Adaptation Decision-Making at Metropolitan Water District of Southern California

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October 18, 2023

Overview

- Metropolitan Water District and Its Planning Scope
- Evolution of uncertainty planning for MWD
- Lessons Learned

Metropolitan Water District and Its Planning Scope

Metropolitan Water District of Southern California

Regional Water Wholesaler

26 Member Agencies

19+ Million People

5,200 Square Miles

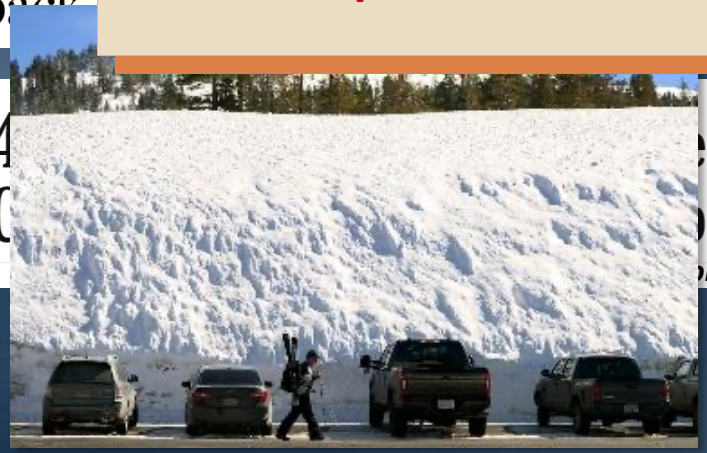
~3 to 4 MAF Annual Demand

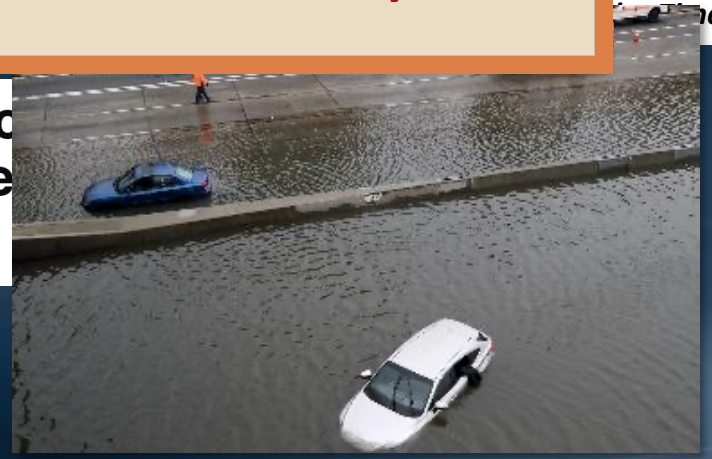
- ½ MWD Imported Supplies

Metropolitan Water District Sources of Supply

Recent Southern California Climate Impacts

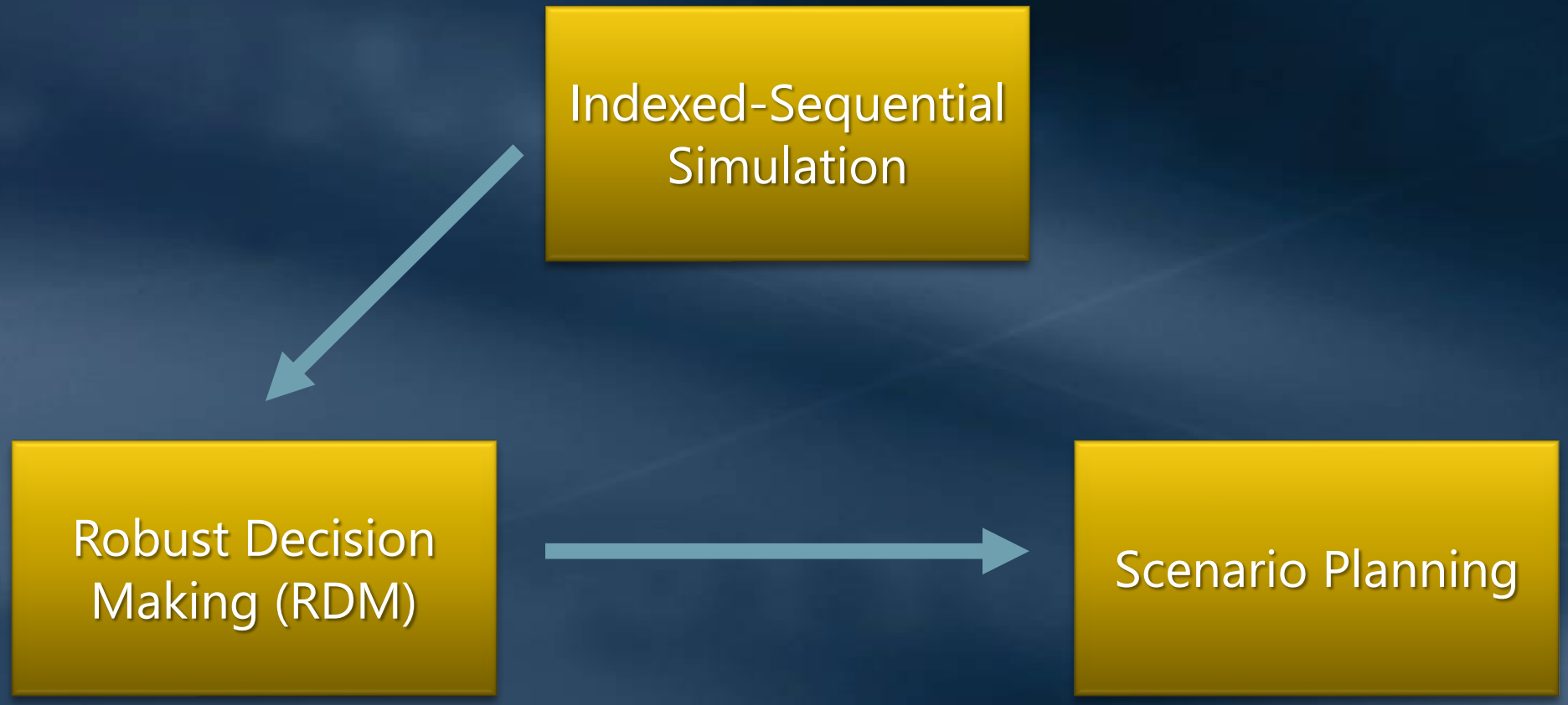
These pictures were all taken in California in the last 3 years





