FYI in 45

Better Water Planning for a Prosperous Future

Panelists:
Dan Rodrigo
Andria Loutsch

Moderated by:
Andrew Beaton

May 9, 2018

CDM Smith

Today's Discussion

- Why does traditional water planning fail when "disruption points" occur in the future?
- How can we account for the full range of uncertainties in water planning, and overcome them successfully?
- Why is scenario planning a better technique for water planning, and how does it work?
- What tools are available for faster, more comprehensive forecast simulations to address future unknowns?

Our Panel

Dan Rodrigo
Senior Vice President, Technical Specialist

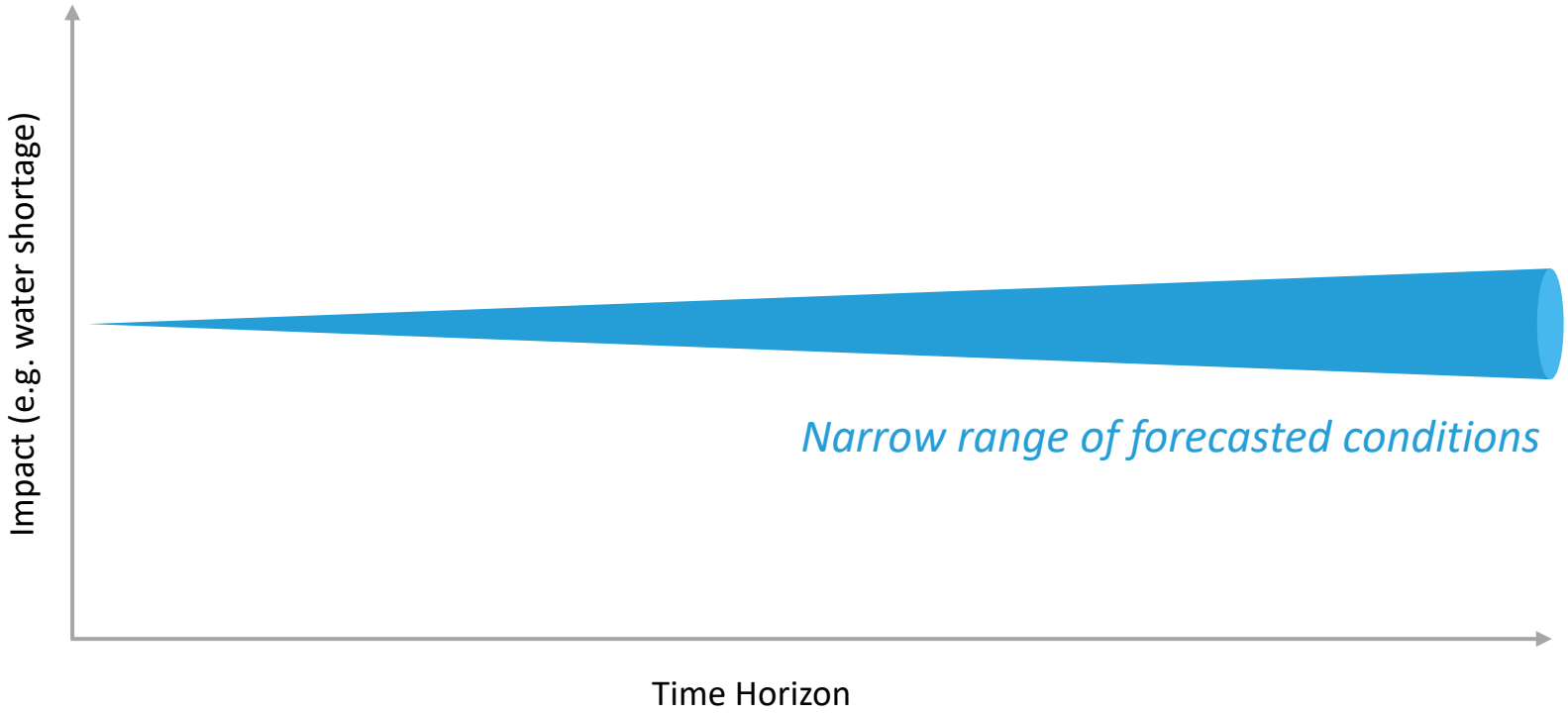
Andria Loutsch
Principal Water Resources Planner

What's Missing from Traditional Water Planning?

Why Do We Need Better Planning?

- As utility managers, you have to plan for the future
- But we all know the future is uncertain
- Given the time and expense to plan for critical infrastructure, it is essential to account for uncertainty

Current Water Planning Paradigm



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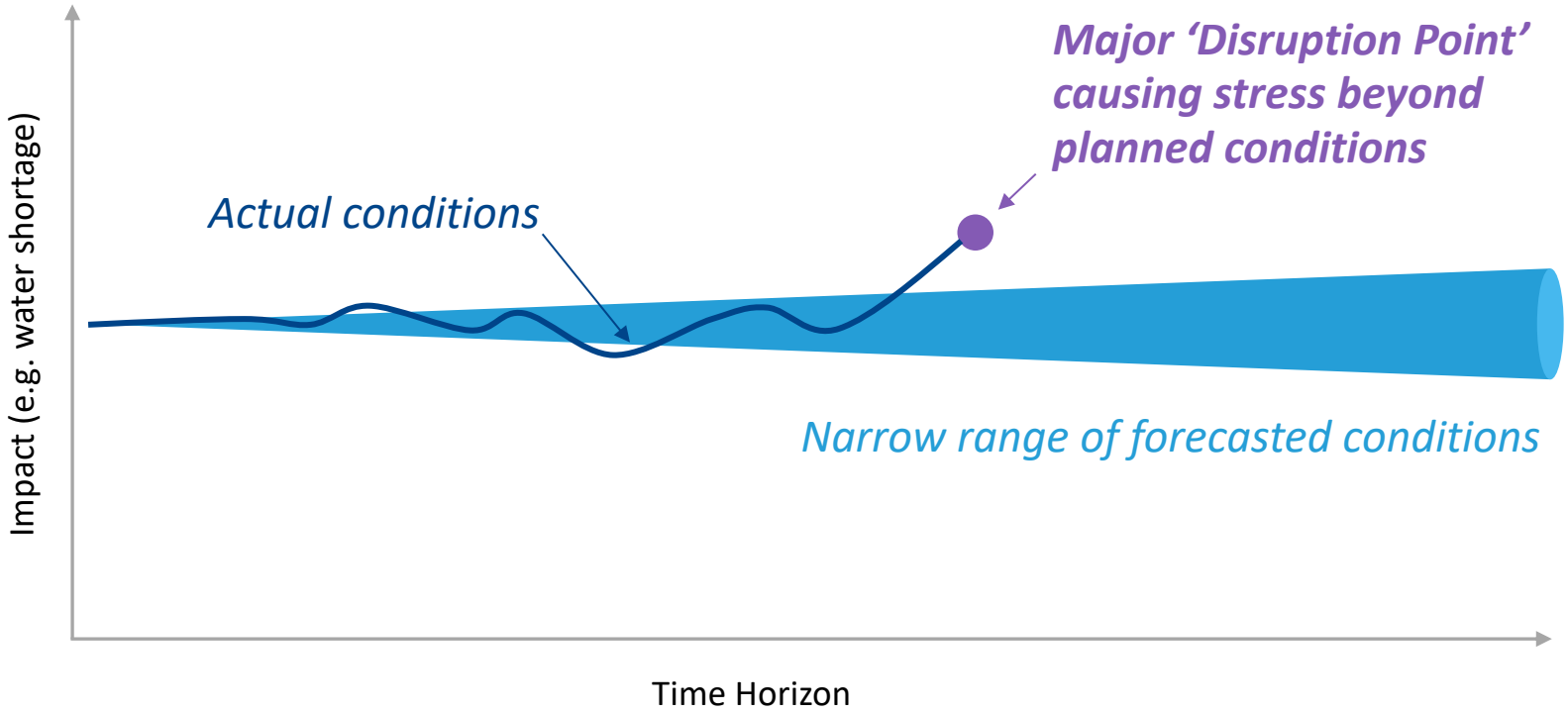
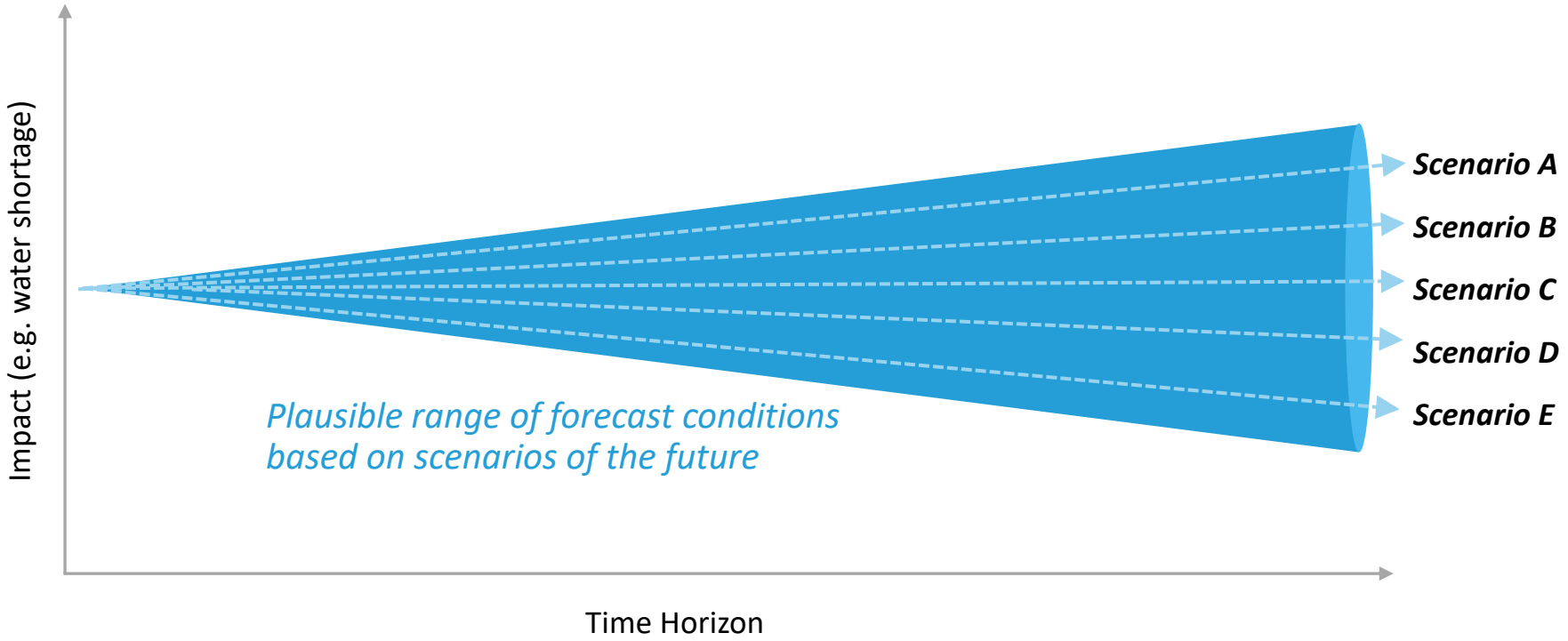


