From: Guy
To: Guy
Subject: Review of Jacobs Engineering presentation on MMWD water supply projects selection
Date: Wednesday, January 25, 2023 1:28:43 PM
Attachments: image.png
Review of Jacobs Engineering Jan 24..docx
Project Selection2.xlsx
Jacobs Engineering January 24, 2023.pdf

After 10 months and $620K, we still do not have the actionable information from Jacobs Engineering to move forward.

For the ones who don't want to read much, here are my recommendations at the start of the Word document.

Upfront recommendation

- JE should understand and disclose the financial implications of their project selection;
- JE should come up with one or more specific portfolios that meet our target of raising 8,000 AFY in a cost efficient way;
- JE should disclose capital costs including principal and interest payments;
- JE should continue refining estimates, and hopefully graduate from Class 3 to Class 2 or Class 1 level.

The recommendations become self-explanatory once you read the Word document (not too long about 1,100 words).

Best,

Gaetan "Guy" Lion

Review of Jacobs Engineering (JE) presentation of January 24, 2023

Gaetan Lion, January 25, 2023

Upfront recommendation

- JE should understand and disclose the financial implications of their project selection;
- JE should come up with one or more specific portfolios that meet our target of raising 8,000 AFY in a cost efficient way;
- JE should disclose capital costs including principal and interest payments;
- JE should continue refining estimates, and hopefully graduate from Class 3 to Class 2 or Class 1 level.

All the recommendations become self-explanatory once you read the remainder of this document (that is not long… about 1,100 words).

1) **JE does not outline any financial implications of the various portfolio selections**

JE presents numerous different project combinations with various AF yields and $AFY. But, it does not disclose what are the financial implications of those projects.

Let's first, figure out what the annual costs are for various AFY and $AFY combinations.

Annual costs						
				$AFY		
		$ 2,000	$ 2,500	$ 3,000	$ 3,500	$ 4,000
	8,000	$ 16,000,000	$ 20,000,000	$ 24,000,000	$ 28,000,000	$ 32,000,000
	9,000	$ 18,000,000	$ 22,500,000	$ 27,000,000	$ 31,500,000	$ 36,000,000
	10,000	$ 20,000,000	$ 25,000,000	$ 30,000,000	$ 35,000,000	$ 40,000,000
AFY	11,000	$ 22,000,000	$ 27,500,000	$ 33,000,000	$ 38,500,000	$ 44,000,000
	12,000	$ 24,000,000	$ 30,000,000	$ 36,000,000	$ 42,000,000	$ 48,000,000
	13,000	$ 26,000,000	$ 32,500,000	$ 39,000,000	$ 45,500,000	$ 52,000,000
	14,000	$ 28,000,000	$ 35,000,000	$ 42,000,000	$ 49,000,000	$ 56,000,000
	15,000	$ 30,000,000	$ 37,500,000	$ 45,000,000	$ 52,500,000	$ 60,000,000
	16,000	$ 32,000,000	$ 40,000,000	$ 48,000,000	$ 56,000,000	$ 64,000,000

Next, let's figure out what those annual costs would represent in basic water rates and fee increases based on fiscal 2022 revenues.

Fiscal 2022 water related revenues	
Water sales and service charges	$ 68,060,107
Connection charges	$ 540,349
Capital Management fee	$ 16,444,158
Watershed Management fee	$ 4,899,012
	$ 89,943,626

Increase in water rates and fees

		$AFY				
		$ 2,000	$ 2,500	$ 3,000	$ 3,500	$ 4,000
	8,000	17.8%	22.2%	26.7%	31.1%	35.6%
	9,000	20.0%	25.0%	30.0%	35.0%	40.0%
	10,000	22.2%	27.8%	33.4%	38.9%	44.5%
AFY	11,000	24.5%	30.6%	36.7%	42.8%	48.9%
	12,000	26.7%	33.4%	40.0%	46.7%	53.4%
	13,000	28.9%	36.1%	43.4%	50.6%	57.8%
	14,000	31.1%	38.9%	46.7%	54.5%	62.3%
	15,000	33.4%	41.7%	50.0%	58.4%	66.7%
	16,000	35.6%	44.5%	53.4%	62.3%	71.2%

Next, let's add a couple of assumptions including Debt service multiple covenant at 1.25 and capital costs representing 50% of annual operating costs. And, let's observe again what the resulting increase in water rates and fees would be.

Increase in water rates and fees

Assumptions	
Debt service multiple covenant	1.25
Debt service/Annual cost	50%

		$AFY				
		$ 2,000	$ 2,500	$ 3,000	$ 3,500	$ 4,000
	8,000	20.0%	25.0%	30.0%	35.0%	40.0%
	9,000	22.5%	28.1%	33.8%	39.4%	45.0%
	10,000	25.0%	31.3%	37.5%	43.8%	50.0%
AFY	11,000	27.5%	34.4%	41.3%	48.2%	55.0%
	12,000	30.0%	37.5%	45.0%	52.5%	60.0%
	13,000	32.5%	40.7%	48.8%	56.9%	65.0%
	14,000	35.0%	43.8%	52.5%	61.3%	70.0%
	15,000	37.5%	46.9%	56.3%	65.7%	75.0%
	16,000	40.0%	50.0%	60.0%	70.0%	80.1%

Above, I used an automated Excel color tiering. It is generous with green color up to 40% increase in rates and fees and moving progressively towards yellow/orange/red as the increase in rates and fees level rises.

From the above table, we can extract very few useful and realistic scenarios. As shown below.

Increase in water rates and fees	
Assumptions	
Debt service multiple covenant	1.25
Debt service/Annual cost	50%

		$AFY	
		$ 2,000	$ 2,500
AFY	8,000	20.0%	25.0%
	9,000	22.5%	28.1%
	10,000	25.0%	31.3%

The 8,000 to 10,000 AFY should be plenty to provide the MMWD with a reasonably secure water supply given a severe 4-year drought. JE and I have independently figured that around 8,000 AFY would suffice just fine.

2) JE portfolio selection to meet our 8,000 AFY target is nearly inexistent

JE presents 23 different options within Portfolios A/B/C/D. Only 3 of them randomly meet the above criteria (AFY 8,000 to 10,000 with $AFY =< 2,500). JE does not demonstrate being aware of those 3 portfolios that would meet the mentioned objectives.

I spent much time reviewing JE's previous disclosure, and I came up with three portfolios that would meet the mentioned criteria. I also recalculated the annual costs of each project by calculating capital costs independently. JE has never managed to disclose capital costs including separating principal repayment and interest. And, it appears they made errors when figuring out their stealthy capital costs (never adequately disclosed). I am sharing my calculations within the attached Excel workbook Project Selection 2.

Option 1

		AF	Calculated $/AF	Jacobs $/AF	Feasibility	Reliability	Timing est. yrs
SM1	Maximize Sonoma water supply, existing facilitie	1,500	$ 1,300	$ 1,300	1	3	2.1
DS4	Petaluma brackish desal	5,600	$ 2,339	$ 2,000	2	3	6.1
LS3A/3B/3C/3D	Spillway Gates (Kent, Nicasio, Soulajule, Alpine)	1,300	$ 2,269	$ 1,950	2	2	6.1
		8,400	$ 2,143	$ 1,867	1.82	2.85	5.39

Option 2

		AF	Calculated $/AF	Jacobs $/AF	Feasibility	Reliability	Timing est. yrs
SM2A	Maximize Sonoma water resolve bottleneck	2,500	$ 1,616	$ 2,100	1	3	6.1
DS4	Petaluma brackish desal	5,600	$ 2,339	$ 2,000	2	3	6.1
		8,100	$ 2,116	$ 2,031	1.69	3.0	6.1

Option 3

		AF	Calculated $/AF	Jacobs $/AF	Feasibility	Reliability	Timing est. yrs
SM1	Maximize Sonoma water supply, existing facilitie	1,500	$ 1,300	$ 1,300	1	3	2.1
SM2A	Maximize Sonoma water resolve bottleneck	2,500	$ 1,616	$ 2,100	1	3	6.1
SM4	Regional Groundwater bank	2,500	$ 1,860	$ 1,750	2	3	6.1
LS1B	Surface storage enlargement Nicasio	1,825	$ 2,388	$ 2,000	3	2	10.8
		8,325	$ 1,801	$ 1,829	1.74	2.78	6.4

After giving the above some extra thought, I also recommend an additional Option 4 that would be very simple just build a Petaluma brackish desalination plant with a capacity of 9,000 AF (or AFY if you want). Desalination plants have high fixed costs regardless of capacity. So, a larger desalination plant would have a lower cost per AF.

3) JE demonstrates no concept of portfolio diversification or optimization

Let me explain by using an investment portfolio example.

So, you go to your investment manager and you ask what mix of asset classes should I use given your risk tolerance and objectives. Your investment manager proposes the following:

Equities	40%
Private equity	20%
Bonds	40%
Sum	100%

Now, here is how JE would answer the same question. "We have no idea how you should diversify your investments, but we came up with 7 different investment proposals in each of the mentioned asset classes." That is exactly what JE did with Portfolios A/B/C.

In each case, JE concentrates on one single water supply infrastructure solution (such as interties or reservoir augmentation, etc.), and discloses 7 different options with no regard to the overall objective (raising 8,000 AFY in a cost-efficient way). That is where portfolio optimization comes in. They have not done it.

With portfolio D, JE moves in that direction somewhat. But, it proposes two alternatives that are way off the mark; one is way too low at 5,100 AFY. The other is much too high at 11,700

AFY. Remember AFYs represent a lot of money associated with hefty increases in water rates and fees.

On one of the last slides, JE shows a hypothetical Roadmap. This slide shows what JE should have done. This slide should be populated by quantitative and qualitative metrics to evaluate a true portfolio selection. In other words, one of the last slide of this presentation should have been one of the very first. And, JE could have developed two or three alternatives, as I did and showed earlier.

Going back to our investment manager example, JE on its last slide would tell you "we acknowledge you do need an asset class mix including Equities, Private Equity, and Bond. But, we can't give you any specific information regarding the actual mix, their risk/return profile, etc."

