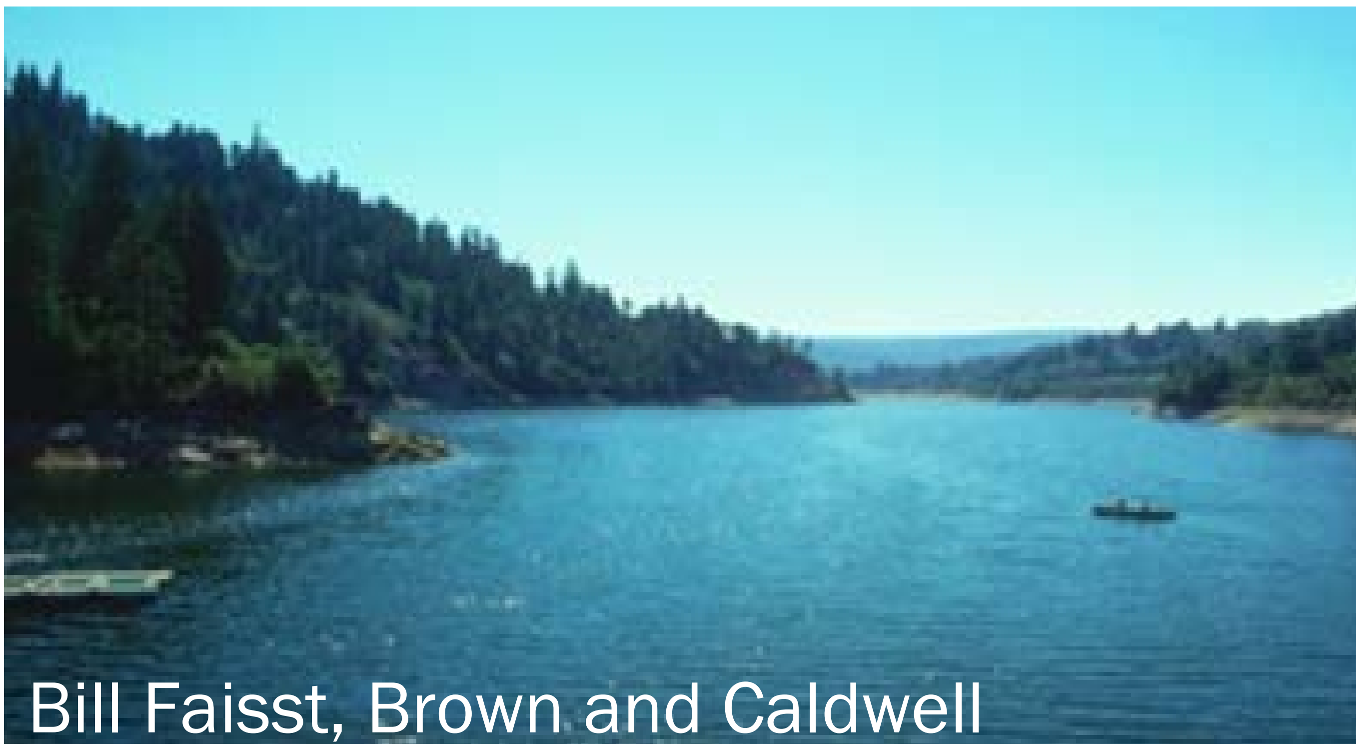
Brown AND Caldwell

Brown AND Caldwell

Santa Cruz, CA

Technical Update on the Water Supply Alternatives Committee Process

April 22 | 2015

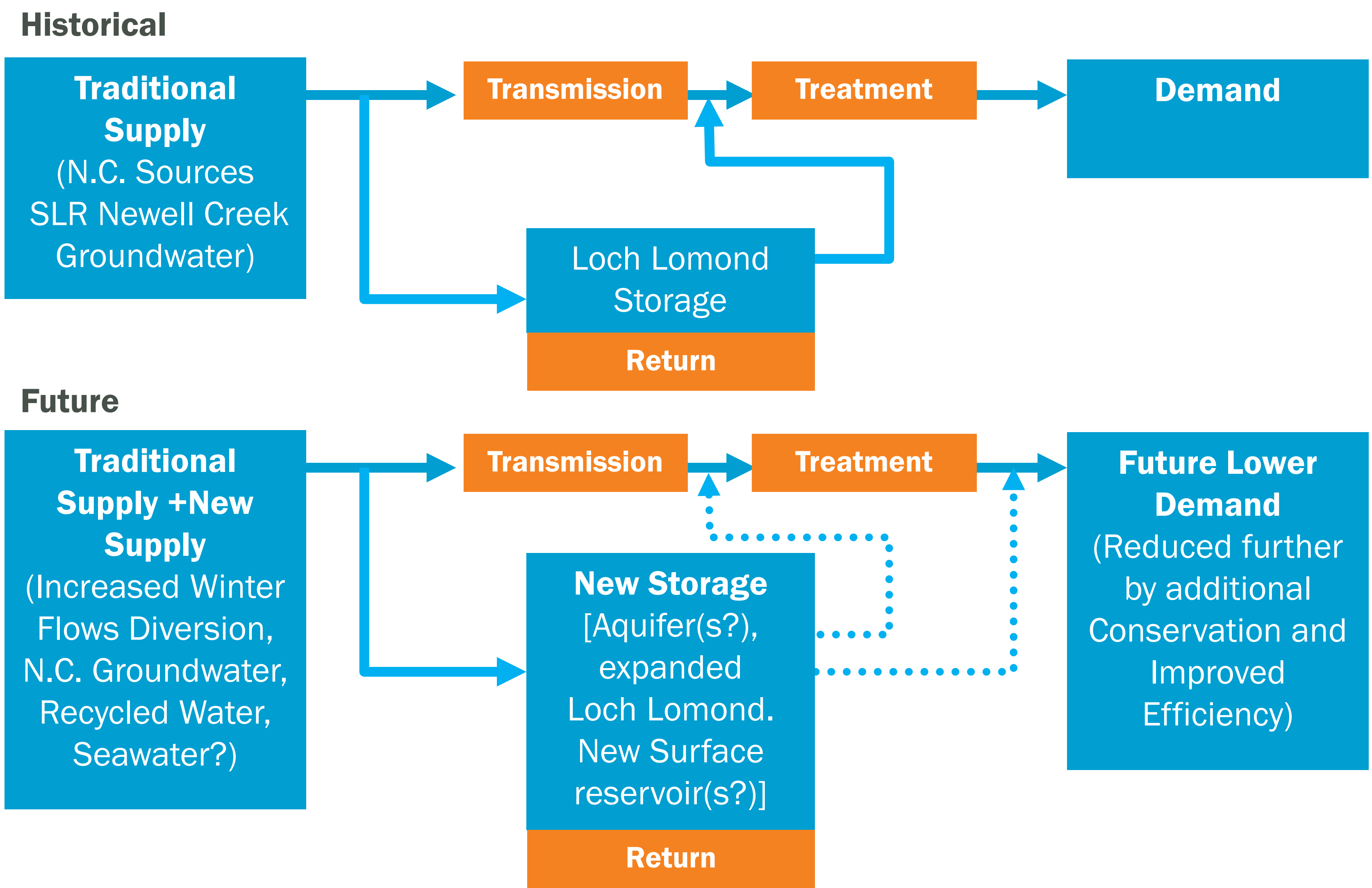


CITY OF SANTA CRUZ

Overview of Presentation

- Water supply overview
- Introduction of Consolidated Alternatives (CAs)
- Updated state of the work
- Review of CAs
- Current status of WSAC technical process

City of Santa Cruz Water Supply Flow Schematic



CA Formation Goals

- Capture range of high-level ideas from the community
- Balance need to have a manageable number of CAs
    - in terms of time, clarity, and resources

Process and State of the Work

- Compile full list of Water Convention Alternatives (WCAs) (update continuing)
- Group similar WCAs to reduce redundancy
- Capture full breadth of project types
- Clearly demonstrate what happened to each WCA