Scenario Planning



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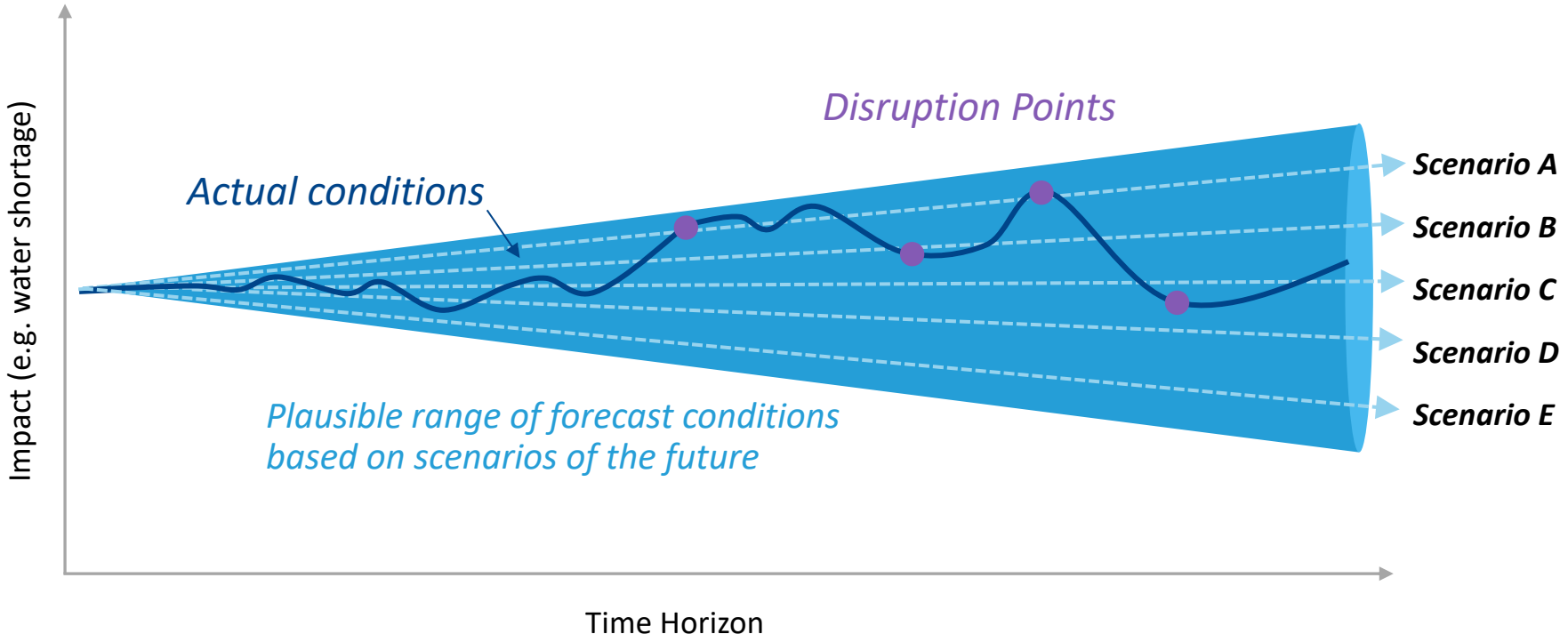
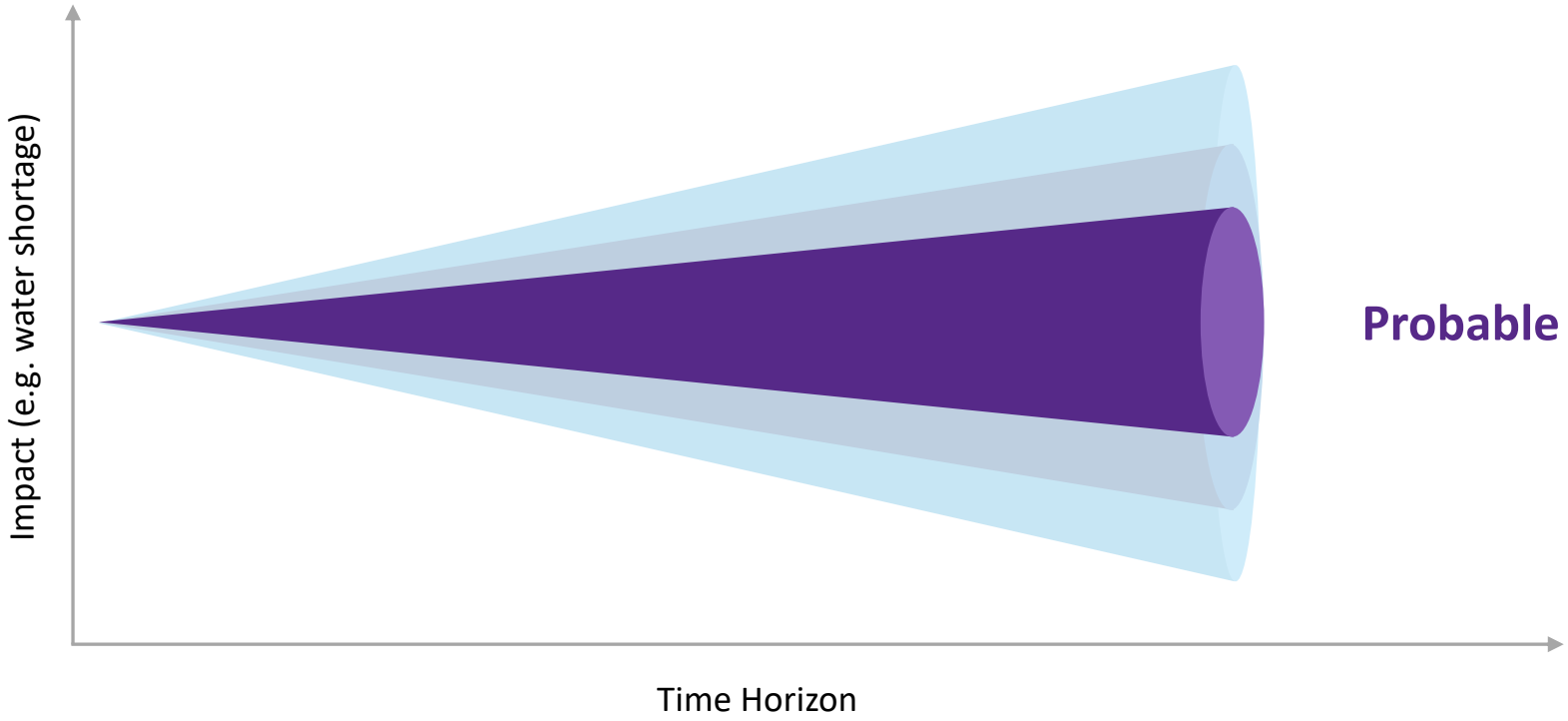


Scenario Planning in Practice



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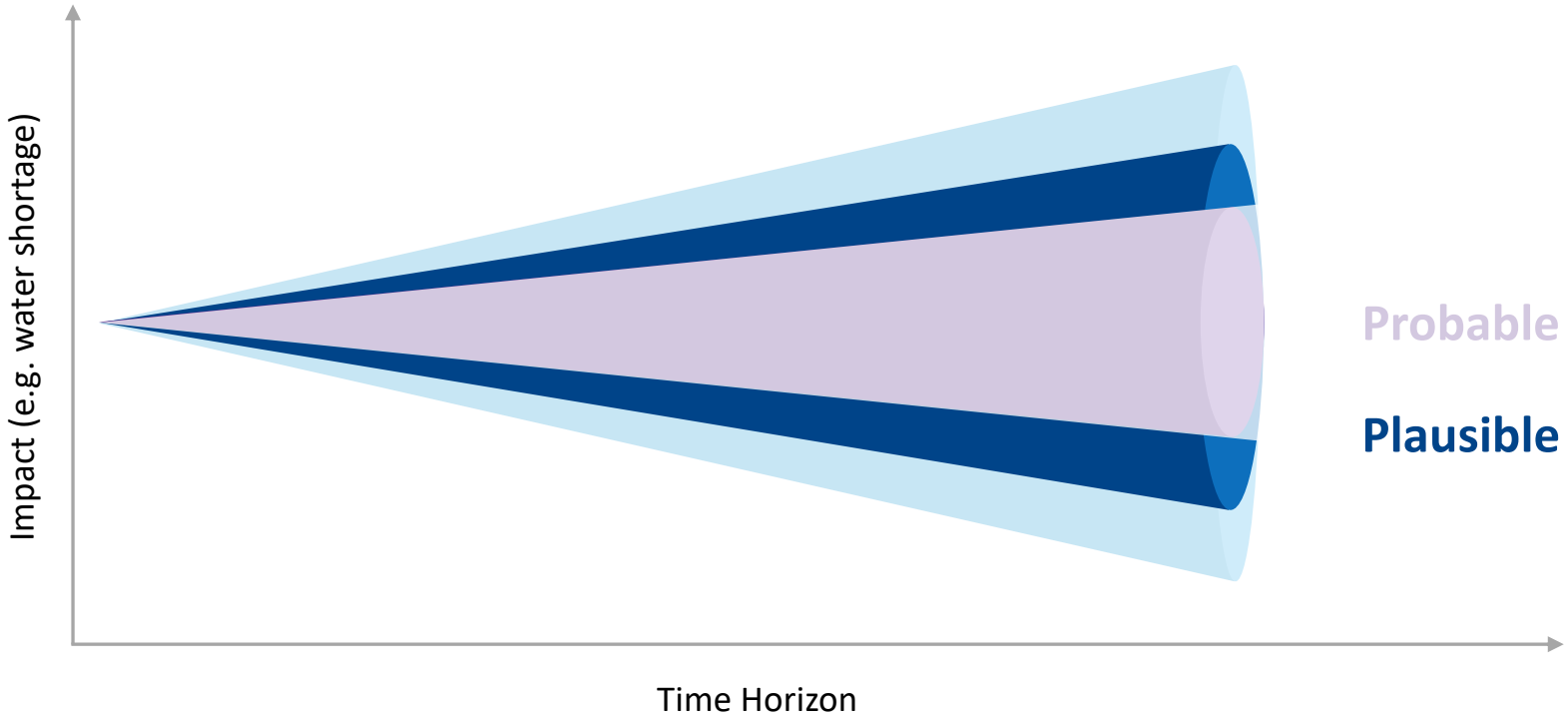