4) JE cost estimates are still vague

During most of their consulting engagement, JE stated that they provided Class 5 estimates (the vaguest possible). On January 24, 2023, they indicated that they now provide Class 3 estimates. The table below indicates what this all means.

	Primary Characteristic	*Secondary Characteristic*			
ESTIMATE CLASS	**LEVEL OF PROJECT DEFINITION** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical variation in low and high ranges [a]	**PREPARATION EFFORT** Typical degree of effort relative to least cost index of 1 [b]
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgment, or Analogy	L: -20% to -50% H: +30% to +100%	1
Class 4	1% to 15%	Study or Feasibility	Equipment Factored or Parametric Models	L: -15% to -30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, Authorization, or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: -10% to -20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or Bid/ Tender	Detailed Unit Cost with Forced Detailed Take-Off	L: -5% to -15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Take-Off	L: -3% to -10% H: +3% to +15%	5 to 100

Notes: [a] The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.

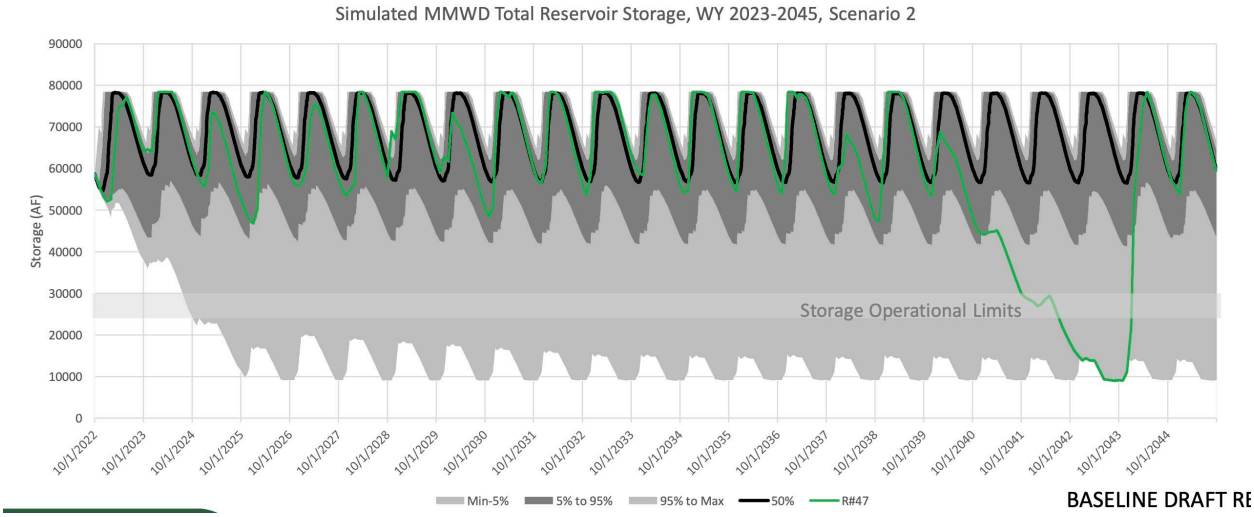
[b] If the range index value of "1" represents 0.005% of project costs, then an index value of 100 represents 0.5%. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

Class 3 estimate means that if a project is estimated to cost $100 million, it could ultimately cost anywhere between $80 million and $130 million. That is still pretty vague.

The above is a material concern when you add it to JE's undisclosed and questionable calculations of capital costs.

5) **JE Simulation Model does not look like a Simulation Model**

Scenario	Max. Deficit Duration	Annual Deficit (AFY)
Scenario 2 – Short and Severe Drought	4 years	**7,500 – 8,500 AFY (4 yrs)**



If you look at JE Simulation Model visual output, several characteristics do not look like a Simulation Model.

First, the output at the Median outcome (50%) shows no variation whatsoever. It looks like one single-year's seasonality replicated for 24 years.

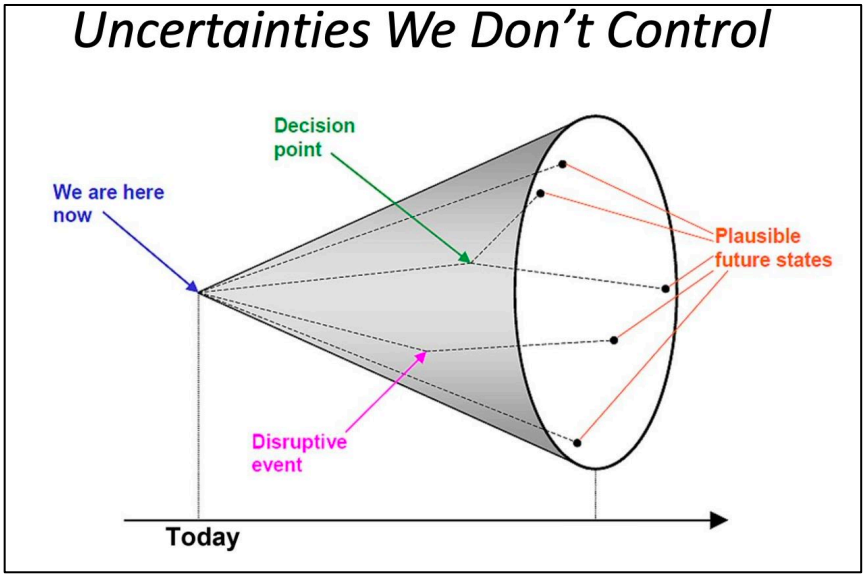
Second, the same is true for the Prediction Interval (5% to 95%), the Bottom (Minimum to 5%), and the top (95% to Maximum). Everything is a perfect replication of the previous year.

Third, the constructed drought (green line) is the consecutive tying of the water years 2020 – 2021 and 1976 – 1977. This is a stress test scenario, not a simulation.

Fourth, the Median, the 95th percentile, and the maximum seem strangely all bunched together. This may be possible given that the reservoirs have a maximum capacity. But it looks a bit strange for a simulation.

6) JE management consultant obfuscation continues

JE is big on aesthetics absent of any information. As an example, see this cone of uncertainty below.



The cone above is a three-dimensional object with an X-axis, a Y-axis, and a Z-axis. The X-axis is time. What are the other two axes? What do they represent?

Regarding obfuscation, the Simulation Model is another example of it. There are no disclosed assumptions about what variables were simulated and how they were simulated (what statistical distributions were used to simulate the dynamic variables).

At times, the AFY disclosed within the graphs and charts is not consistent with the ones disclosed in the tables.

		AF	Capital cost $ mm	Annual O & M $ mm	$/AF	Feasibility	Reliability	Timing (in years) Low	High	Estimate
SM1	Maximize Sonoma water supply, existing facilitie	1,500	$ -	$ -	$ 1,300	1	3	0	3	2.1
SM2A	Maximize Sonoma water resolve bottleneck	2,500	$ 16.0	$ 3.0	$ 2,100	1	3	4	7	6.1
SM4	Regional Groundwater bank	2,500	$ 10.0	$ 4.0	$ 1,750	2	3	4	7	6.1
LS1A/1B/1C	Surface storage enlargement	5,000	$ 137.5	$ 3.0	$ 2,000	3	2	8	12	10.8
	LS1A Soulaju 9.8%	490	$ 13.5	$ 0.3	$ 2,000	3	2	8	12	10.8
	LS1B Nicasio 36.5%	1,825	$ 50.2	$ 1.1	$ 2,000	3	2	8	12	10.8
	LS1C Kent 53.7%	2,685	$ 73.8	$ 1.6	$ 1,074	3	2	8	12	10.8
WP1	EBMUD intertie	5,000	$ 111.0	$ 8.0	$ 2,750	1	4	4	7	6.1
DS4	Petaluma brackish desal	5,600	$ 140.0	$ 4.0	$ 2,000	2	3	4	7	6.1
LS3A/3B/3C/3D	Spillway Gates (Kent, Nicasio, Soulajule, Alpine	1,300	$ 30.0	$ 1.0	$ 1,950	2	2	4	7	6.1

Financing assumptions

Interest rate	4.00%
Term	40 years

		AF	Capital cost in $ million	Principal	Interest	Annual O & M	Total cost	Calculate $/AF	Jacobs $/AF
SM1	Maximize Sonoma water supply, existing facilitie	1,500	$ -			$ -			$ 1,300
SM2A	Maximize Sonoma water resolve bottleneck	2,500	$ 16.0	$ 400,000	$ 640,000	$ 3,000,000	$ 4,040,000	$ 1,616	$ 2,100
SM4	Regional Groundwater bank	2,500	$ 10.0	$ 250,000	$ 400,000	$ 4,000,000	$ 4,650,000	$ 1,860	$ 1,750
LS1A/1B/1C	Surface storage enlargement	5,000	$ 137.5	$ 3,437,500	$ 5,500,000	$ 3,000,000	$ 11,937,500	$ 2,388	$ 2,000
	LS1A Soulaju 9.80%	490	$ 13.5	$ 336,875	$ 539,000	$ 294,000	$ 1,169,875	$ 2,388	$ 2,000
	LS1B Nicasio 36.50%	1,825	$ 50.2	$ 1,254,688	$ 2,007,500	$ 1,095,000	$ 4,357,188	$ 2,388	$ 2,000
	LS1C Kent 53.70%	2,685	$ 73.8	$ 1,845,938	$ 2,953,500	$ 1,611,000	$ 6,410,438	$ 2,388	$ 2,000
WP1	EBMUD intertie	5,000	$ 111.0	$ 2,775,000	$ 4,440,000	$ 8,000,000	$ 15,215,000	$ 3,043	$ 2,750
DS4	Petaluma brackish desal	5,600	$ 140.0	$ 3,500,000	$ 5,600,000	$ 4,000,000	$ 13,100,000	$ 2,339	$ 2,000
LS3A/3B/3C/3D	Spillway Gates (Kent, Nicasio, Soulajule, Alpine)	1,300	$ 30.0	$ 750,000	$ 1,200,000	$ 1,000,000	$ 2,950,000	$ 2,269	$ 1,950

