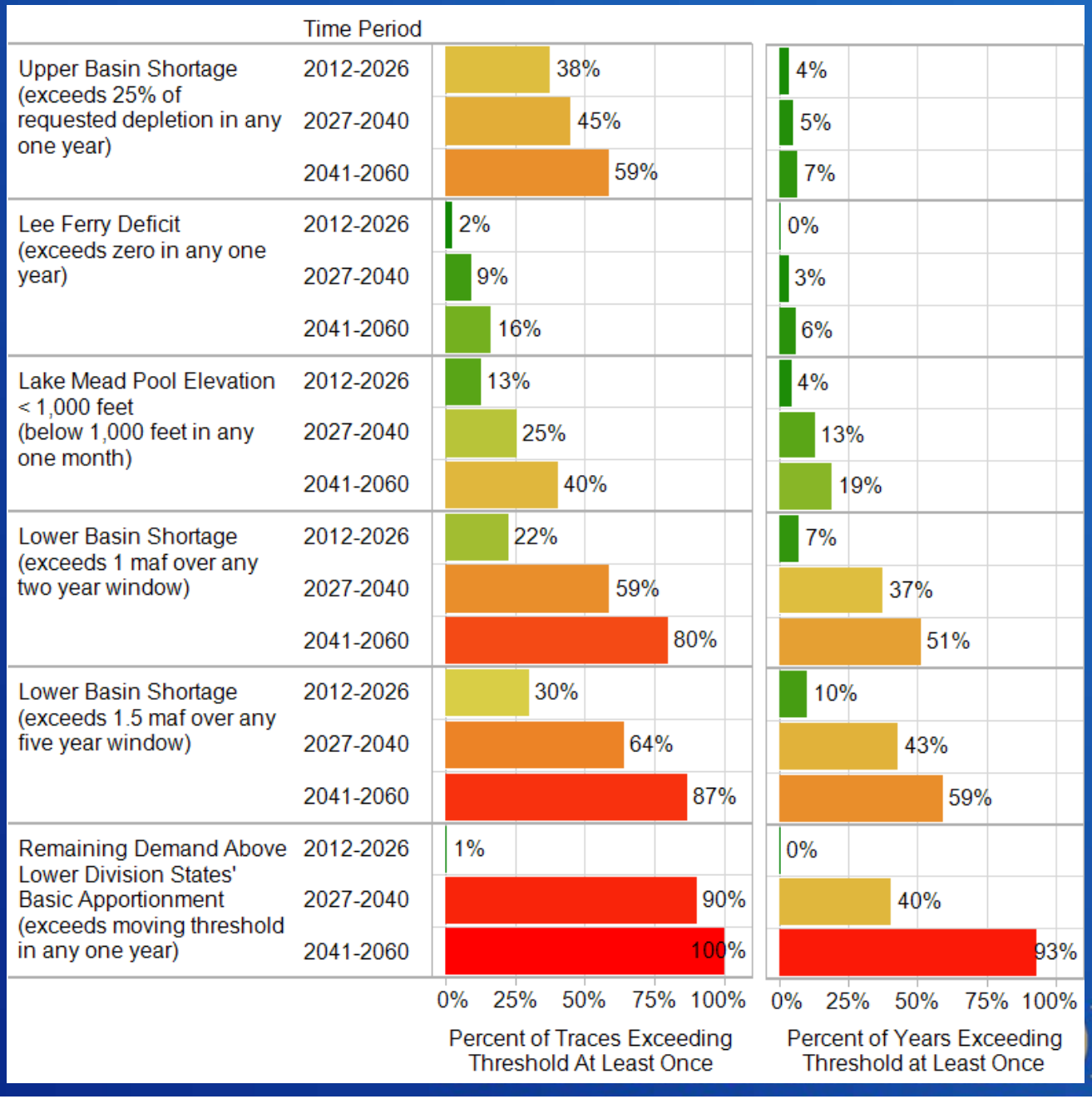
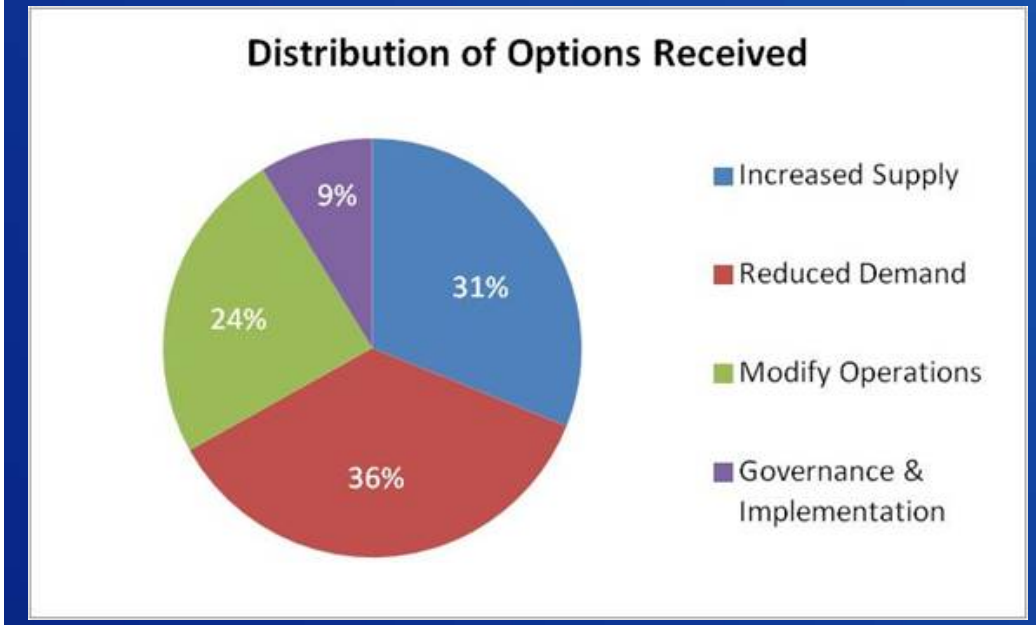
Water Deliveries