Typical Process and State of the Work—Example of Combining Steps

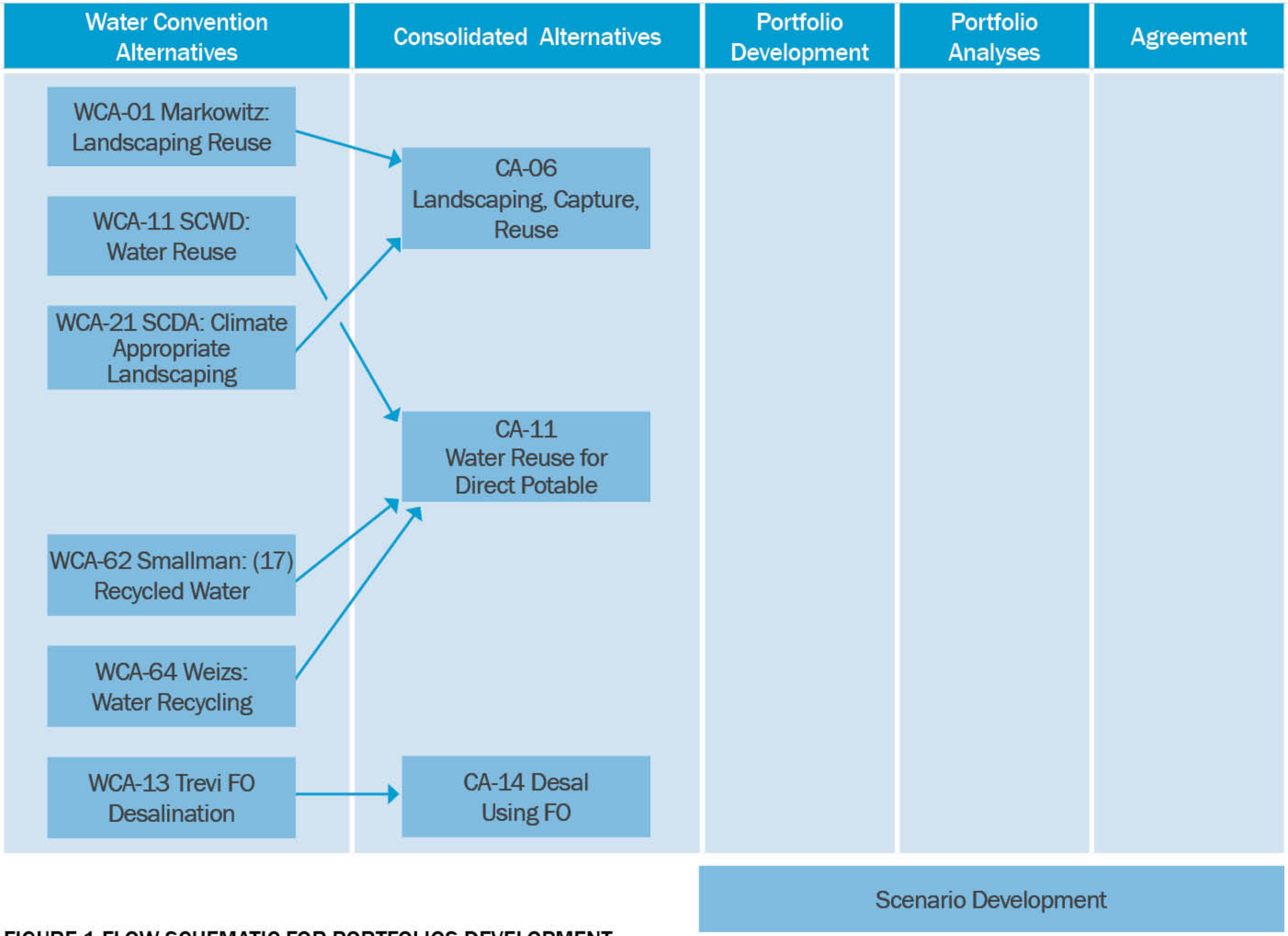


FIGURE 1 FLOW SCHEMATIC FOR PORTFOLIOS DEVELOPMENT

Process and State of the Work—Example Components Req'd for Complete CA

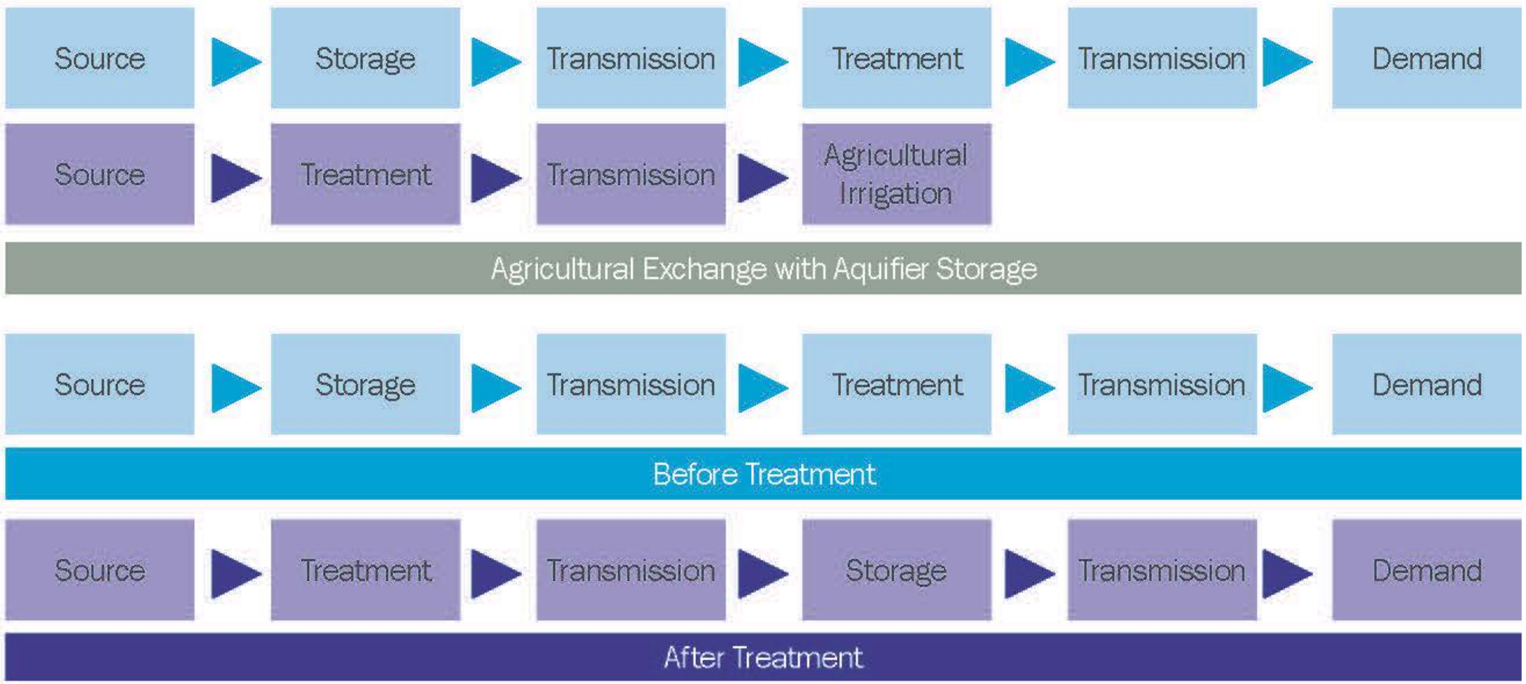


FIGURE XX SCHEMATIC OVERVIEW - KEY COMPONENTS FOR EXAMPLE NON-WATER EFFICIENCY CONSOLIDATED ALTERNATIVES

CAs for Improved Water Efficiency

- CA-01: Peak Season Reduction
- CA-02 Water-Neutral Development
- CA-03: Water Conservation Measures
- CA-04: WaterSmart Home Water Reports
- CA-05: Home Water Recycling

<u>Would save about 188 MG annually</u>

CAs for Increased Flow Capture

- Includes storage feature
  - More water in raised dam at Loch Lomond Reservoir (~260 MG)
  - Aquifer storage and return (~5,000 MG)
- CA-16: Aquifer Restoration/Storage
- CA-17: Expand Treatment Capacity
- CA-18: Off-Stream Water Storage
- CA-19: Ranney Collectors

CAs for Effluent Recycling

- CA-10: Recycled Water Reuse for Aquifer Recharge [IPR—Indirect Potable Reuse] (up to ~1,100 MG annually if 80 percent returned)
- CA-11: Recycled water Treatment at Graham Hill WTP [DPR—Direct Potable Reuse] (up to ~1,300 MG annually)
- CA-12: Recycled Water Reuse, Pumped to Loch Lomond Reservoir (IPR) (up to ~1,300 MG annually)
- CA-13: Recycled Water Reuse for Agriculture (Title 22 unrestricted effluent quality) in Exchange for Groundwater (up to ~500 MG annually)