		AF	Calculated $/AF	Jacobs $/AF
SM1	Maximize Sonoma water supply, existing facilities	1,500		$ 1,300
SM2A	Maximize Sonoma water resolve bottleneck	2,500	$ 1,616	$ 2,100
SM4	Regional Groundwater bank	2,500	$ 1,860	$ 1,750
LS1A/1B/1C	Surface storage enlargement	5,000	$ 2,388	$ 2,000
	LS1A Soulajule 9.8%	490	$ 2,388	$ 2,000
	LS1B Nicasio 36.5%	1,825	$ 2,388	$ 2,000
	LS1C Kent 53.7%	2,685	$ 2,388	$ 2,000
WP1	EBMUD intertie	5,000	$ 3,043	$ 2,750
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Option 1

		AF	Calculated $/AF	Jacobs $/AF	Feasibility	Reliability	Timing est. yrs
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DS4	Petaluma brackish desal	5,600	$ 2,339	$ 2,000	2	3	6.1
LS3A/3B/3C/3D	Spillway Gates (Kent, Nicasio, Soulajule, Alpine)	1,300	$ 2,269	$ 1,950	2	2	6.1
		8,400	$ 2,143	$ 1,867	1.82	2.85	5.39

Option 2

		AF	Calculated $/AF	Jacobs $/AF	Feasibility	Reliability	Timing est. yrs
SM2A	Maximize Sonoma water resolve bottleneck	2,500	$ 1,616	$ 2,100	1	3	6.1
DS4	Petaluma brackish desal	5,600	$ 2,339	$ 2,000	2	3	6.1
		8,100	$ 2,116	$ 2,031	1.69	3.0	6.1

Option 3

		AF	Calculated $/AF	Jacobs $/AF	Feasibility	Reliability	Timing est. yrs
SM1	Maximize Sonoma water supply, existing facilitie	1,500	$ 1,300	$ 1,300	1	3	2.1
SM2A	Maximize Sonoma water resolve bottleneck	2,500	$ 1,616	$ 2,100	1	3	6.1
SM4	Regional Groundwater bank	2,500	$ 1,860	$ 1,750	2	3	6.1
LS1B	Surface storage enlargement Nicasio	1,825	$ 2,388	$ 2,000	3	2	10.8
		8,325	$ 1,801	$ 1,829	1.74	2.78	6.4

Option 4

		AFY	Calculated $/AF	Jacobs $/AF	Feasibility	Reliability	Timing est. yrs
SM1	Maximize Sonoma water supply, existing facilitie	1,500	1,300	1,300	1	3	2.1
WP1	EBMUD intertie	5,000	$ 3,043	$ 2,750	1	4	6.1
LS1B	Surface storage enlargement Nicasio	1,825	2,388	2,000	3	2	10.8
		8,325	$ 2,585	$ 2,324			

MARIN WATER

Strategic Water Supply Assessment

BOARD UPDATE

January 24, 2023

Workshop Agenda: Strategic Water Supply Assessment

- Project Update
- Review of Water Management Portfolios
- Summary of Performance of Portfolios
- Developing Roadmaps
- Next Steps

Strategic Water Supply Assessment: Schedule

- December 13 – Draft Strategies and Portfolios
- **January 24 – Analysis of Portfolios**
- February TBD – Roadmap

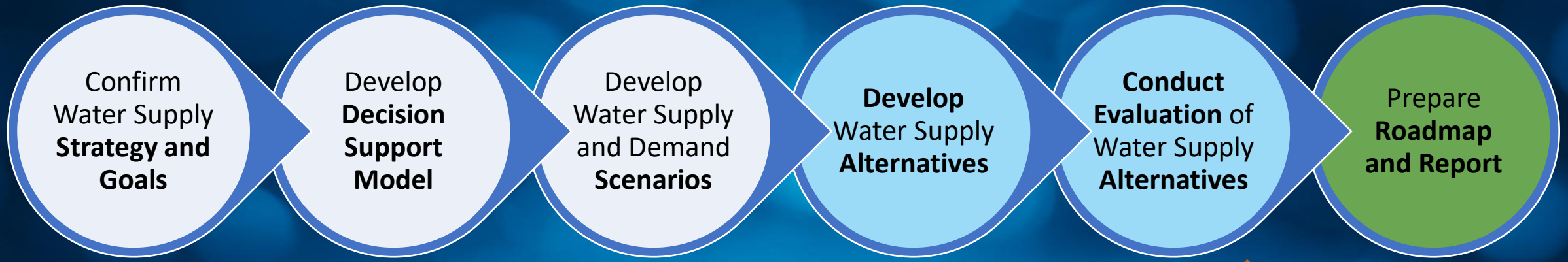
Process for Assessment

Key Project Scope Elements

Understanding Current Risks & Establishing Goals

Identifying & Evaluating Alternatives

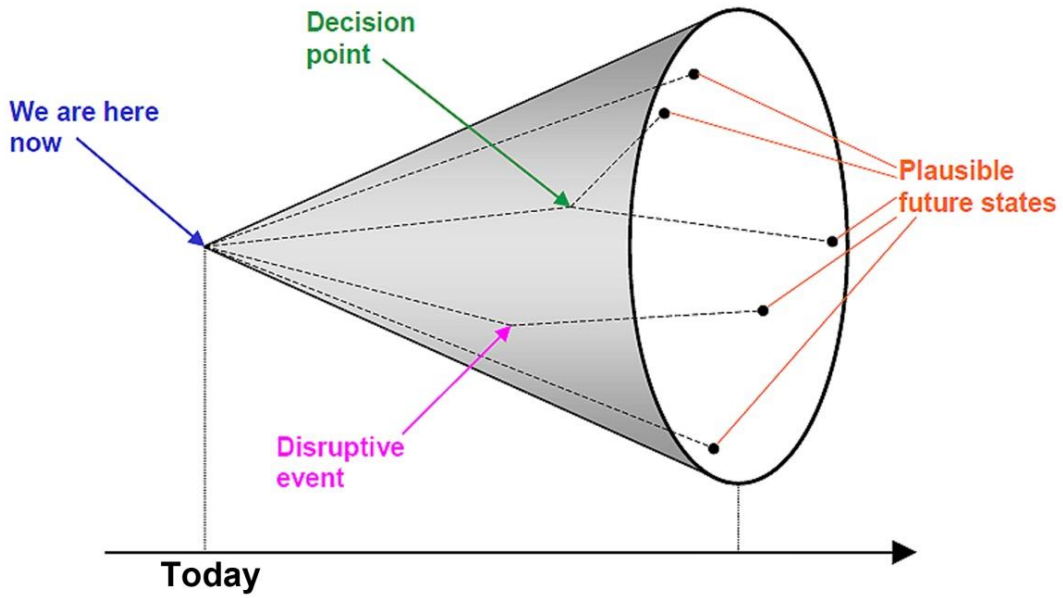
Recommendations & Path Forward



We are here

Strategic Water Supply Assessment: Scenarios

- Draft Scenarios – *Explore Uncertainties We Don't Control*



- Scenario 1 – Current Trends
- Scenario 2 – Short and Severe Drought
- Scenario 3 – Beyond Drought of Record
- Scenario 4 – Abrupt Disruptions