Percent of Traces and Years Vulnerable



Summary of Options Submitted

- Over 150 options were submitted to the Study from Nov 2011 - Feb 2012
- All options received were included and are reflected in the Study



Increased Supply – reuse, importation, desalination, etc.

Reduced Demand – M&I and agricultural conservation, etc.

Modify Operations – transfers & exchanges, water banking, etc.

Governance & Implementation – stakeholder committees, population control, re-allocation, etc.

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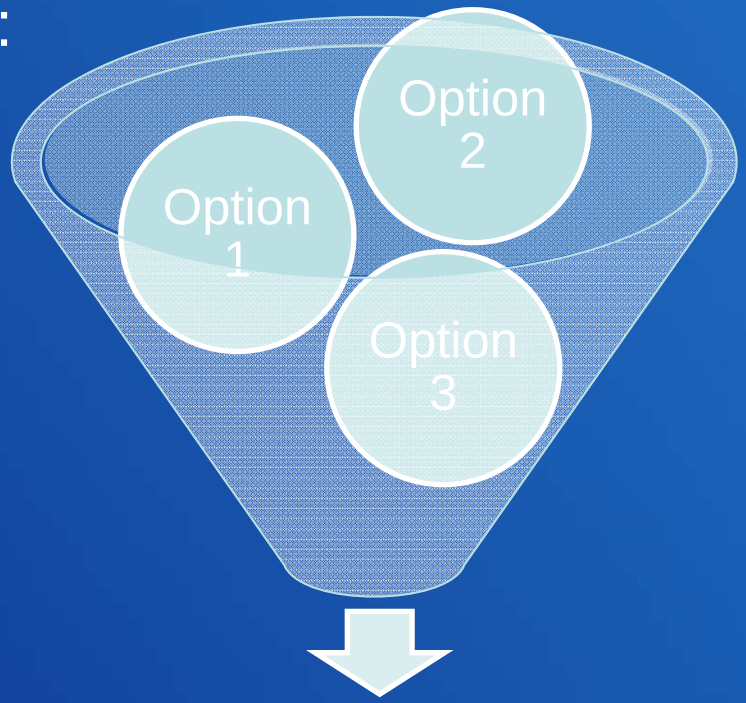
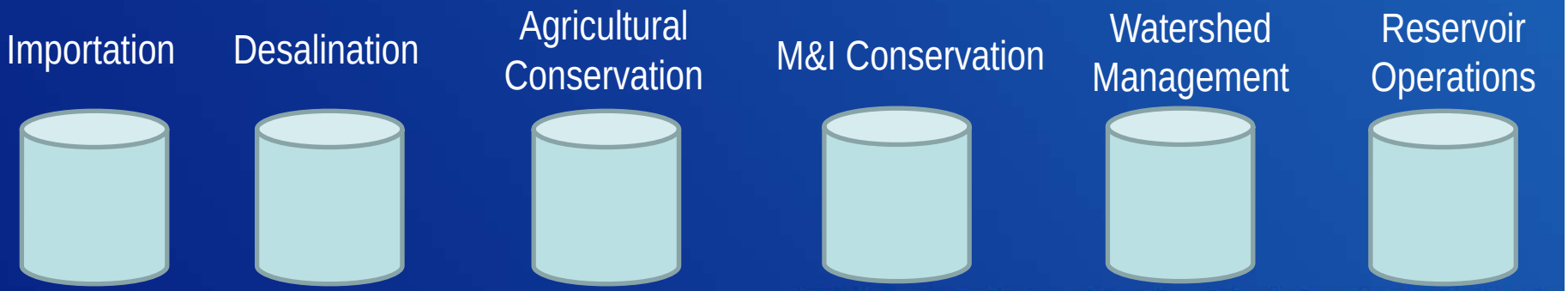
Organizing and Characterizing Options