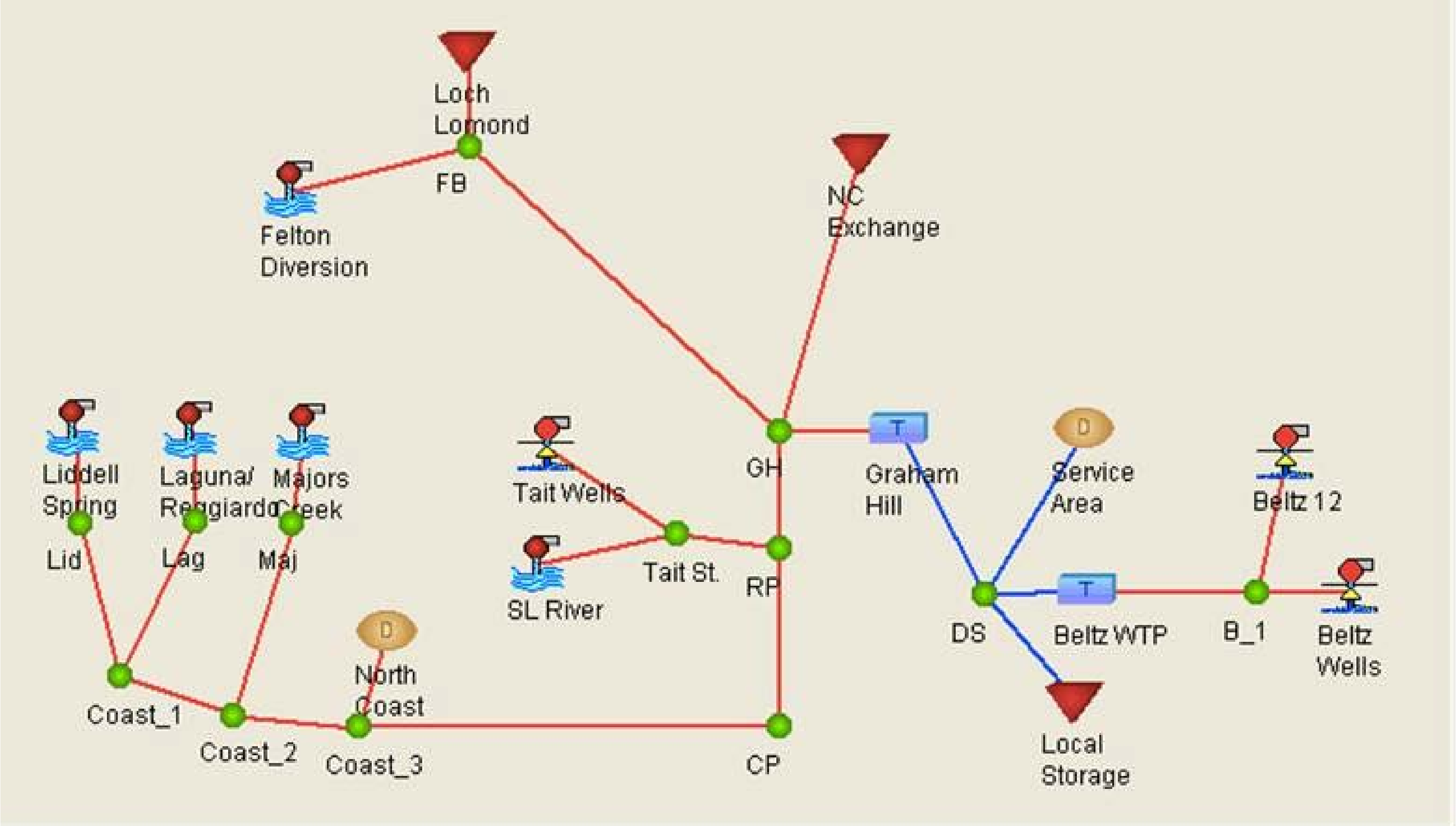
CAs for Seawater Desalination

- Includes aquifer storage in wet and average years and recovery in drought years
- CA-07: Deepwater Desalination (550 MGY at 1.5 mgd)
- CA-15: City seawater desalination(550 MGY at 1.5 mgd)

Confluence Supply Model

- Produces an extended period simulation model for the City of Santa Cruz water supply system
- Uses historic or Climate change hydrologic record together with projected City water demands
- Incorporates system operating as well as water rights and fish flows requirements
- Estimates the distribution of future water shortfalls