Conservation scenario is now a Water Management Alternative

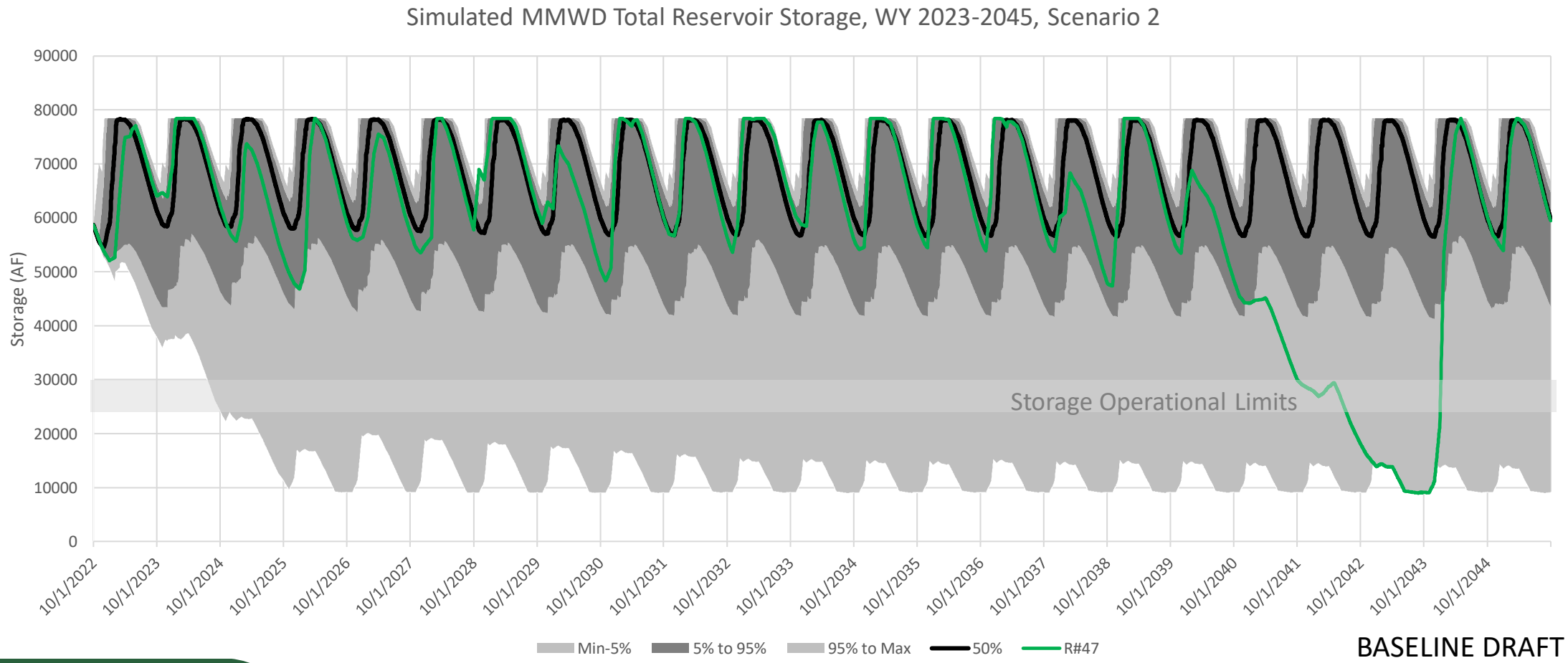
Draft Scenario Assumptions

Scenario	Hydroclimate Assumptions	Demand Assumptions	Operational Assumptions
Scenario 1 – Current Trends	Historical observed	Passive-level savings; drought conservation per WSCP	Current operations; local supply preference; supplemental water with Kastania Pump Station rehabilitation
Scenario 2 – Short and Severe Drought	Severe 4-Yr drought (2020, 2021, 1976, 1977)	Passive-level savings; drought conservation per WSCP	Current operations; local supply preference; supplemental water with Kastania Pump Station rehabilitation
Scenario 3 – Beyond Drought of Record	Long-range, extended 6- or 7-Yr drought (based on climate change projections)	Passive-level savings; drought conservation per WSCP	Current operations; local supply preference; supplemental water with Kastania Pump Station rehabilitation
Scenario 4 – Abrupt Disruptions	Severe 2-Yr (2020, 2021) or 4-Yr drought (2020, 2021, 1976, 1977); high wildfire likelihood	Passive-level savings; drought conservation per WSCP	Operational disruptions due to post-wildfire sediment loads; Treatments plants at reduced capacity (Bon Tempe offline & San Geronimo @ 50% operating capacity for 6 months)

Conservation scenario is now a Water Management Alternative

Scenarios Provide Planning Level Estimates of Deficit

Scenario	Max. Deficit Duration	Annual Deficit (AFY)
Scenario 2 – Short and Severe Drought	4 years	**7,500 – 8,500 AFY (4 yrs)**



BASELINE DRAFT RESULTS

Review of Water Management Portfolios

Moving Toward Strategies and Portfolios

- **Strategies –** a particular plan of action or policy designed to achieve the overall water management goals
- **Portfolios –** a combination of actions designed to implement a particular strategy
- Recognizing no singular alternative is likely to achieve all goals
  - How to balance long-term and shorter-term actions?
  - Are some alternatives synergistic? Can one set of alternatives amplify the benefit of other alternatives or preclude others?
  - Develop select strategies and associated portfolios for testing performance
- Draft portfolios are designed to INFORM roadmap; but are NOT themselves the roadmap
  - Roadmap will follow analysis and evaluation of the portfolios

Draft Portfolios for Analysis

- **Portfolio A: Maximize Existing Infrastructure**
  - Emphasizes alternatives that maximize existing local and regional water supplies
  - Sonoma-Marin partnerships, local storage optimization, interconnections
- **Portfolio B: New Local Supply**
  - Emphasizes alternatives which add new local drought-resilient supplies
  - Desalination, Reuse
- **Portfolio C: Diversify Imports**
  - Emphasizes alternatives that diversify imported water from different source watersheds
  - Water purchases with Bay interties (EBMUD or CCWD)
- **Portfolio D: Low Cost**
  - Emphasizes lowest cost actions (less than ~ $2,500/AF)
  - Greater conservation, maximizing Sonoma Water purchase, regional groundwater bank, local storage augmentation, Petaluma brackish desalination

Portfolio A – Maximize Existing Infrastructure

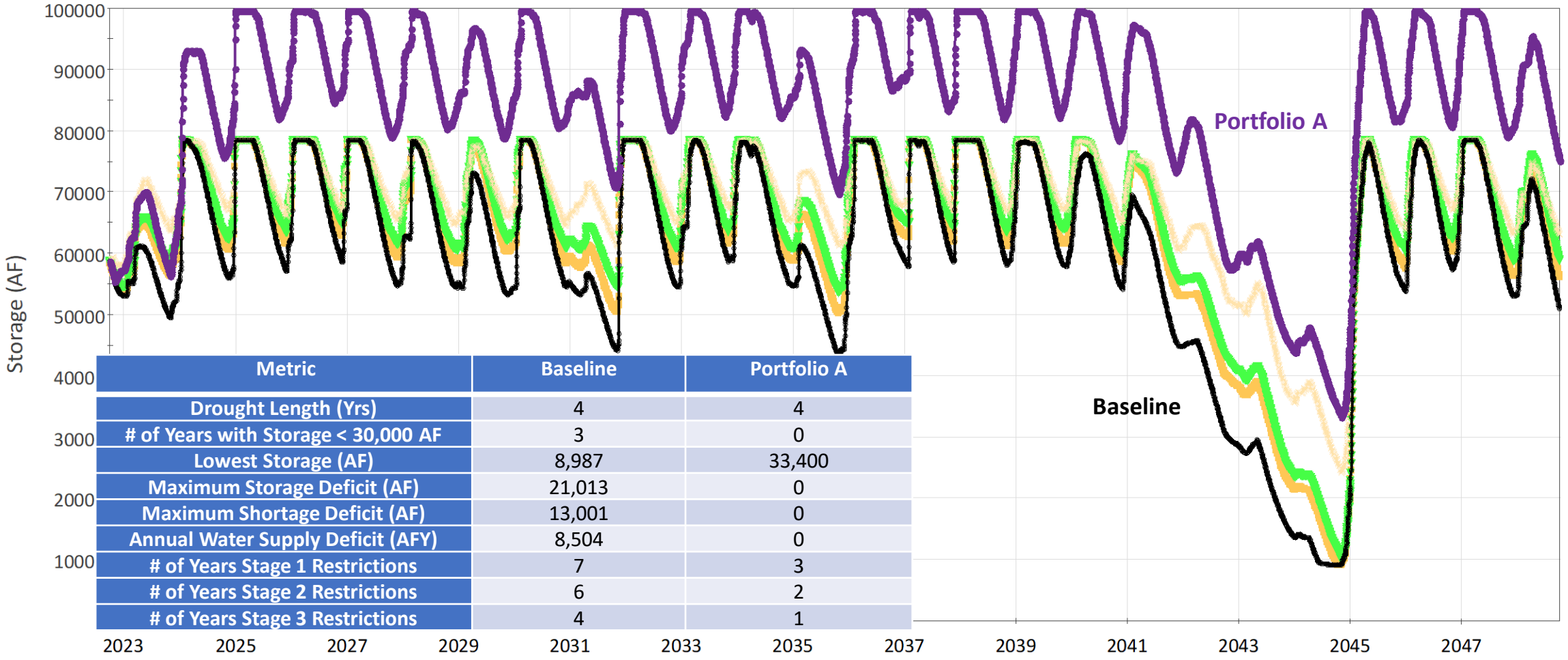
	Portfolio A: Maximize Existing Infrastructure		
Project	Near Term (0-3yrs)	Mid Term (4-7yrs)	Long-Term (8-12 yrs)
Temporary Urgency Change Permits (TUCPs)			
Water Shortage Contingency Plan (WSCP) - Stage 1-3			
Water Conservation Program			
Regulatory Driven Program			
Maximize Use of Sonoma Water - Existing Facilities			
Maximize Use of Sonoma Water - Resolve Bottlenecks			
Maximize Use of Sonoma Water - Resolve Bottlenecks+South Transmission System			
Maximize Use of Sonoma Water - Dedicated Conveyance Stafford to Nicasio			
Maximize Use of Sonoma Water - Dedicated Conveyance Kastania to Nicasio			OR
Maximize Use of Sonoma Water - Dedicated Conveyance Cotati to Soulajule			OR
Regional Groundwater Bank			
Soulajule Enlargement			OR
Nicasio Enlargement			OR
Kent Enlargement			OR
Halleck Reservoir			
Devil's Gulch Reservoir			
Movable Spillway Gates - Soulajule			
Movable Spillway Gates - Nicasio			
Movable Spillway Gates - Kent			
Movable Spillway Gates - Alpine			
Phoenix Lake - Bon Tempe Lake Connection			
Soulajule Electrification			

Part of portfolio, but uncertain implementation. Planning required. Not simulated.

OR — Decision between projects. Only one would be selected.

Portfolio A - Maximize Existing Infrastructure

Total MMWD Reservoir Storage (Scenario 2)



Metric	Baseline	Portfolio A
Drought Length (Yrs)	4	4
# of Years with Storage < 30,000 AF	3	0
Lowest Storage (AF)	8,987	33,400
Maximum Storage Deficit (AF)	21,013	0
Maximum Shortage Deficit (AF)	13,001	0
Annual Water Supply Deficit (AFY)	8,504	0
# of Years Stage 1 Restrictions	7	3
# of Years Stage 2 Restrictions	6	2
# of Years Stage 3 Restrictions	4	1