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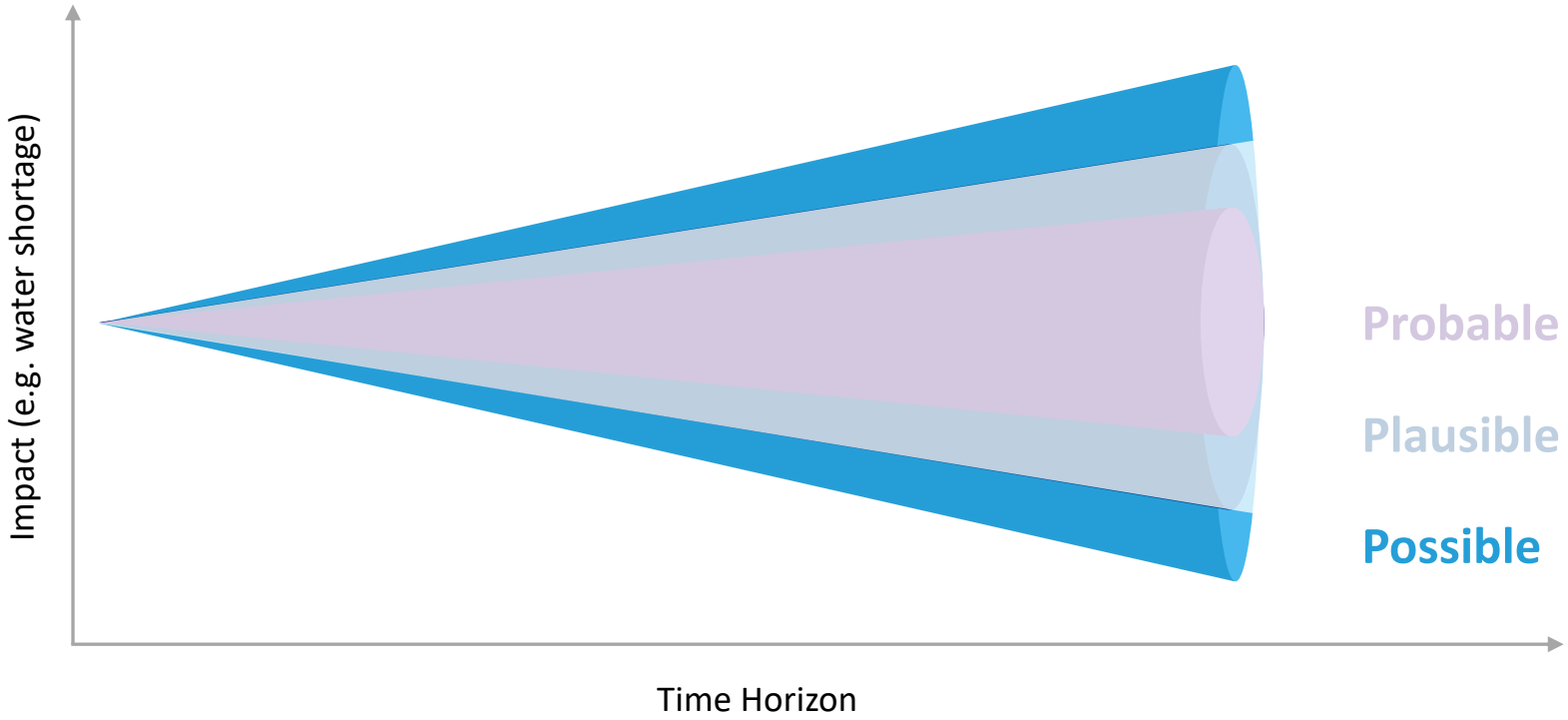


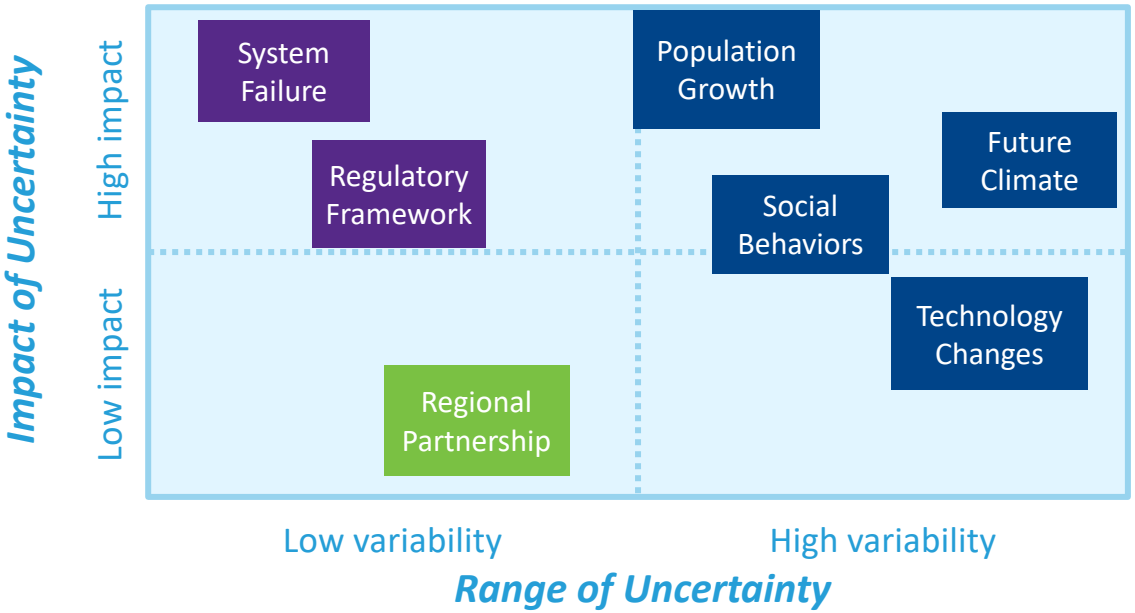
The Five Steps of Scenario Planning

STEP 1

Assess Major Uncertainties

STEP 2

Select Most Important Uncertainties



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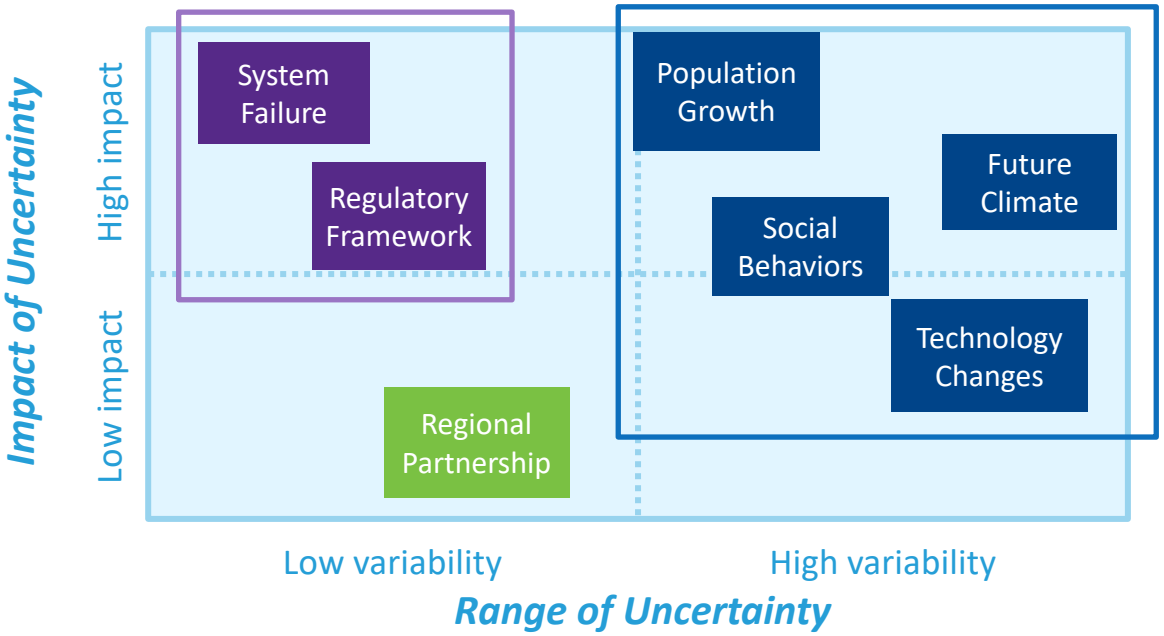

- Uncertainties that should be included in baseline conditions
- Uncertainties that should form basis for future scenarios

STEP 3

Develop Scenario Narratives

Scenario Name	Population Growth	Development Density	Future Climate	Social Behaviors	Regulatory Framework