Confluence Model--Example Network of Components, CA-13



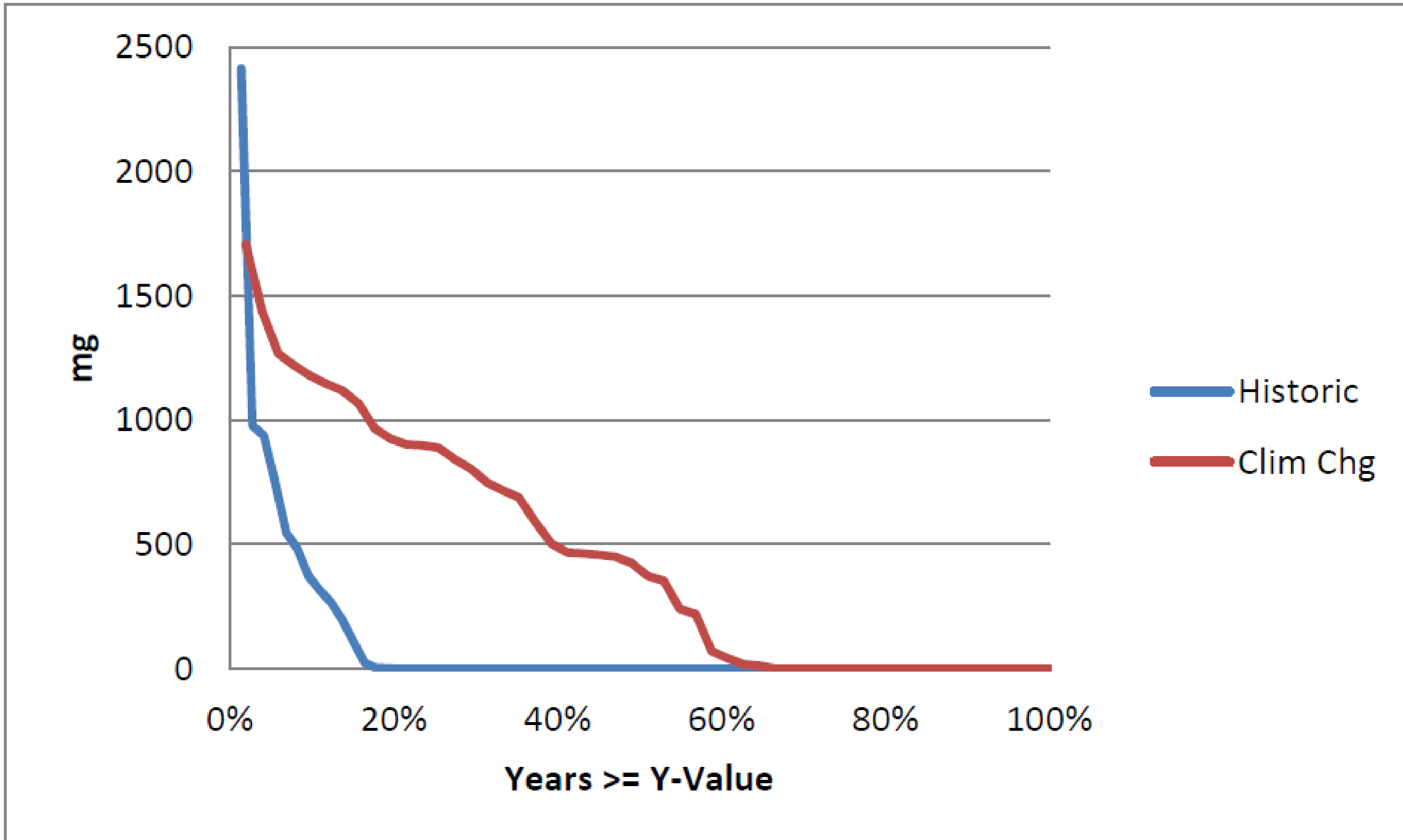
Confluence Model Assumptions for Water Futures for WSAC Consideration/Evaluation

- No infrastructure capacity constraints
- Current water rights and associated limitations
- DFG-5 fish flow requirements
- Virtual reservoir of up to 5 billion gallons for surface or groundwater storage CAs, e.g., better harvesting of winter flows
- 80 % recovery from virtual reservoir for groundwater storage CAs
- Considers both extended drought and climate change scenarios

Diverting water (e.g., CA-19 Ranney Collectors) from Felton to VR Produces Reliability Benefits

- Adds Ranney Collectors (horizontal wells deep under SLR sediments)
- Modeling conclusions
  - Ranney Collectors themselves don’t improve reliability significantly
  - For historical hydrology, adding virtual reservoir eliminates shortages
  - For climate change hydrology, adding virtual reservoir leaves significant shortages

CA-19 Ranney Collectors with Additional Storage (Virtual Reservoir) cont.



Annual Production Duration Curves of Virtual Reservoir

From Confluence Model by Gary Fisk & Associates, Inc.

Cost Estimating

- Estimating capital costs at planning (order-of-magnitude) accuracy level
- Assembling annual O&M costs based on use of energy, chemicals, spare parts, equipment replacement, labor, etc.
- Converting capital, financing, and O&M costs into life cycle costs (30-year present value)
- Cost estimating recognizes City's ongoing CIP and potential offsets

Implementing Proposed CAs Would Use Facilities Already in SCWD Capital Improvement Plan—No Stranded Assets