Model

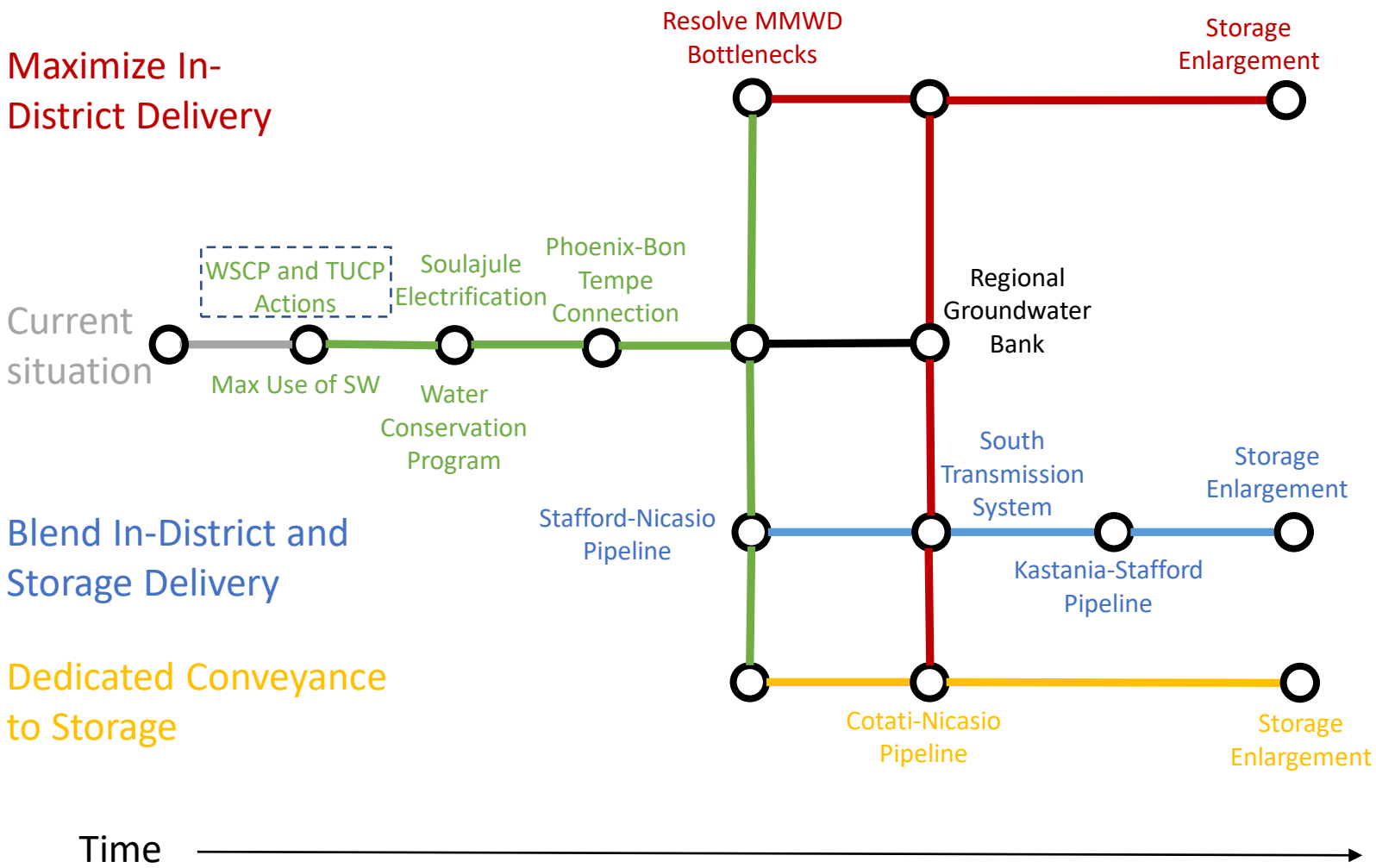
SM1-S2-Maximise Sonoma Water-Existing Facilities Baseline Scenario2

SM2B-S2-Max SON + Bottlenecks+ STS Portfolio A-S2 Max Exist Infrast

SM4-S2-Max SON with dedicated pipe from Cotati to SOU

Draft Roadmap for Portfolio A

Adaptation Pathway Roadmap



Scorecard for Pathways

Pathway	Yield (AFY)	Cost ($/AFY)	Reliability Rating[1]	Environ. Rating[2]	Social Rating[3]
	5,100	1,600	H	H	H
	10,800	2,200	M/H	M/H	M/H
	6,300	1,700	H	H	H
	9,100	2,200	M/H	M/H	M
	13,500	2,300	M/H	M/H	M
	14,800	2,400	M/H	M/H	M/H
	16,300	2,500	M/H	M/H	M/H

1. Includes “Reliability”, “Flexibility”, and “Feasibility” ratings.
2. Includes “Environmental”, “Energy”, and “Permitting” ratings.
3. Includes “Social” and “Public Acceptance” ratings.

Portfolio B – New Local Supply

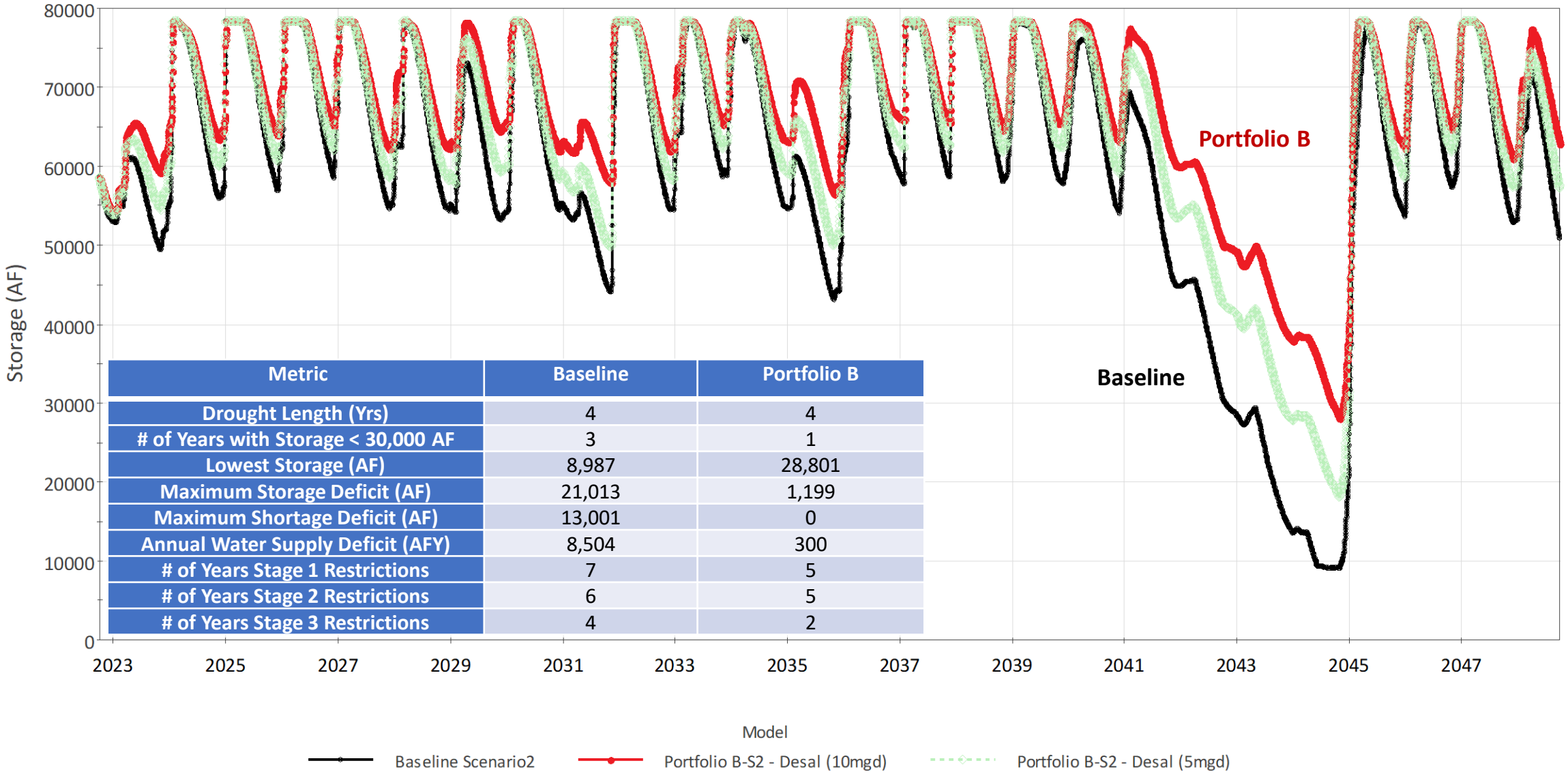
Project	Portfolio B: New Local Supply		
	Near Term (0-3yrs)	Mid Term (4-7yrs)	Long-Term (8-12 yrs)
Temporary Urgency Change Permits (TUCPs)			
Water Shortage Contingency Plan (WSCP) - Stage 1-3			
Water Conservation Program			
Regulatory Driven Program			
Marin Regional Desalination Facility- 5 MGD Stand Alone			
Marin Regional Desalination Facility - 5 MGD Expandable			OR
Marin Regional Desalination Facility - 10 MGD Expandable			OR
Marin Regional Desalination Facility - 15 MGD			
Containerized Desalination Facility			
Bay Area Regional Desalination Facility			
Petaluma Brackish Groundwater Desalination Facility			
Recycled Water Expansion - Peacock Gap			
Recycled Water Expansion - San Quentin			
Regional Indirect Potable Reuse (IPR)			
CMSA Direct Potable Reuse (DPR) - Raw Water Augmentation			
CMSA Direct Potable Reuse (DPR) - Treated Water Augmentation			
Regional Direct Potable Reuse (DPR)			

Part of portfolio, but uncertain implementation. Planning required. Not simulated.

OR — Decision between projects. Only one would be selected.