- Characterization Criteria includes:
  - Potential yield
  - Timing of implementation
  - Technical feasibility
  - Cost
  - Environmental impacts/permitting requirements
  - Legal/public policy
  - Risk/uncertainty





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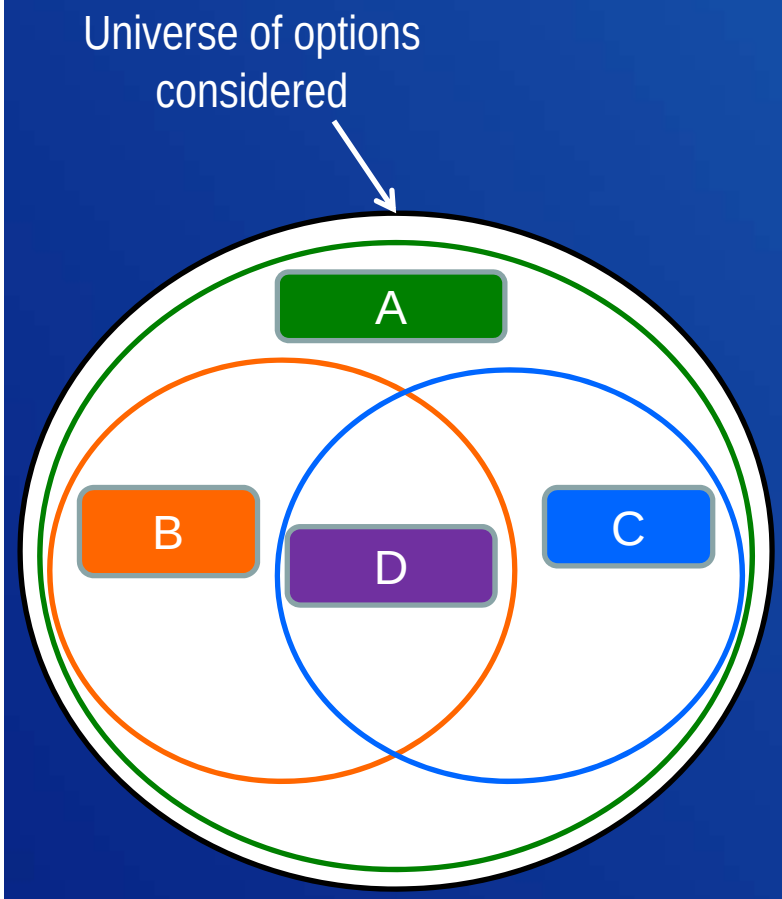
Summary of Portfolios



Option Selection
• Least restrictive resulting in a highly inclusive set of option preferences • Considers the largest set of options
• Low-risk strategy in the long-term with high reliability • High technical feasibility • Excludes options with high permitting, legal and policy risks
• Prioritizes options that have low environmental impacts and long-term flexibility • Excludes options with high permitting risk
• High technical feasibility and long-term reliability • Low energy intensity • Excludes options with high permitting, legal, and policy risk • Considers smallest set of options