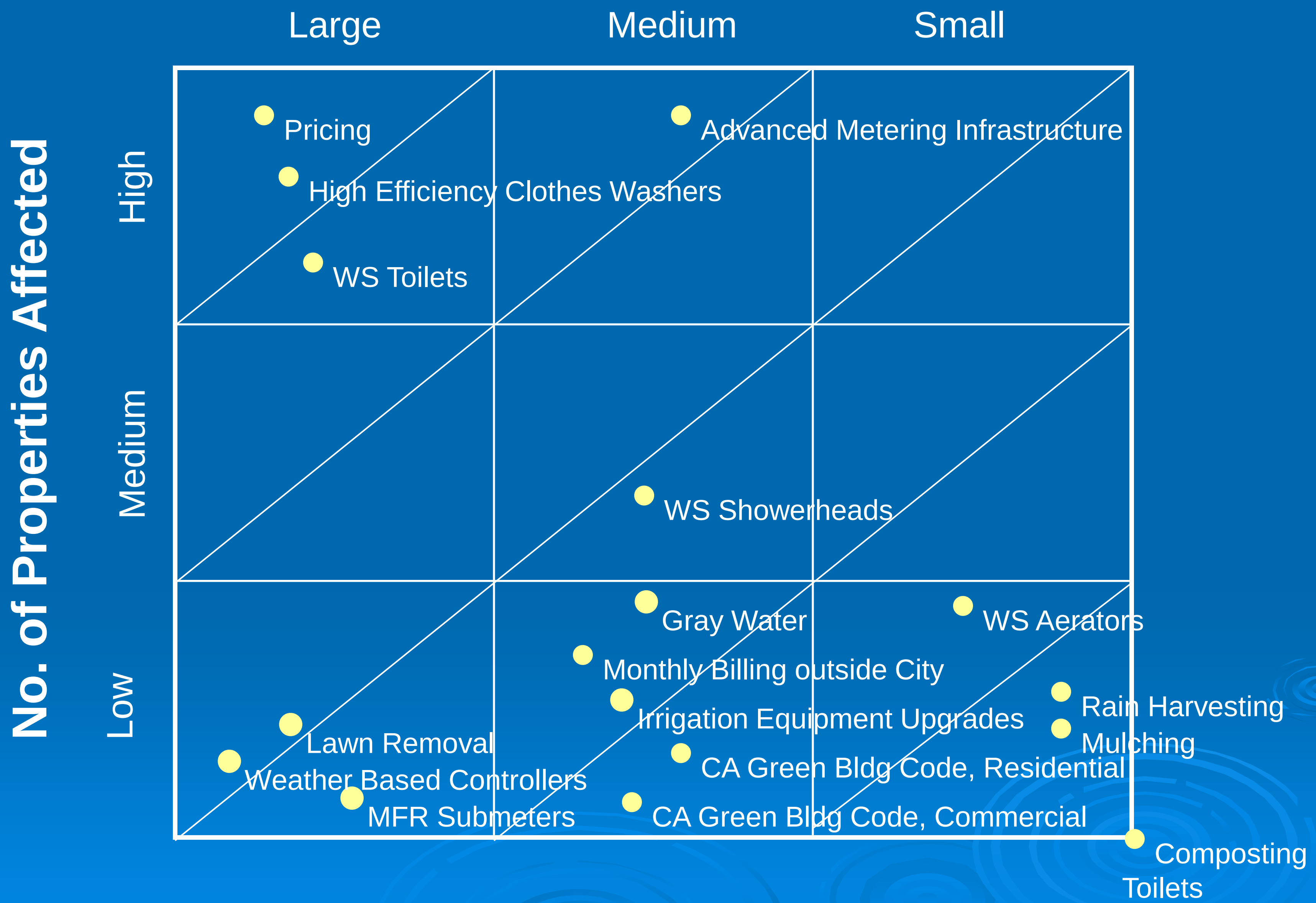
- North Coast System Improvements
- Newell Creek Dam Rehab and pipeline replacement(s)
- Water Treatment Plant Upgrades