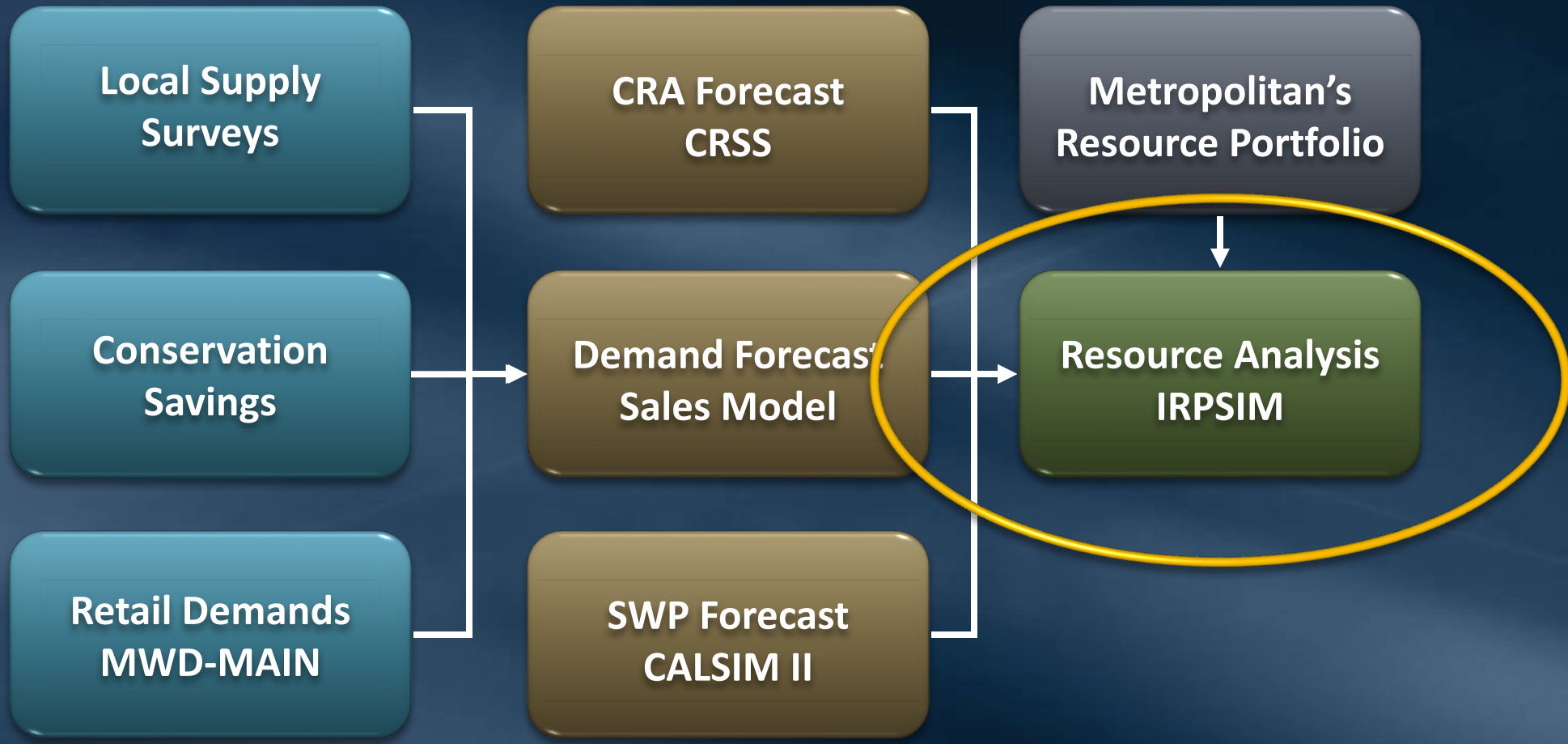
Evolution of Uncertainty Planning for MWD

Modeling and Analytical Approaches



Building the Foundation with IRPSIM

Metropolitan's Planning Models



IRPSIM Simulation Model for MWD

- Inputs
  - 30 Supply Sources and Programs
  - 10 Demand Categories
  - 20 Storage and Transfer Programs
  - 1000+ Supporting Variables
  - 24 Operational Stages
- Outputs
  - 50 Year Simulation
  - 83 Hydrologic Traces

50 Years x 83 Traces x 1000 Variables x 24 Stages

≈ 100 Million Calculations

Simulation Run Time… 8 seconds !