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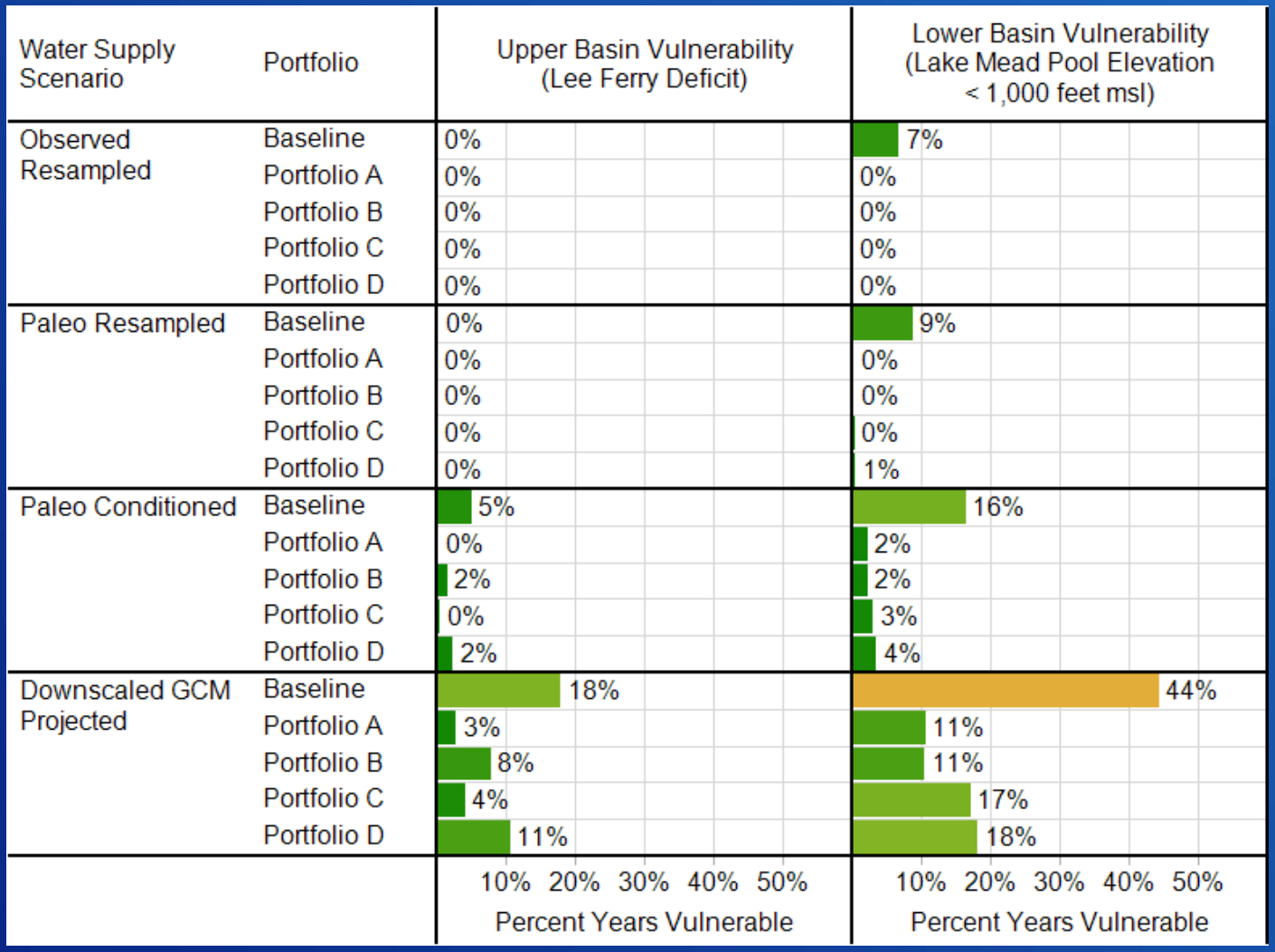
Portfolios Effectiveness at Reducing Vulnerability

Percent of Years Vulnerable from 2041 - 2060



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Summary

- The system is vulnerable if we do nothing
- Doing something greatly reduces that vulnerability and makes us more resilient to adverse conditions but does eliminate vulnerability
- In the near term, all portfolios show that conservation, transfers, and reuse are cost-effective ways to reduce vulnerability
- In the longer term, more tradeoffs emerge to achieve an acceptable level of risk in terms of options, cost, resources, and other implications.

Next Steps

- Educational Outreach Sessions
  - March 25 in Salt Lake City, UT
  - March 26 in Phoenix, AZ
  - April 3 via Webinar
- Reduce uncertainties related to water conservation, reuse, water banking, augmentation, and weather modification concepts
- Further study of tribal water issues
- Advance science and modeling tools used in the Study
- Consider strategies that provide a wide-range of benefits to all water users
- In early 2013, a workshop will be held to initiate actions to implement next steps

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Study Contact Information

- Website: http://www.usbr.gov/lc/region/programs/crbstudy.html
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