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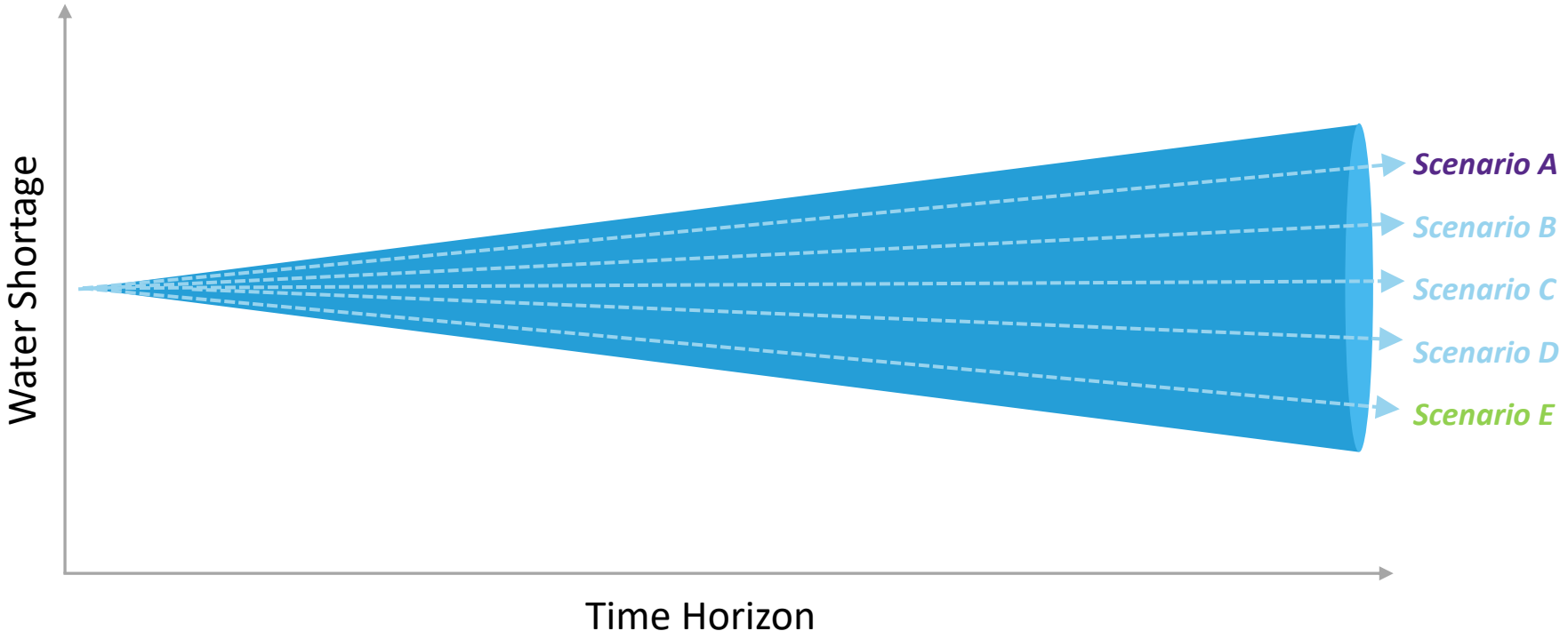
Adaptive Innovation	High	High	Hot/dry	More favorable sustainability attitudes	Adaptive

STEP 4

Analyze Impact of Scenarios



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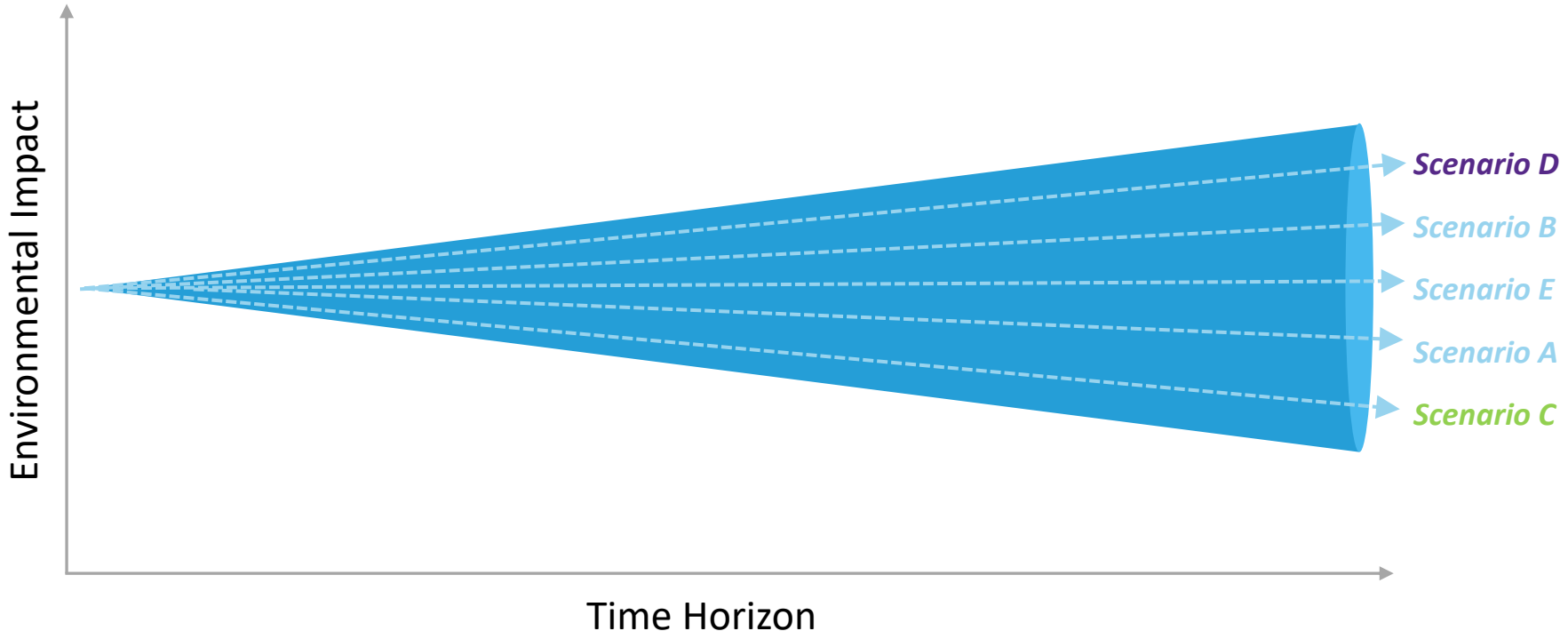


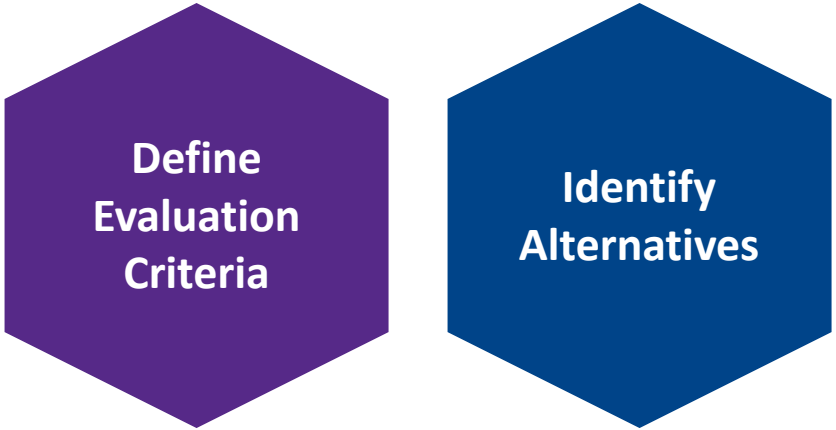
STEP 5

Test Alternatives

Define Evaluation Criteria

STEP 5

Test Alternatives



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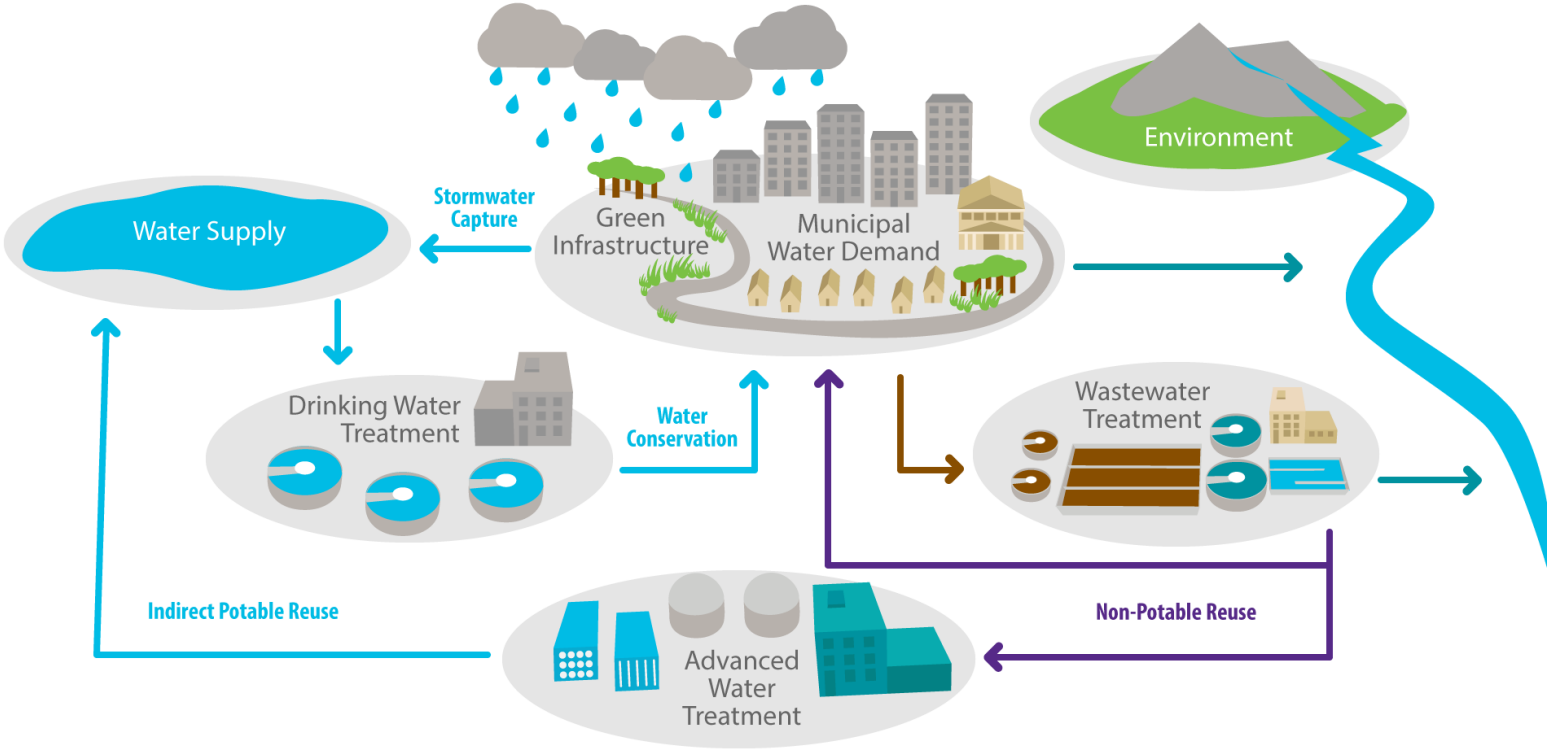
Tools Used in Scenario Planning

Integrated Perspective



Traditional Models vs Systems Models

Traditional Water Planning Models

- Single-focused in capability (e.g., water distribution, or groundwater)
- Output limited to flows, or sometimes flow and cost
- Typically not user friendly
- Runtimes are longer, interim results not possible, and not well-suited for rapid testing of scenarios