Portfolio B – New Local Supply

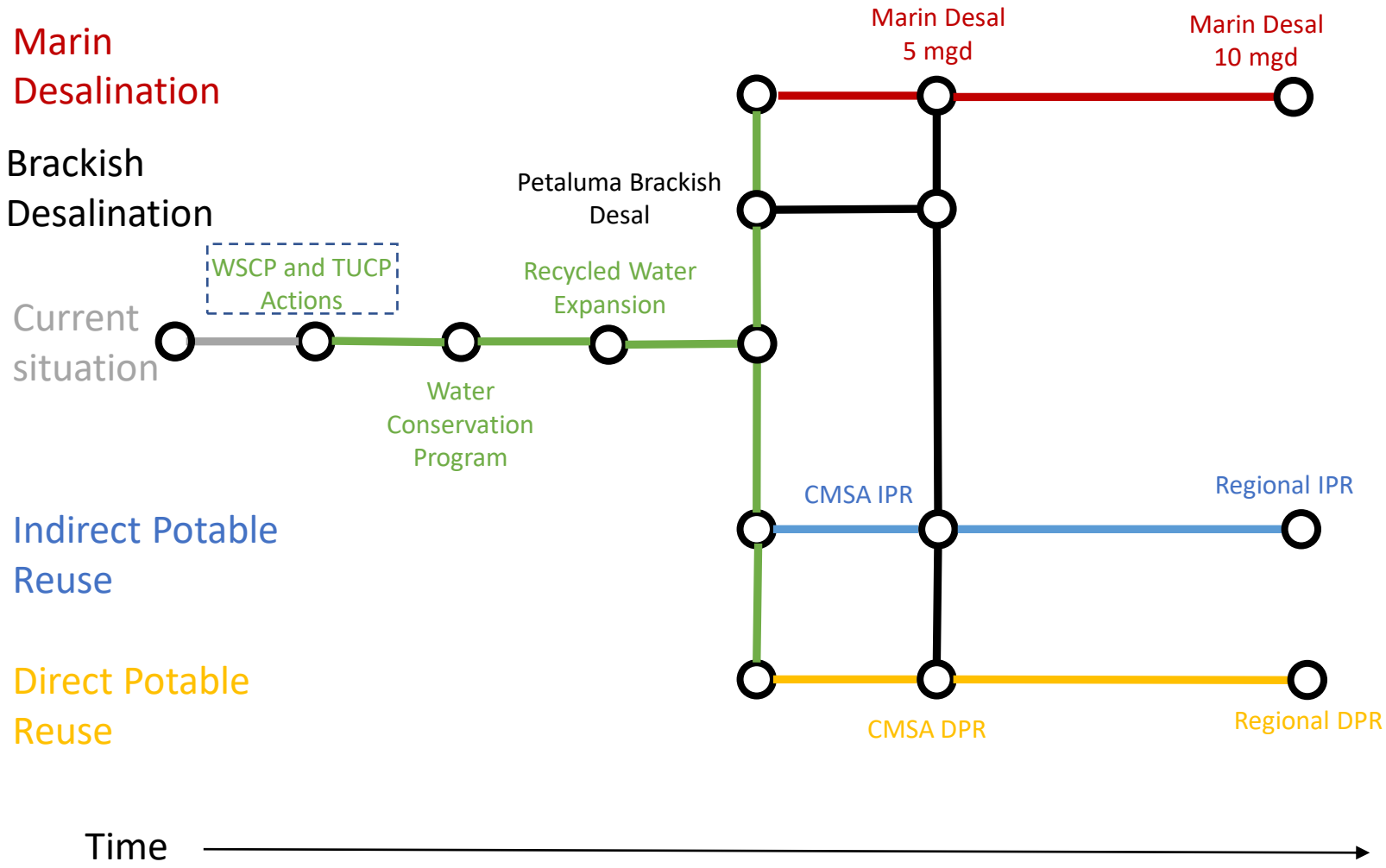
Total MMWD Reservoir Storage (Scenario 2)



Metric	Baseline	Portfolio B
Drought Length (Yrs)	4	4
# of Years with Storage < 30,000 AF	3	1
Lowest Storage (AF)	8,987	28,801
Maximum Storage Deficit (AF)	21,013	1,199
Maximum Shortage Deficit (AF)	13,001	0
Annual Water Supply Deficit (AFY)	8,504	300
# of Years Stage 1 Restrictions	7	5
# of Years Stage 2 Restrictions	6	5
# of Years Stage 3 Restrictions	4	2

Draft Roadmap for Portfolio B

Adaptation Pathway Roadmap



Scorecard for Pathways

Pathway	Yield (AFY)	Cost ($/AFY)	Reliability Rating	Environ. Rating	Social Rating
	2,800	2,300	H	H	H
	12,900	3,400	M/H	L/M	M/H
	8.200	2,400	M/H	M/H	H
	9,900	3,600	M/H	M	M/H
	9,900	4,600	M	L/M	L/M
	15,200	3,200	M/H	M	M/H
	15,200	3,800	M	L/M	M

1. Includes “Reliability”, “Flexibility”, and “Feasibility” ratings.
2. Includes “Environmental”, “Energy”, and “Permitting” ratings.
3. Includes “Social” and “Public Acceptance” ratings.

Portfolio C – Diversify Imports

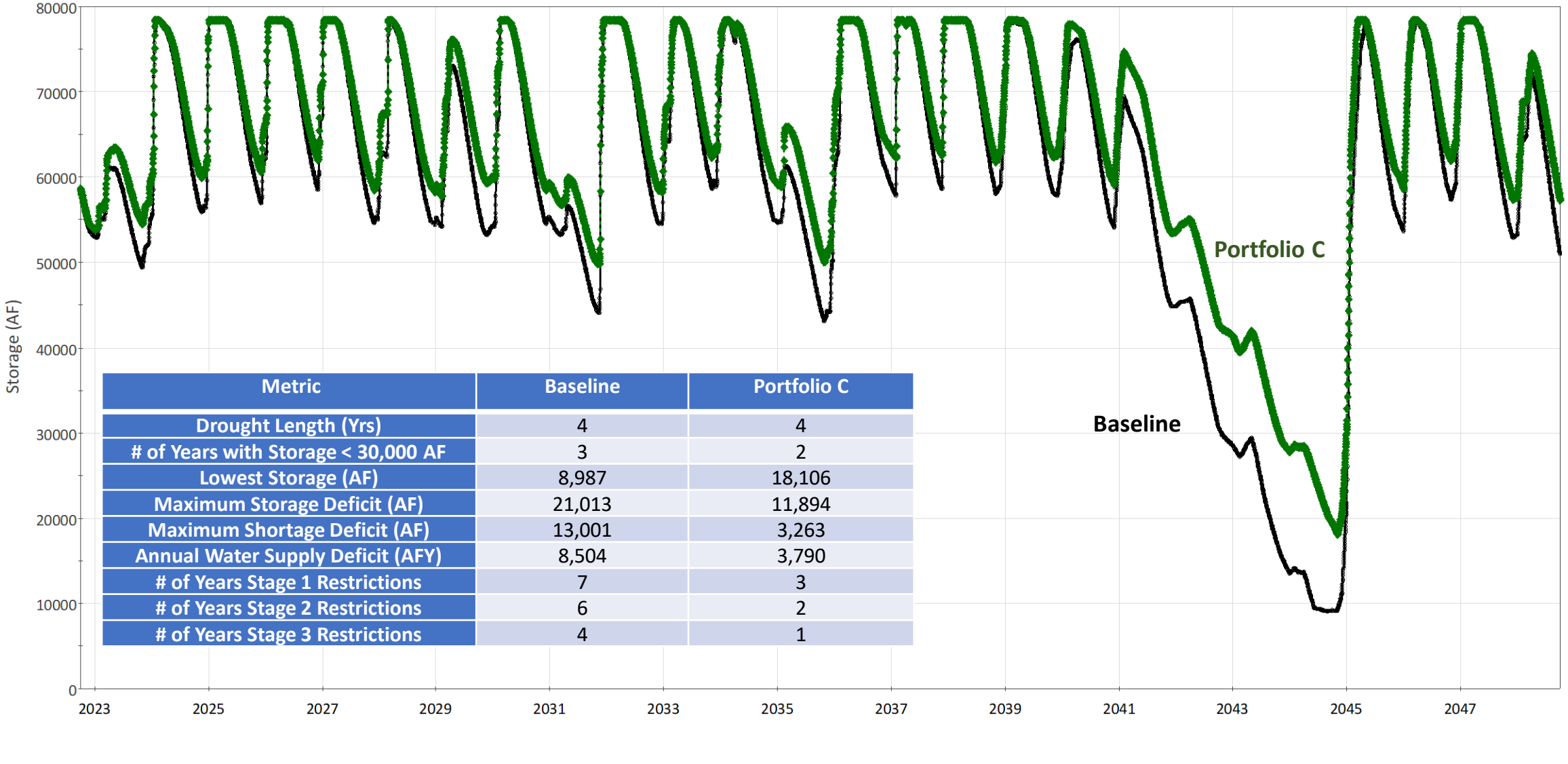
	Portfolio C: Diversify Imports		
	Near Term (0-3yrs)	Mid Term (4-7yrs)	Long-Term (8-12 yrs)
Temporary Urgency Change Permits (TUCPs)			
Water Shortage Contingency Plan (WSCP) - Stage 1-3			
Water Conservation Program			
Regulatory Driven Program			
EBMUD Intertie			OR
CCWD Intertie			OR
NBA Intertie - MMWD			
NBA Intertie - Sonoma Aqueduct			
SFPUC Intertie			

Part of portfolio, but uncertain implementation. Planning required. Not simulated.

OR — Decision between projects. Only one would be selected.