Expanding Uncertainty Planning with RDM

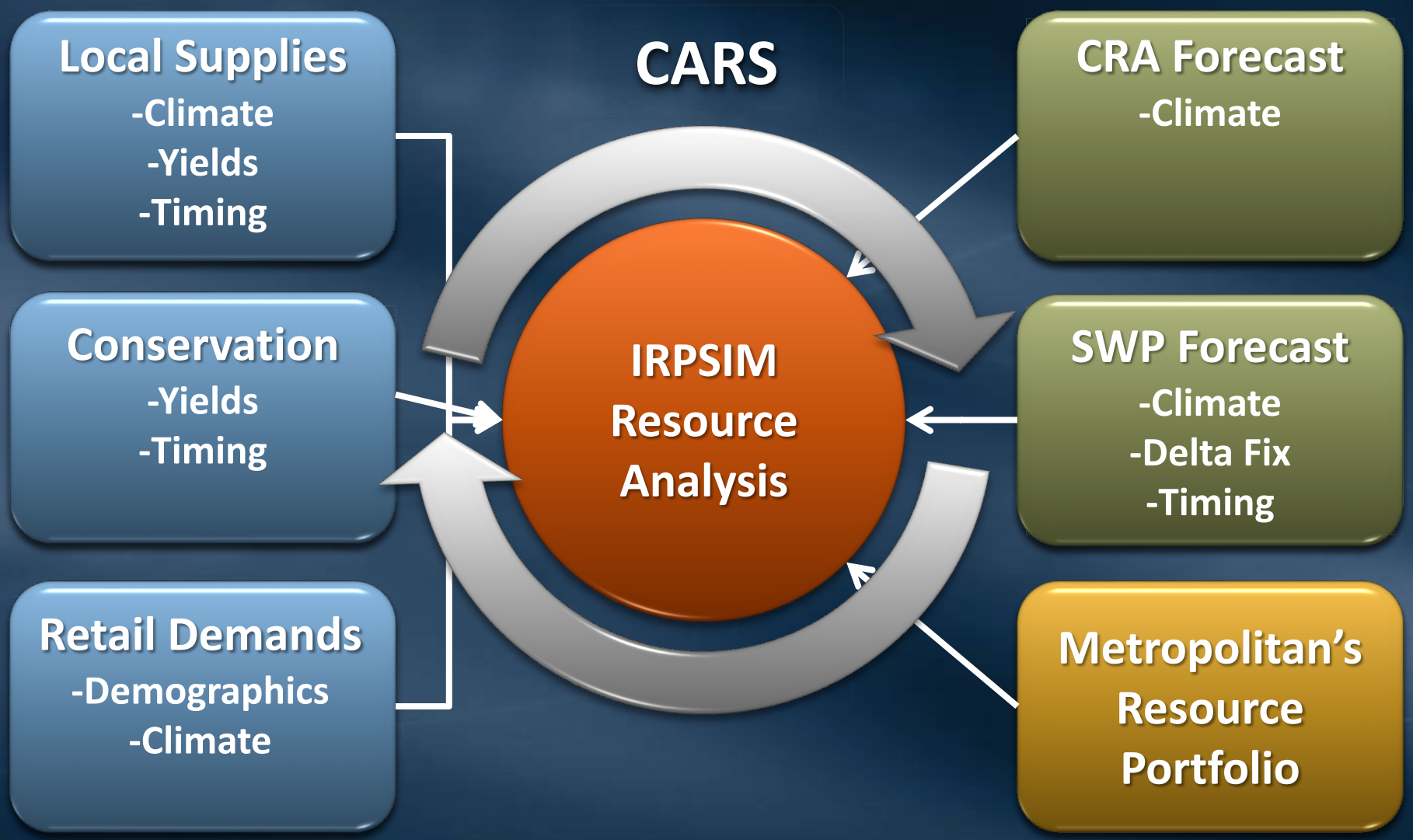
Defining Future Uncertainties for RDM

The Experimental Design

Factor	Range of Uncertainty
Demographic Changes	4 Scenarios: Balanced Growth, Baseline Growth, Periurban Growth, High Growth
Climate Conditions	12 Climate Scenarios: 6 GCMs x 2 Emissions Scenarios used by IPCC
Bay-Delta Conditions	3 Scenarios: No Delta Fix, Partial Delta Fix, Full Delta Fix
Local Resource Yields	±20% Variation in Groundwater, Recycling, Groundwater Recovery, Conservation
Project Implementation Timing	Delays: 0-10 years Desalination & Recycling, 0-20 years Conservation, 0-30 years Delta Fix

Incorporating Uncertainty In RDM

Using an Existing Model Framework



RDM Analytical Approach

- Analyzed +6,900 combinations of uncertainty
- Used Rand's "Scenario Discovery" to identify where IRP Resource Plan failed to be reliable:
  - Net Surplus/Shortage Balance
  - Total Storage Levels
- Used statistical methods to identify and determine common areas of vulnerability

