MARIN WATER

Strategic Water Supply Assessment

BOARD WORKSHOP #5

June 28, 2022

Workshop Agenda: Strategic Water Supply Assessment

- Project Update
- Assumptions and Estimates
- Overview of Water Management Alternatives
- Summary and Next Steps
- Q&A

Strategic Water Supply Assessment: Schedule

- **June 28 (5pm-7pm) – Initial Review of Water Management Options**
- July 12 (5pm-7pm) – Review Desalination and Recycled Water
- July 19 (7:30pm – 9:30pm) – Review Interties, Local Supply Enhancement and Sonoma options
- July TBD – Public Workshop
- August 9 (5pm-7pm) – Evaluation of Water Management Alternatives
- August 23 (5pm-7pm) – Evaluation of Water management alternatives
- August TBD – Public Workshop

Project Overview

Water Supply Assessment: Project Overview

- Strategic Water Supply Assessment will be additive to past planning efforts and is designed to fill in the gaps on water supply alternatives
- Comparative analysis of water supply options available to MMWD and provide recommendations on a strategic water supply roadmap
- Respond to accelerated pace of climate change and greater hydrologic extremes than those that have occurred in the past

Project Overview

The Assessment will address the following questions:

1. What is the current risk to MMWD's water delivery reliability under recent and projected future droughts?

2. How much additional water supply is needed under different future hydrologic drought and demand scenarios?

3. What are the range of water supply alternatives that could increase resiliency of MMWD's system? And what are their strengths and weaknesses?

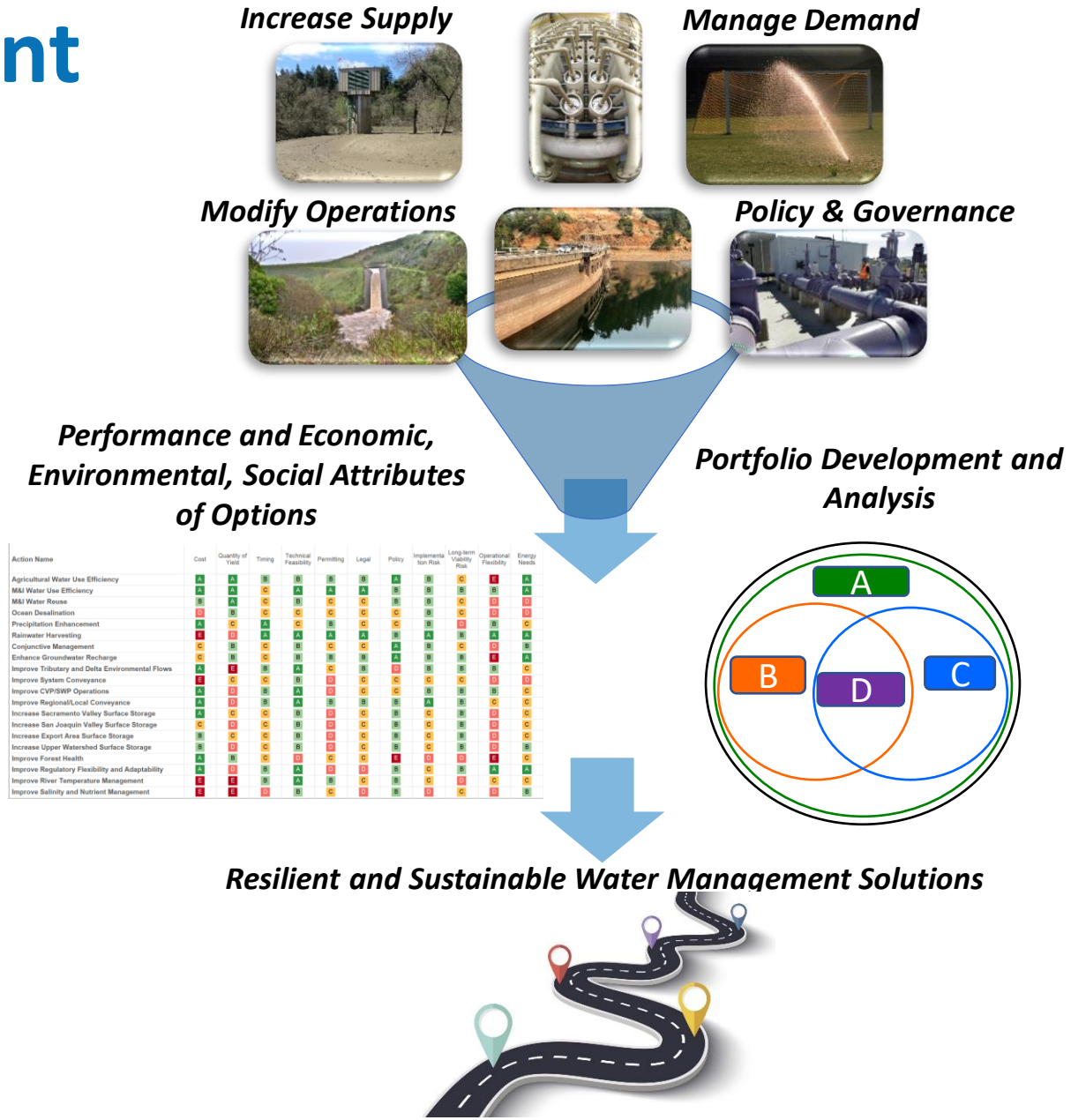
4. What recommendations can be developed to support MMWD's near-term investment in drought resiliency?