Portfolio C – Diversify Imports

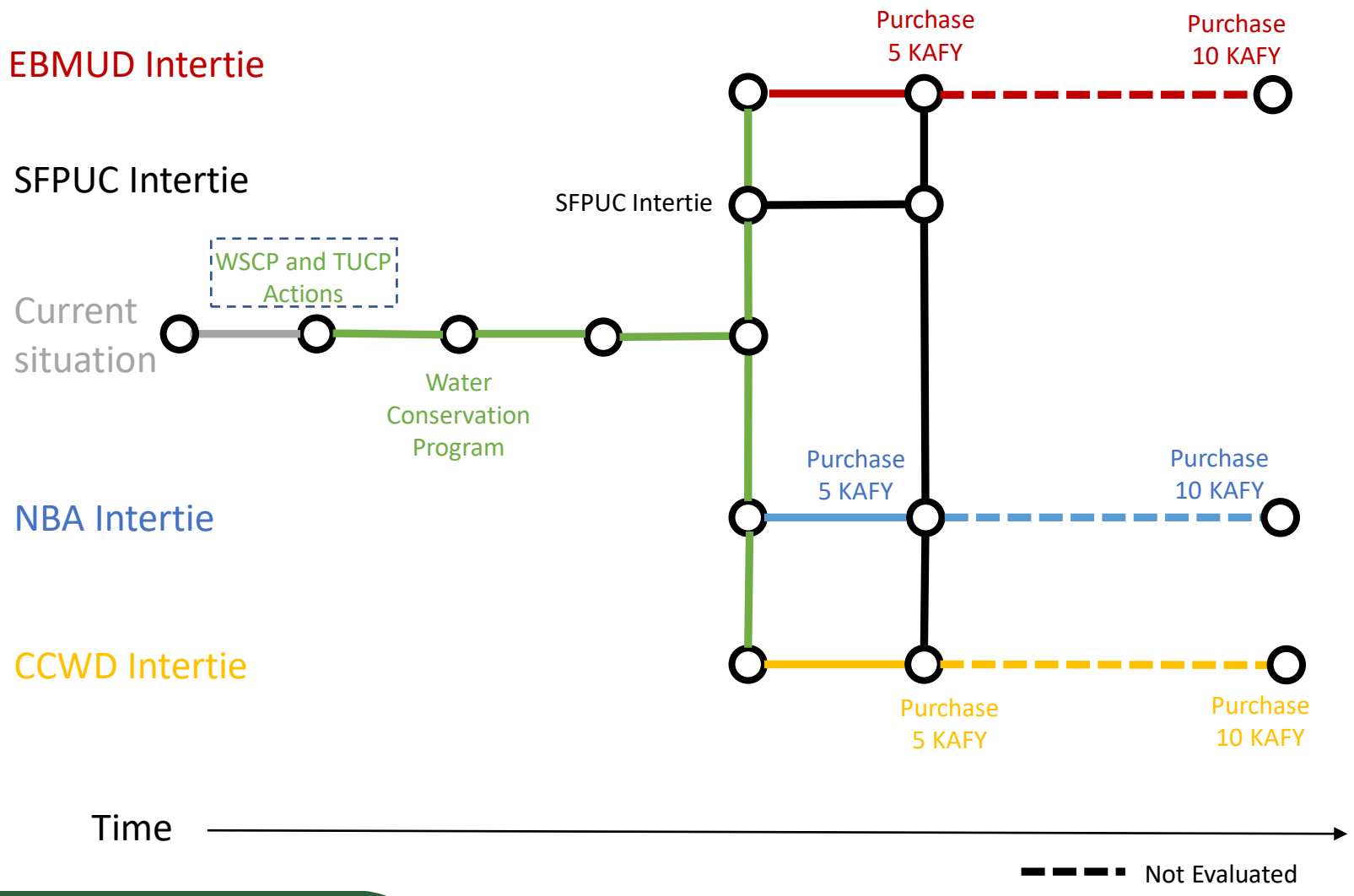
Total MMWD Reservoir Storage (Scenario 2)



Metric	Baseline	Portfolio C
Drought Length (Yrs)	4	4
# of Years with Storage < 30,000 AF	3	2
Lowest Storage (AF)	8,987	18,106
Maximum Storage Deficit (AF)	21,013	11,894
Maximum Shortage Deficit (AF)	13,001	3,263
Annual Water Supply Deficit (AFY)	8,504	3,790
# of Years Stage 1 Restrictions	7	3
# of Years Stage 2 Restrictions	6	2
# of Years Stage 3 Restrictions	4	1

Draft Roadmap for Portfolio C

Adaptation Pathway Roadmap

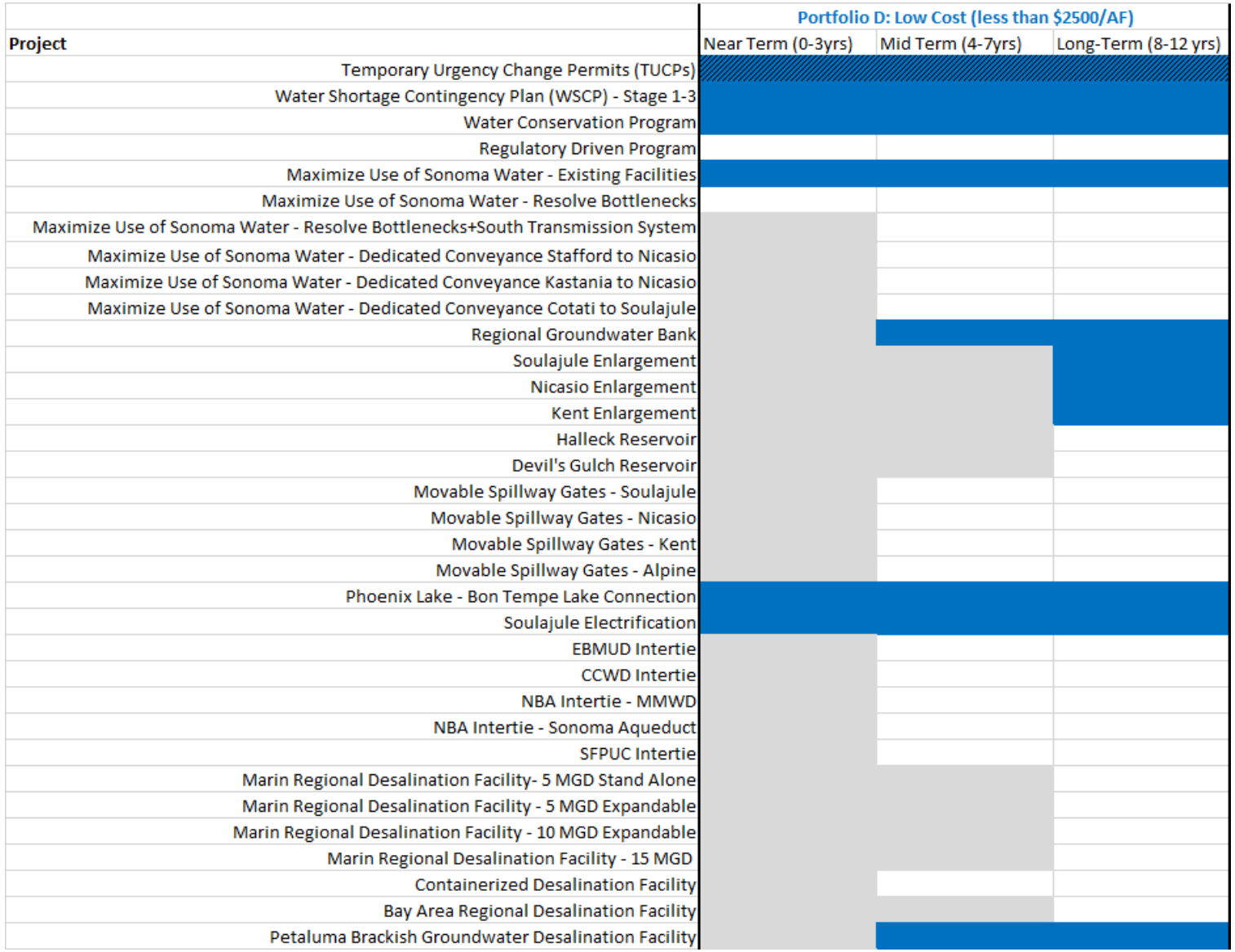


Scorecard for Pathways

Pathway	Yield (AFY)	Cost ($/AFY)	Reliability Rating	Environ. Rating	Social Rating
	2,400	1,800	H	H	H
	7,400	2,500	M/H	M/H	M/H
	3,400	2,200	M/H	M/H	M/H
	7,400	4,200	M/H	M/H	M/H
	7,400	3,600	M/H	M/H	M/H
	8,400	2,500	M/H	M/H	M/H
	8,400	3,500	M/H	M/H	M/H

1. Includes “Reliability”, “Flexibility”, and “Feasibility” ratings.
2. Includes “Environmental”, “Energy”, and “Permitting” ratings.
3. Includes “Social” and “Public Acceptance” ratings.

Portfolio D – Low Cost



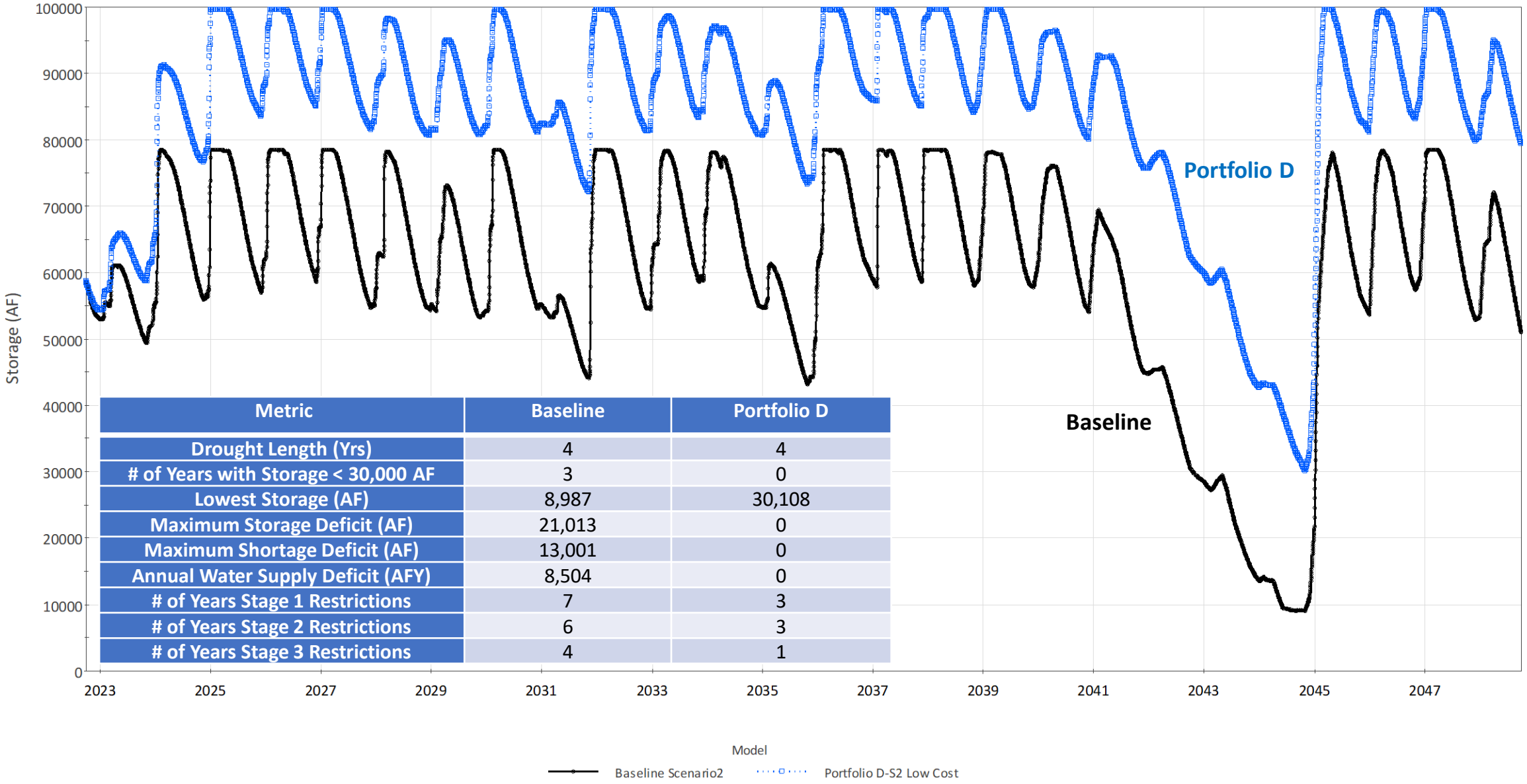
Part of portfolio, but uncertain implementation. Planning required. Not simulated.