Moving to Scenario Planning

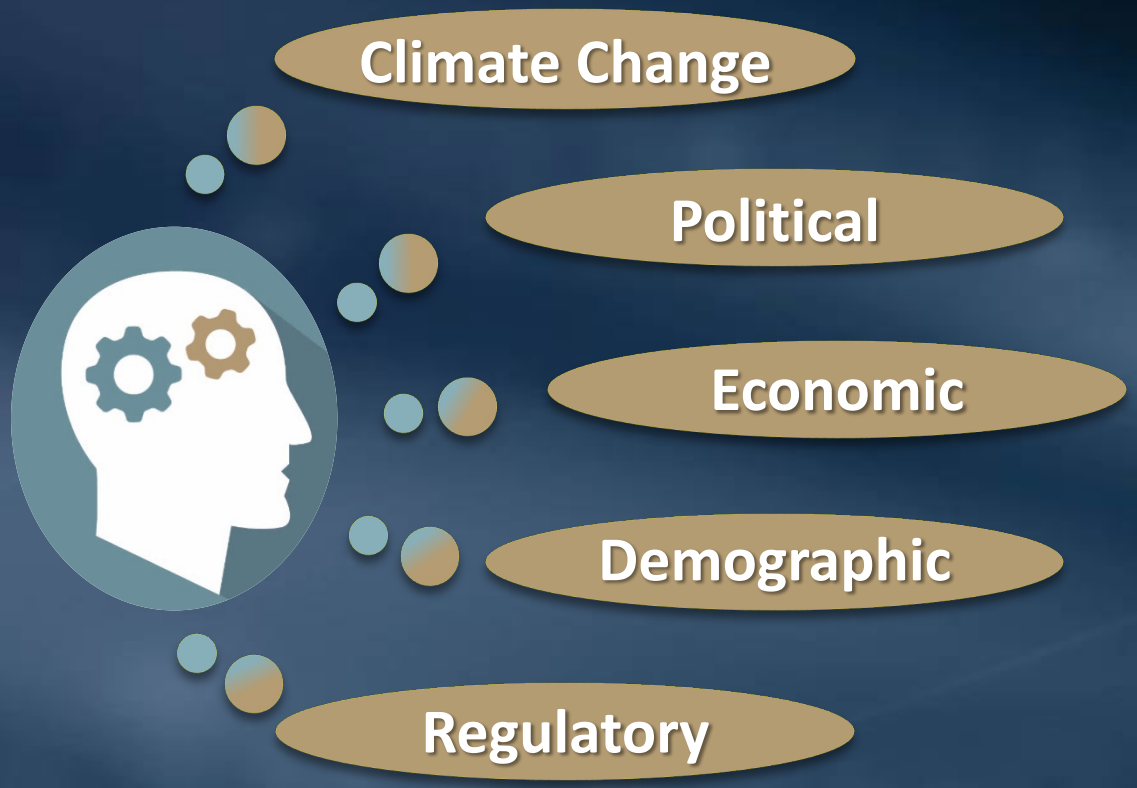
2020 IRP- Scenario Planning Approach

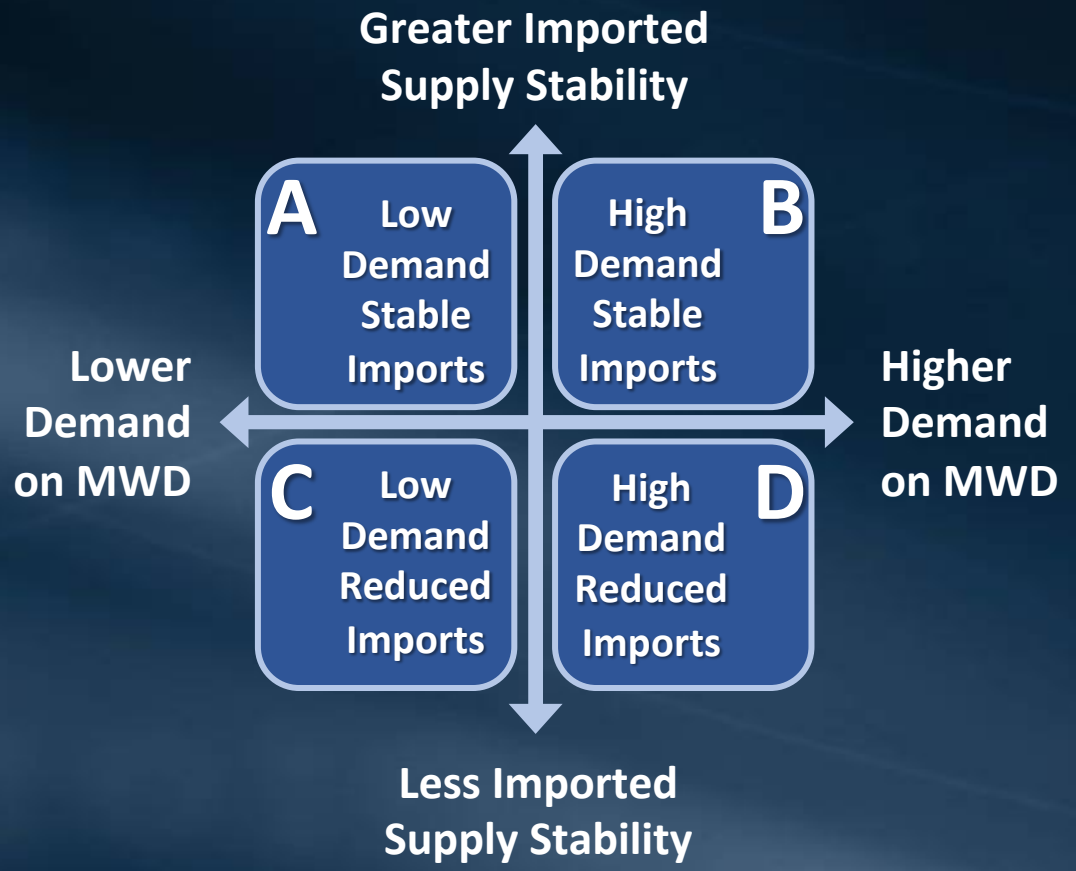
- While RDM is more comprehensive it is difficult to explain the multitude of “what if” outputs. Scenario Planning is clearer and more transparent
- Key potential vulnerabilities and “Drivers of Change” were identified in an extensive stakeholder/public process
- Regarding Climate Change Uncertainty, MWD engaged an expert panel to identify ranges of uncertainty used to define the scenarios included in the IRP
  - Incorporated either a moderate or severe climate change future into the modeling framework for supply and demand

Incorporating Ranges of Uncertainty

Driver	Lower Impact	Higher Impact
Climate Change	Gradual rise in temperatures and erratic precipitation	Rapidly rising temperatures and erratic precipitation
Legislative and Regulatory	Modest constraints	Severe constraints
Demographics	Sluggish economy, moderate population growth and strong water use ethic	Economy and population strong and water use ethic decreases

Combining Ranges of Uncertainty into Scenarios





Brainstormed Drivers of Change: *Conducted surveys and workshops, and collaborated with MWD Board, member agency staff, climate and demand experts, and other interested parties*

Stepping through the Analytical Framework

1. Quantify driver/uncertainty impacts on supply and demand for each scenario

2. Conduct “gap analysis” to show magnitude and frequency of shortages through 2045 for each scenario

3. Identify actions to minimize supply/demand gap and maintain reliability for each scenario

Lessons Learned - Moving Forward

- Balancing communication and transparency while maintaining analytic rigor is important
- Complex approaches and findings are challenging to communicate and gain understanding
- RDM vs Scenario Planning
  - RDM is more technically complex
  - Scenario Planning is more transparent and helped to increase collective understanding of uncertainties and vulnerabilities