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Systems Planning Models

- Simulates multiple systems (water, wastewater, stormwater) at same time
- Can output metrics on flows, water quality, cost, and energy
- User friendly, menu-driven
- Runtimes are seconds and minutes for monthly simulations, allowing for rapid testing of scenarios

Variety of Systems Models Readily Available

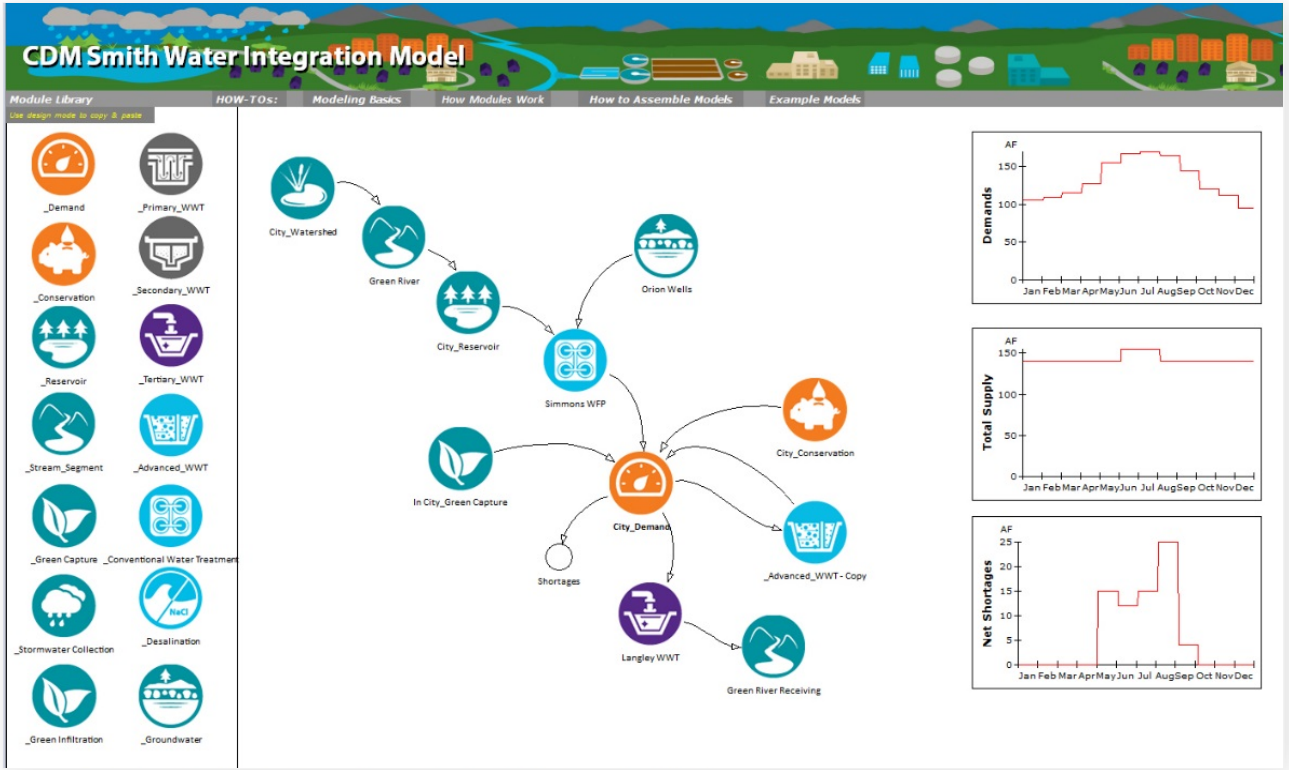
STELLA

WEAP

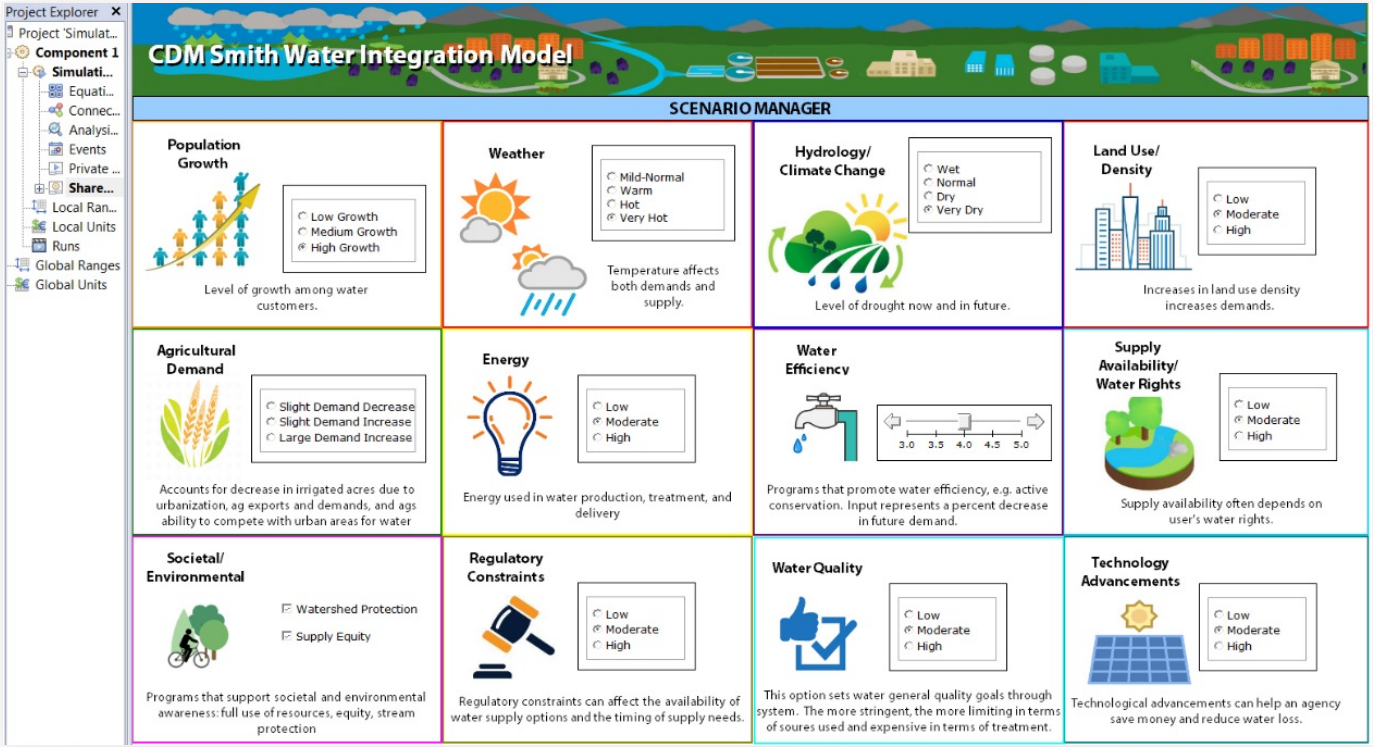
GoldSim
TECHNOLOGY GROUP

Powersim
SOFTWARE

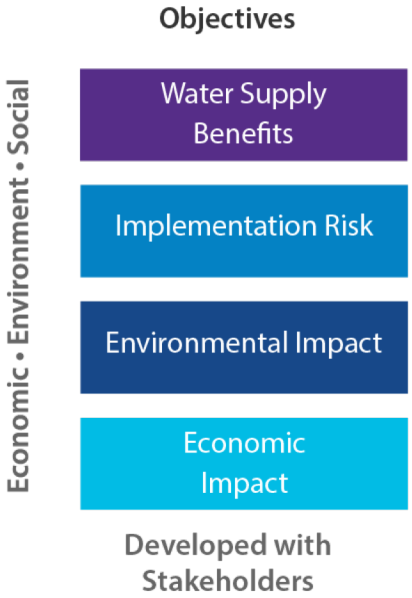
Systems Models: More Intuitive Programming



Systems Model: User Friendly Interface



Multi-Criteria Decision Analysis (MCDA)



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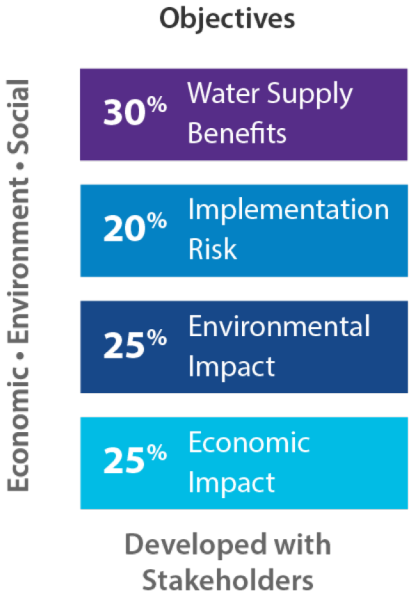

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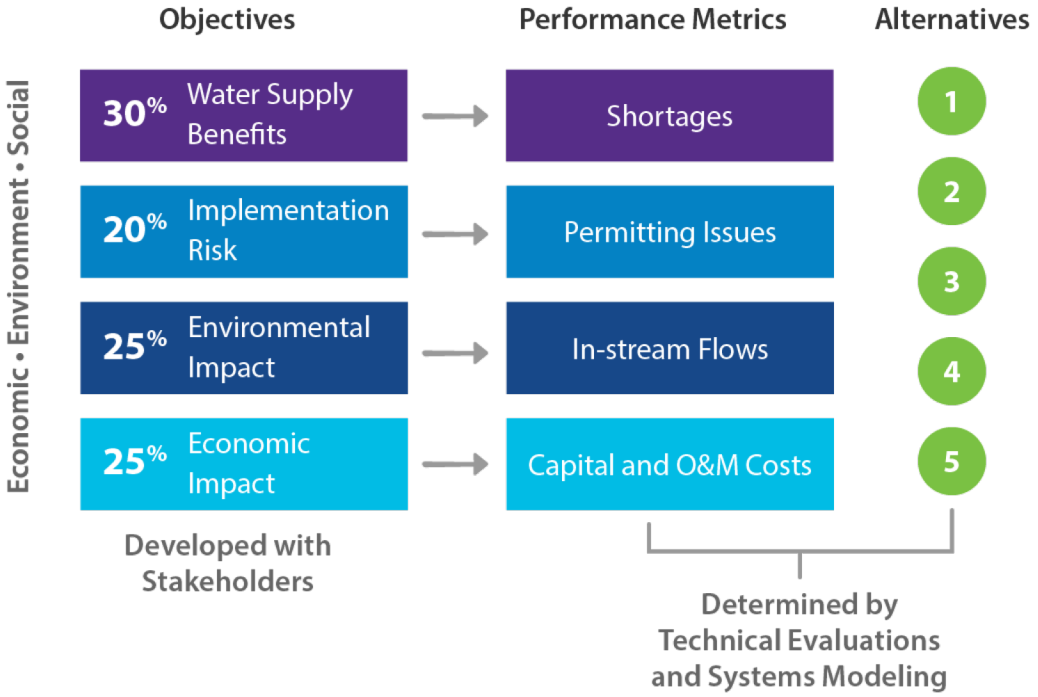