OR

Decision between projects. Only one would be selected.

Portfolio D – Low Cost

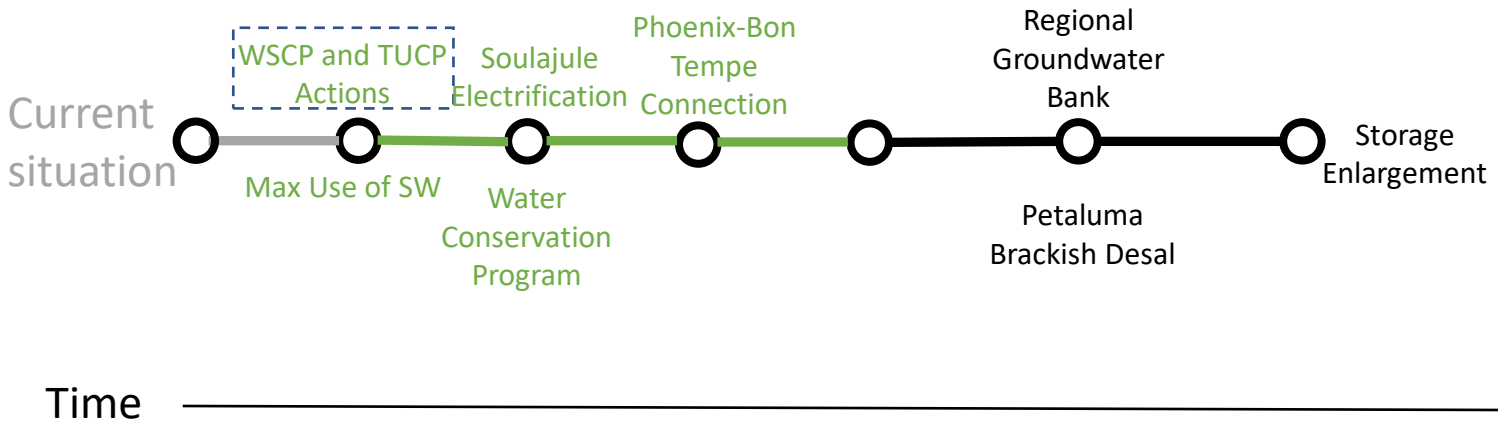
Total MMWD Reservoir Storage (Scenario 2)



Metric	Baseline	Portfolio D
Drought Length (Yrs)	4	4
# of Years with Storage < 30,000 AF	3	0
Lowest Storage (AF)	8,987	30,108
Maximum Storage Deficit (AF)	21,013	0
Maximum Shortage Deficit (AF)	13,001	0
Annual Water Supply Deficit (AFY)	8,504	0
# of Years Stage 1 Restrictions	7	3
# of Years Stage 2 Restrictions	6	3
# of Years Stage 3 Restrictions	4	1

Draft Roadmap for Portfolio D

Adaptation Pathway Roadmap



Scorecard for Pathways

Pathway	Yield (AFY)	Cost ($/AFY)	Reliability Rating	Environ. Rating	Social Rating
○	5,100	1,600	H	H	H
○○	11,700	2,000	M/H	M/H	H

1. Includes “Reliability”, “Flexibility”, and “Feasibility” ratings.
2. Includes “Environmental”, “Energy”, and “Permitting” ratings.
3. Includes “Social” and “Public Acceptance” ratings.

Comparison of Portfolios

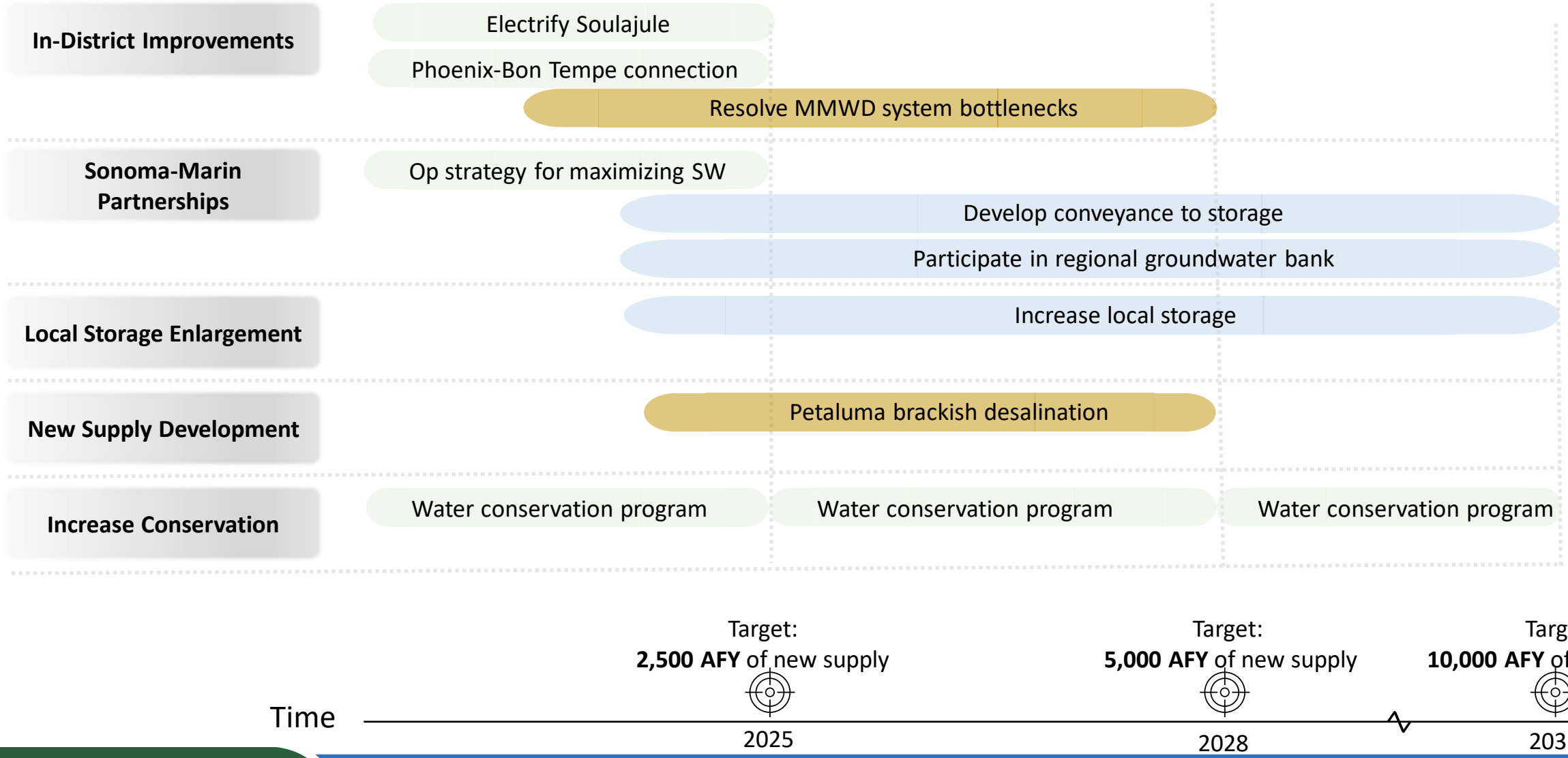
	Portfolio A – Max. Exist Infrastructure	Portfolio B – New Local Supply	Portfolio C – Diversify Imports	Portfolio D – Low Cost
Performance in Achieving Goals	✓✓✓	✓✓✓	✓	✓✓✓
Dry Year Yield (AFY)	9,100 - 16,300	9,900 - 15,200	7,400 – 8,400	11,700
Cost per AFY ($)	$2,200 – 2,500	$3,200 – 4,600	$2,500 – 4,200	$2,000
Reliability Rating	M/H	M/H	M/H	M/H
Environmental Rating	M/H	L/M to M/H	M/H	M/H
Social Rating	M	L/M to M/H	M/H	H
Components Driving Performance	Conservation; maximizing delivery of SW supply; increase storage; resolving conveyance limitations	Conservation; new desal supply; new reuse supply	Conservation; new imports from Sac Valley	Conservation; maximizing delivery of SW supply; brackish desal supply; increase storage

Observations/Findings

- Multiple viable pathways exist for drought resiliency
- Portfolio observations
  - Conservation and drought restrictions are key elements
  - Operational strategies to maximize Sonoma Water supply can yield benefits with existing infrastructure
  - Enlarging storage provides substantial benefits taking advantage of runoff in both local and Russian River watersheds
  - New desalination, reuse, and Sac Valley import supplies likely to need be generated at scale for drought resiliency, or combined with other actions
  - “Low Cost” portfolio is a useful reference and suggests that drought resiliency can be achieved with new supply costs less than $2,500/AF
- Integration of promising elements of the portfolios can demonstrate more realistic roadmaps showing performance over time; linking early “low regret” actions with longer-term infrastructure investments

Example Integrated Roadmap and Supply Targets

Combining actions from various portfolios



Next Steps

- Further evaluation of portfolios and draft roadmaps
- Development and presentation of recommended roadmap
- Final assessment report