The WSAC Process is Ongoing……

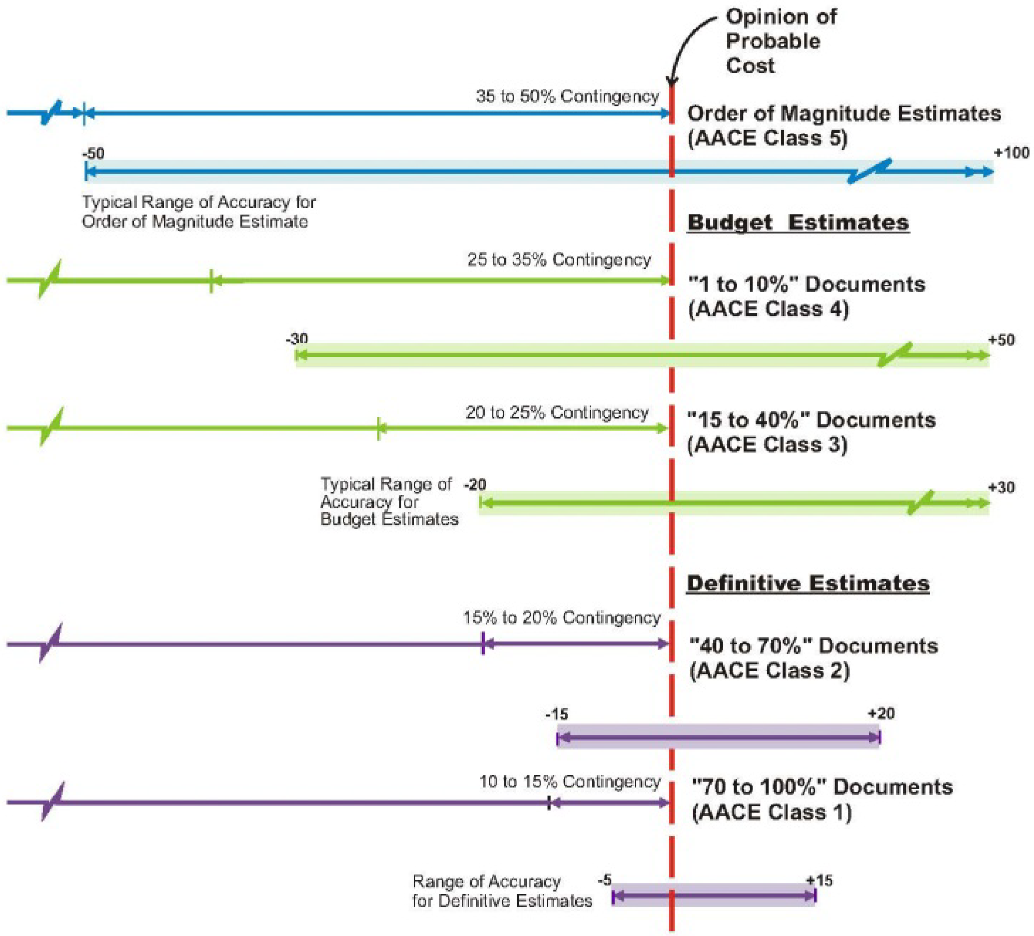
- Opportunities identified
- Data gathering and analyses still underway
- Description development for future conditions, especially extended drought and climate change
- WSAC is responding to scenarios (drought and climate change) and building water supply portfolios to address potential water supply shortfalls


Questions?

Measure Water Savings



Opinions of Probable Cost
Typical Contingencies and Ranges of Accuracy



Note:

1. Contingencies shown are typical
2. Ranges of Accuracy indicated are typical values from AACE document 18R-97 (REV 02/06)

Summary of CAs 07 through 19

Summary of CAs 07-19 with Preliminary Yields and Costs								
CA-# and Title	Additional Water in Wet/Average Year	Drought Recovery		Preliminary Capital Cost Estimate		Preliminary NPV Estimate	Preliminary O&M Cost Estimate	Preliminary Energy Estimate
	MG/yr	MG/yr	Duration (years)	Million dollars	Million dollars/MGD	Million dollars	Million dollars/MG	kWh/MG
CA-07 Deepwater Desalination	500	1,000	4 to 5	117	85	210	0.1	13,000
CA-08 Water from Atmosphere	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CA-09 Winter Flows Capture	560	500	4 to 5	TBD	TBD	TBD	TBD	1,500
CA-10 Water Reuse for Aquifer Recharge	1,330	500	4 to 5	83	23	147	2	6,000
CA-11 Water Reuse for Direct Potable	1,330	1,830	No limit	83	23	147	2	6,000
CA-12 Water Reuse for Indirect Potable	1,330	1,330+	No limit	83	23	147	2	6,000
CA-13 Water Reuse for Non-Potable	770	770	No limit	39	13	99	1	3,500
CA-14 Desal Using Forward Osmosis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CA-15 Desalination Using Reverse Osmosis	500	1000 (500 MG/yr after 5 years)	4 to 5	115	84	207	0.1	13,000
CA-16 Aquifer Restoration/Storage	640	TBD	4 to 5	30	17	54	TBD	TBD
CA-17 Expand Treatment Capacity	560	Availability of water may decrease substantially in drier years	4 to 5	52	3.7	94	TBD	1,500
CA-18 Off-Stream Water Storage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CA-19 Ranney Collectors	560	Availability of water may decrease substantially in drier years	4 to 5	16	1.3	29	0.03	1,500

10-Step Process to Commercial Maturity

- Discovery
- Mathematical modeling
- Lab (Bench Scale) Testing
- Proof of concept
- Pilot testing
- Demonstration testing
- Deployment
- Infancy
- Established track record
- Commercial maturity