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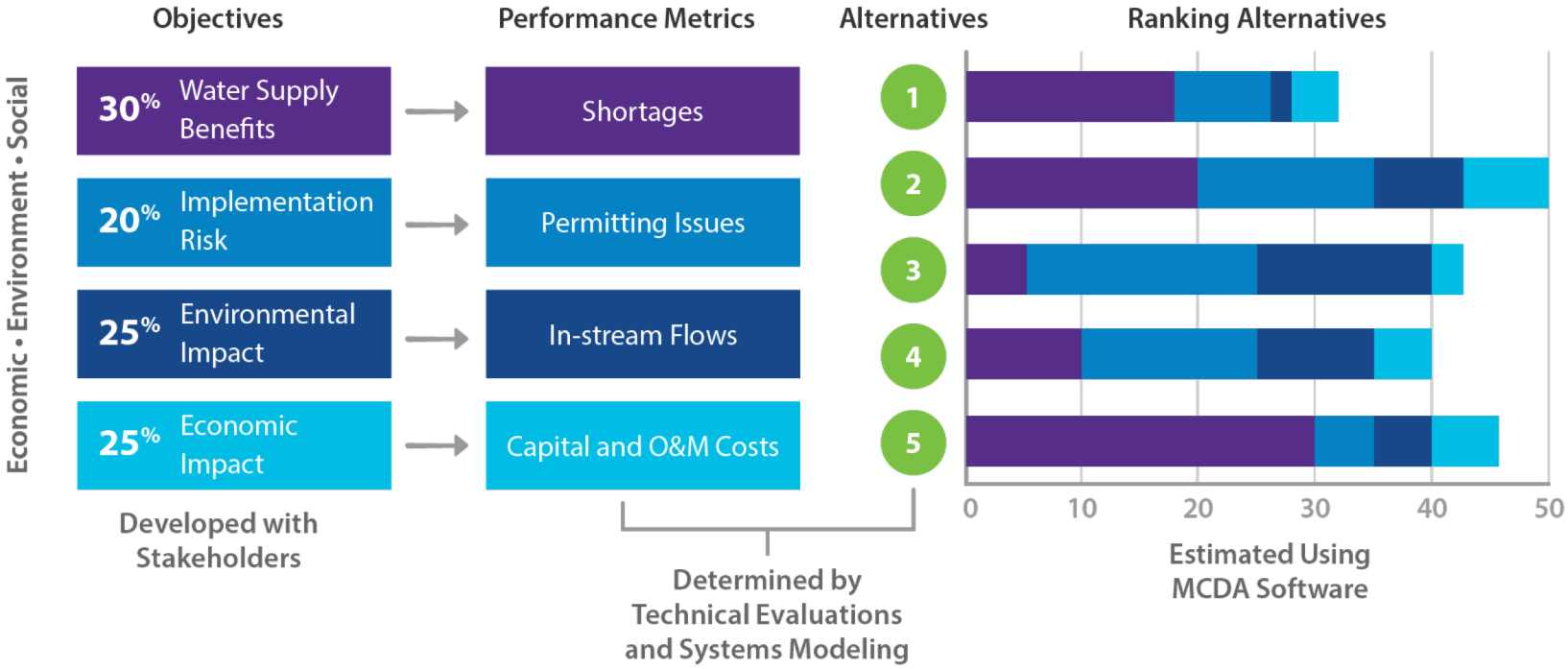


CASE STUDY

Metro Vancouver

Comprehensive Water System Plan

Comprehensive Regional Water System Plan

MV Overview

- Federation comprised of 23 local government jurisdictions
- Provides regional planning and serves as regional provider of water and wastewater services
- Current population 2.5 million
- All water supplied from 3 main surface reservoirs

Challenges

- Fast-growing service area
- Climate change is reducing snowpack and changing monthly patterns of inflows to surface reservoirs
- Area is at risk to large seismic events
- Uncertainties in growth, future climate and technologies

Comprehensive Regional Water System Plan

Purpose of Plan

- Forecast water demands
- Conceptualize water supply alternatives
- Define planning scenarios to account for uncertainties, such as climate, growth, regulations
- Conduct resiliency assessment for droughts, flooding and seismic risks
- Evaluate and rank alternatives against multiple criteria and planning scenarios
- Develop an adaptive strategy for investments for the next 100 years

Planning Scenarios

Planning Scenarios

Limited Stressed Conditions

Regional Growth	10% lower-than-baseline projection
Future Climate	Warmer annual temperatures, less summer precipitation
Technology/Regulations	Moderate implementation of residential water metering
Water Use Efficiency	Current Levels
Drought Actions	Target Level 3 restrictions in water use no more than 1 in 20 years

Planning Scenarios

Moderately Stressed Conditions

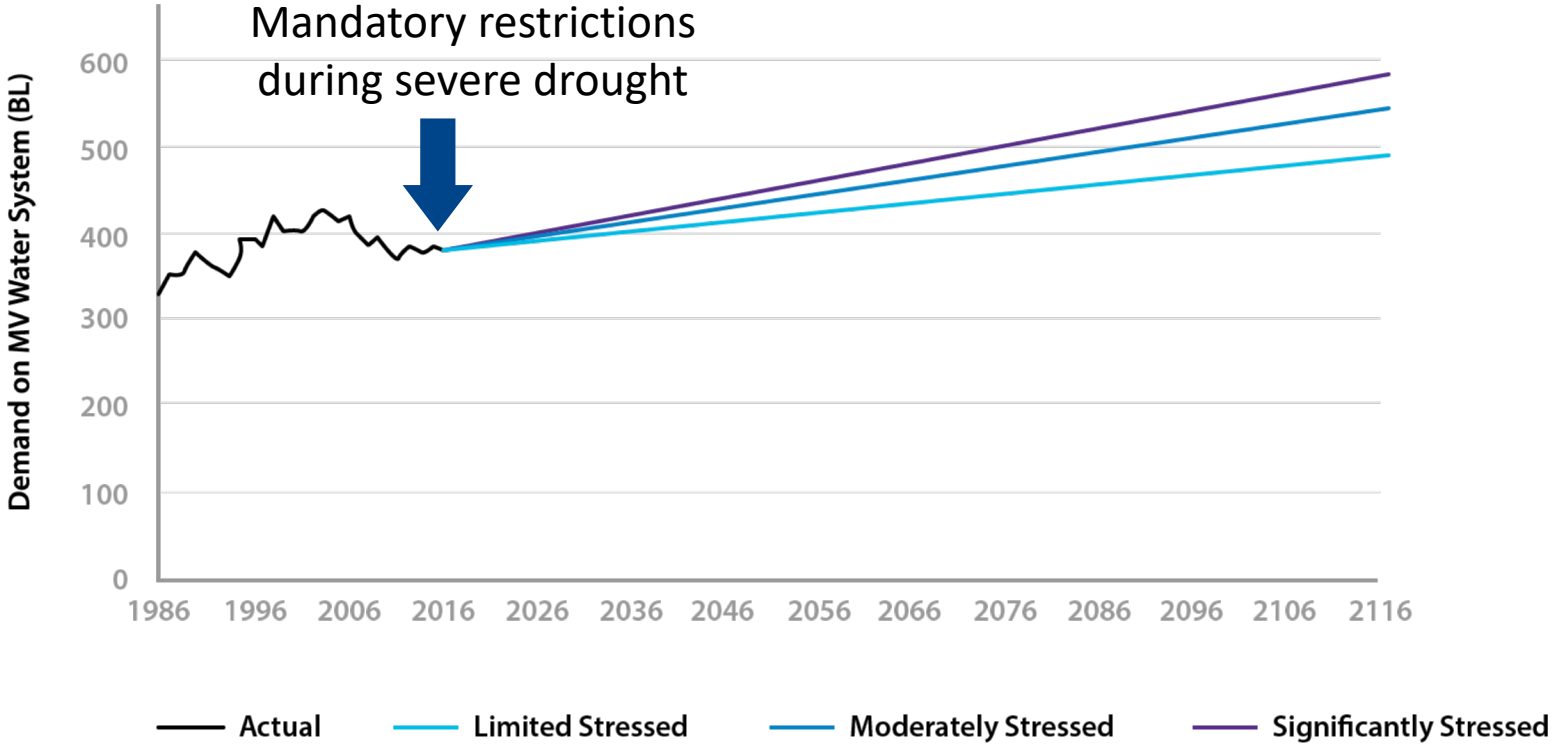
Regional Growth	Baseline Projection
Future Climate	Hotter annual temperatures, dry summer precipitation
Technology/Regulations	Moderate implementation of residential water metering
Water Use Efficiency	Moderate Levels
Drought Actions	Target Level 3 restrictions in water use no more than 1 in 20 years

Planning Scenarios

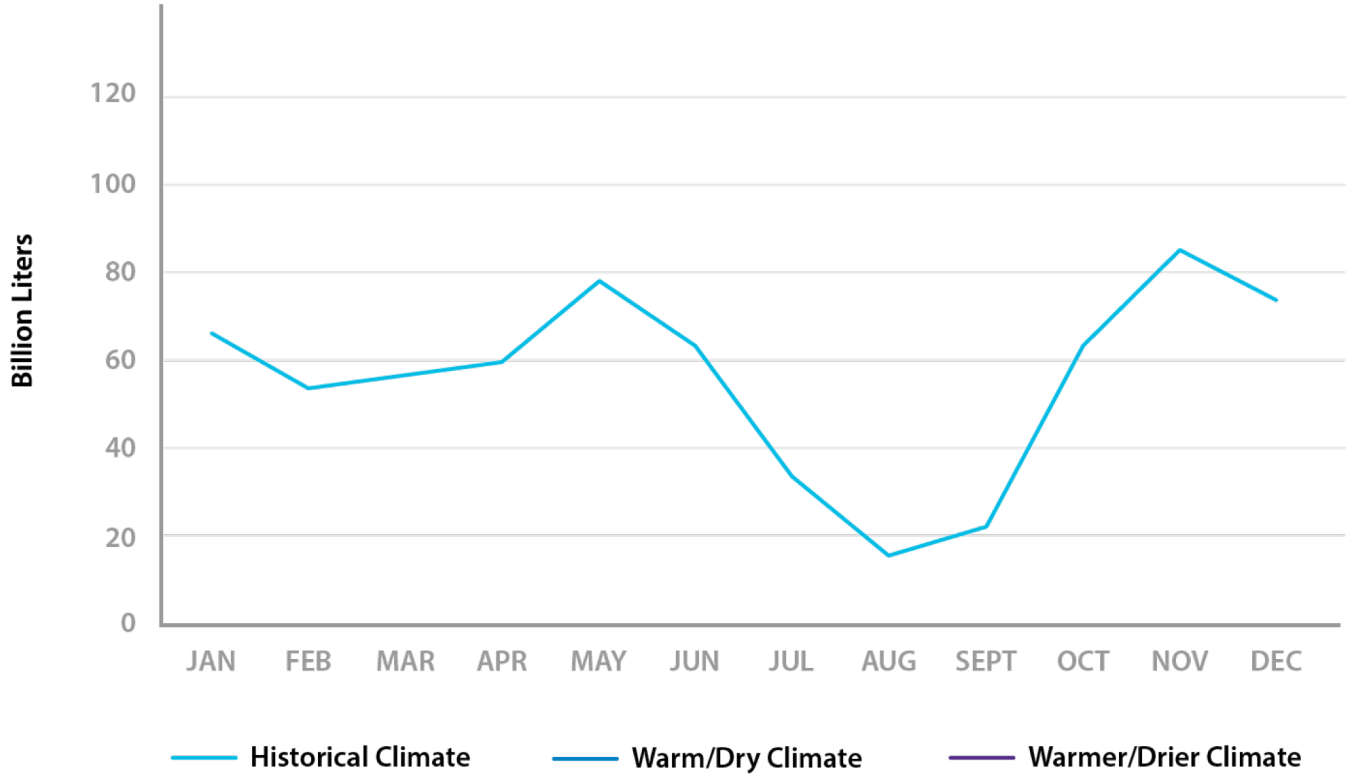
Significantly Stressed Conditions

Regional Growth	15% greater-than-baseline, Plus expansion of service area
Future Climate	Hotter annual temperatures, dry summer precipitation
Technology/Regulations	Accelerated implementation of residential water metering
Water Use Efficiency	Highest Levels
Drought Actions	Target Level 3 restrictions in water use no more than 1 in 15 years

Water Demand Forecast Under Demographic Scenarios



Supply Reservoir Inflows Under Climate Scenarios



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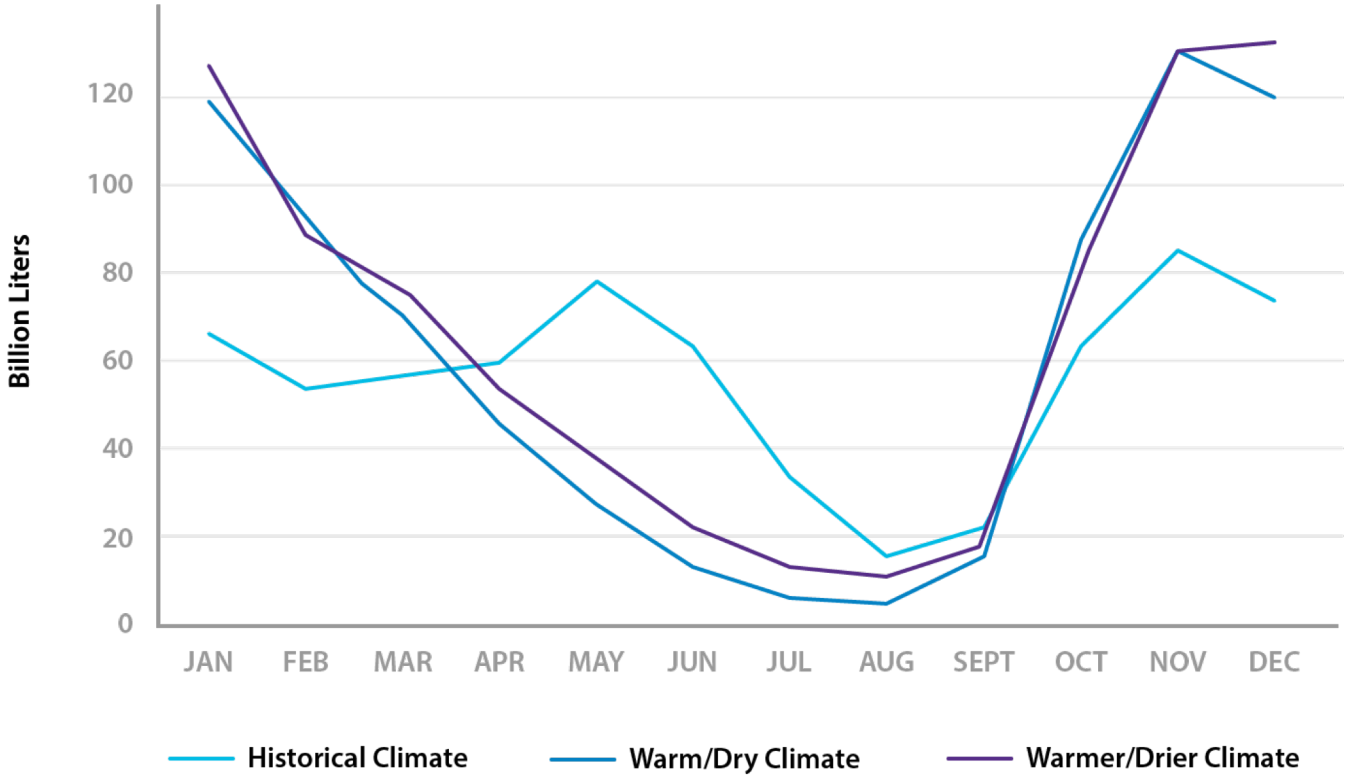

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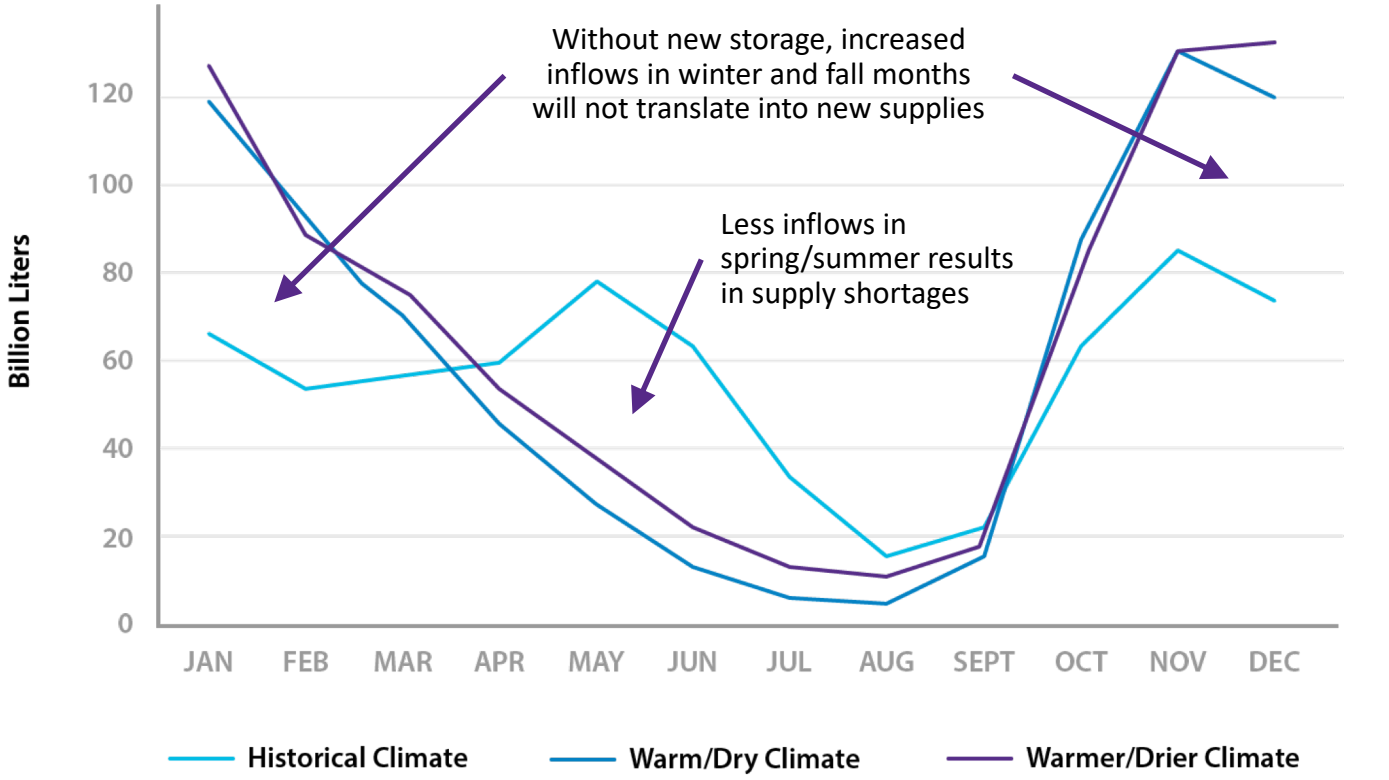
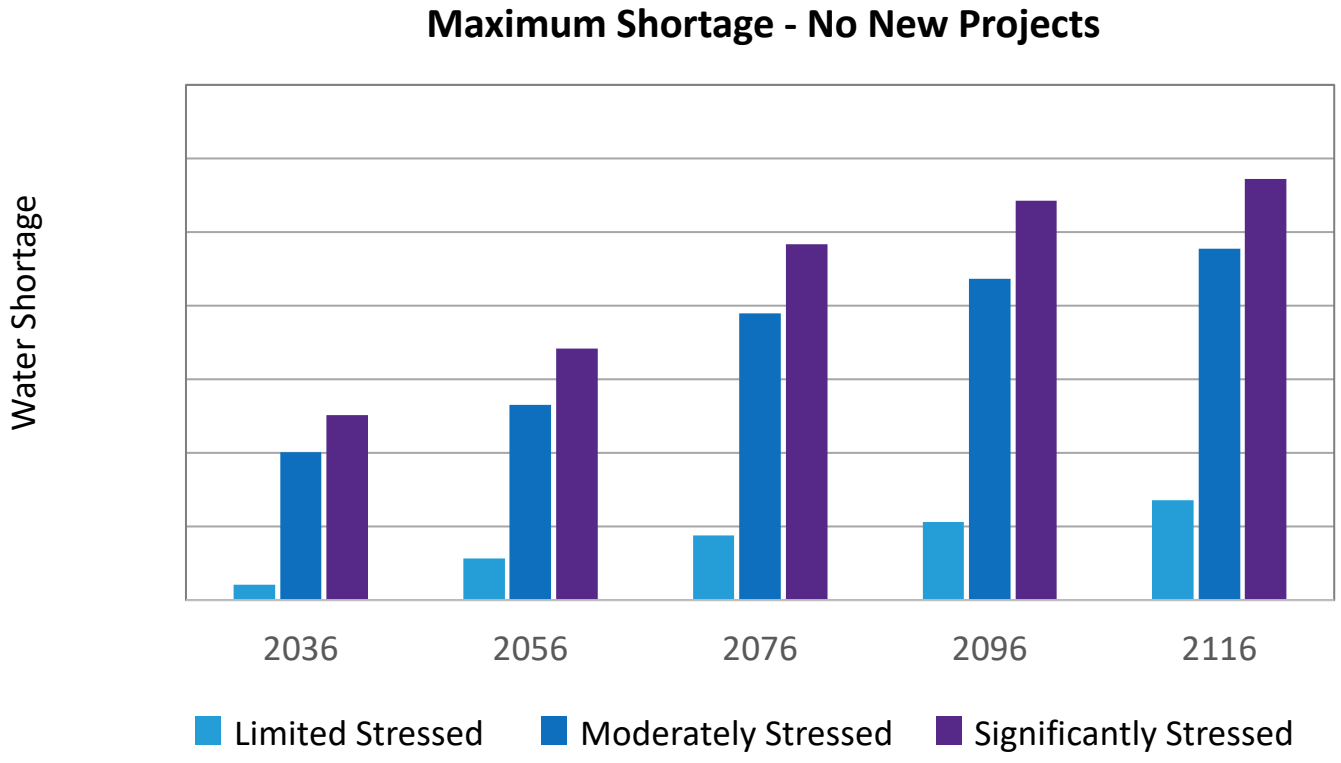


Water Supply Gap Under Planning Scenarios



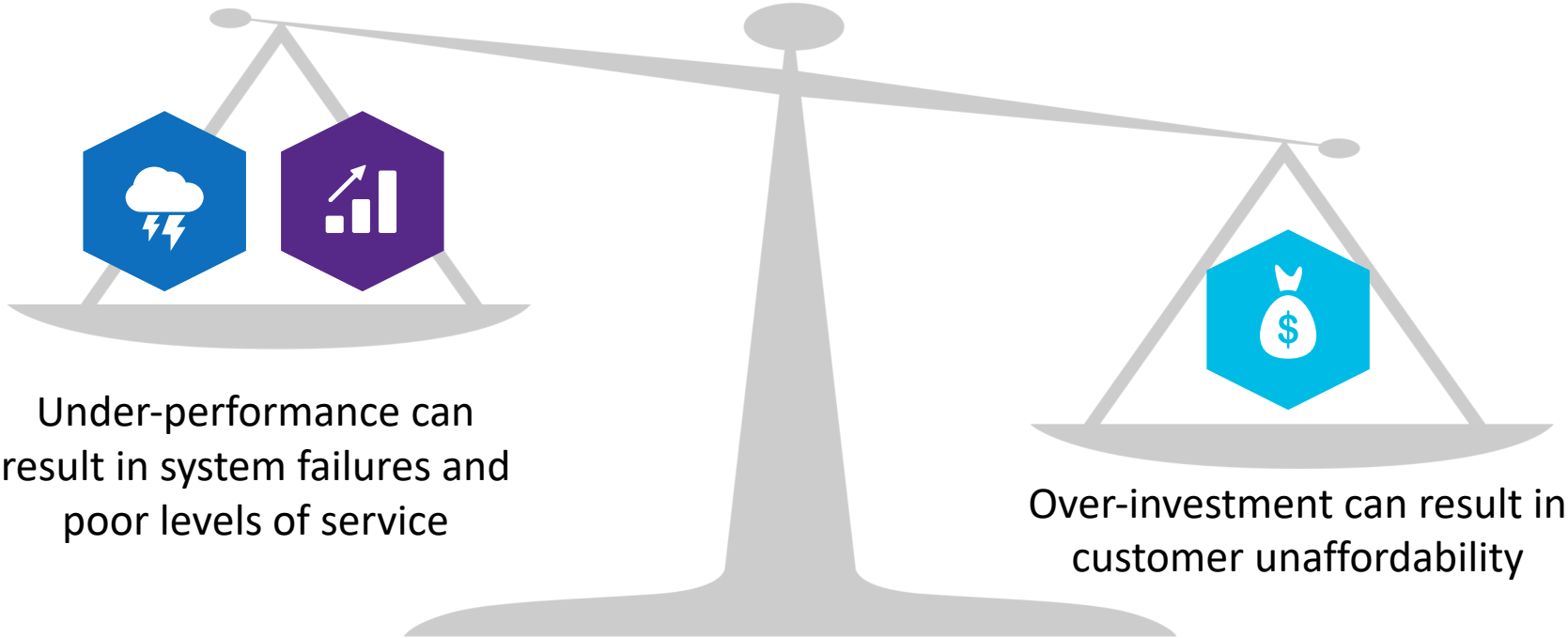
Summary of Feasible Water Supply Options

Supply Option	Maximum Annual Supply	Resiliency Score*	Unit Cost ($M/BL)	Implementation Score**
New Upper Watershed Dam 1	Large	3	$2.5	4
New Upper Watershed Dam 2	Small	3	$2.3	4
New Lower Watershed Dam	Medium	4	$2.7	2
Raise Existing Dam	Large	4	$2.2	5
Lake Intake – Large Project	Large	5	$3.9	3
Lake Intake – Small Project	Medium	4	$6.1	4
River Intake	Large	4	$4.4	2
Out of Region Lake Intake	Large	2	$7.2	1

* Qualitative score from 1 to 5 (with 5 being best score) that measures resiliency against extreme climate, forest fires, seismic events and water quality degradation.
** Score from 1 to 5 (with 5 being best score) that measures implementation challenges such as permitting, land acquisition, public support, impacts to recreation


Where We Go From Here

Balancing Under-Performance & Over-Investment

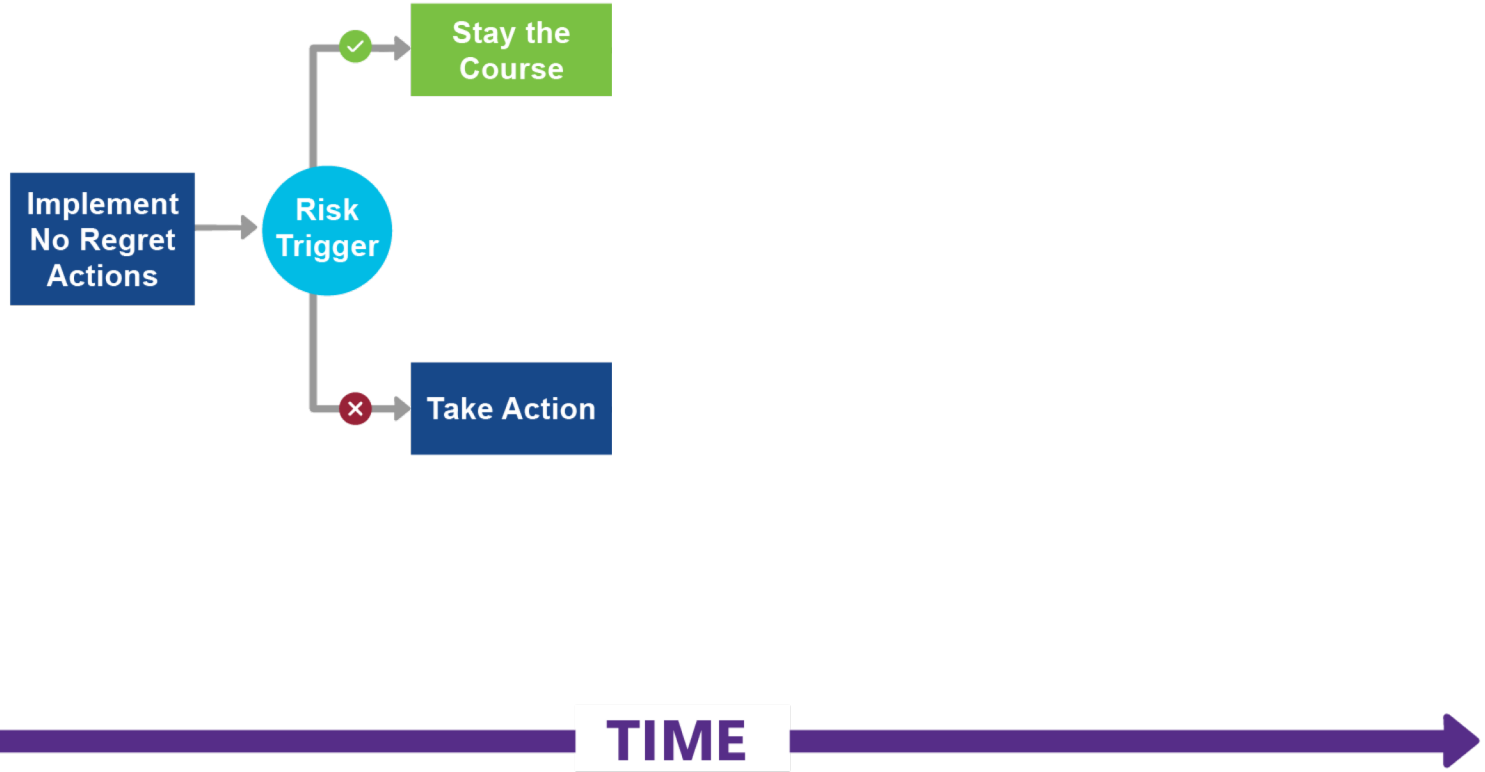


Under-performance can result in system failures and poor levels of service

Over-investment can result in customer unaffordability

Adaptive Management

Adaptive Management



Adaptive Management

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Final Thoughts

Lessons Learned and Observations

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  - Understanding the plausible range of future outcomes that can impact water systems
  - Developing a long-term strategy to mitigate such impacts

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- Uncertainty should not be an excuse not to plan
- Scenario planning can be valuable in
  - Understanding the plausible range of future outcomes that can impact water systems
  - Developing a long-term strategy to mitigate such impacts
- Adaptive management allows for incrementally phasing investments


Questions & Answers

Contact Information

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Thank You