Process for Assessment

Key Project Scope Elements

Water Supply Assessment Process

- Consider a broad range of water management alternatives
- Identify most promising alternatives
- Evaluate alternatives for performance and other economic, environmental, and social criteria
- Explore strategic combinations of alternatives
- Develop roadmap with specific project, pathways, and triggers to achieve resilient and sustainable solutions



Water Management Alternatives

Water Management Alternatives Considered

- Baseline – Existing water supply system with planned improvements
- Desalination
- Recycled Water
- Water Purchases with Conveyance through Bay Interties
- Sonoma-Marin Partnerships
- Local Surface Storage
- Drought Conservation

Assumptions & Estimates

Assumptions & Estimates

- Water Management Alternatives – Level of Development
  - Developed from review of previous water supply assessments for the District
  - Review of project elements and updates based on team's related experience
  - High-level technical evaluations of alternatives
  - Reviewed conveyance needs and developed concept-level routing and sizing
  - Preliminary modeling of some alternatives to support yield estimation
- Work Continuing to Refine Alternatives
  - Yield estimates are for new supply – expressed as acre-feet per year of new supply
  - Operational changes to integrate and optimize use of new supply is important and is underway
  - Modeling forthcoming to evaluate how yields translate to drought benefit

Assumptions & Estimates

- **Cost Assumptions:**
  - **Class 5 Cost Estimates**.
    - *Typical expected accuracy range for Class 5 estimate is –20 to –50 percent on the low side and +30 to +100 percent on the high side.*
    - *Support the relative cost comparison of alternatives*
  - Capital Costs and Annual O&M Costs
  - 30-year Project Planning Period
  - 3% Interest rate
- 3 Types of Cost Estimating Approaches:
  - Independent evaluation using Jacobs' cost estimating tools
  - Updated estimates from previous studies escalated to reflect 2022 conditions
  - Costs from comparable related projects
- COSTS SHOULD BE CONSIDERED DRAFT AND WILL BE UPDATED

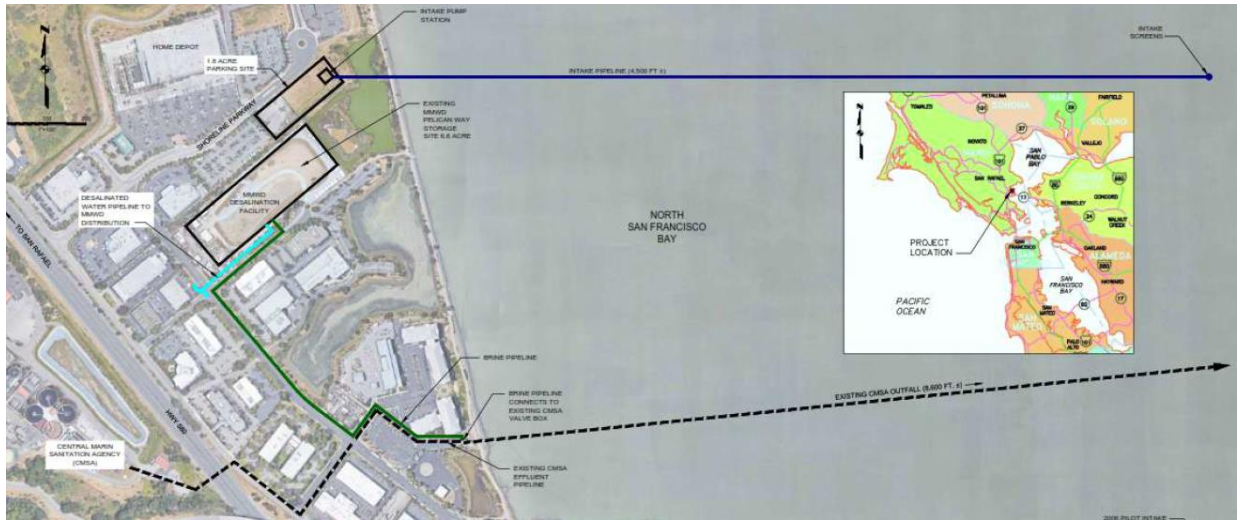
Desalination

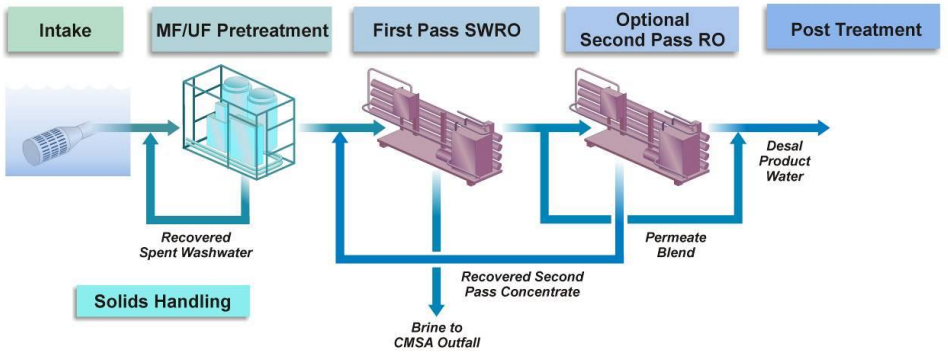
Desalination

1. Marin Regional Desalination Facility
2. Containerized/Leased Desalination Facility
3. Bay Area Regional Desalination Facility
4. Petaluma Brackish Regional Desalination

Option 1: Marin Regional Desalination Facility (MRDF)

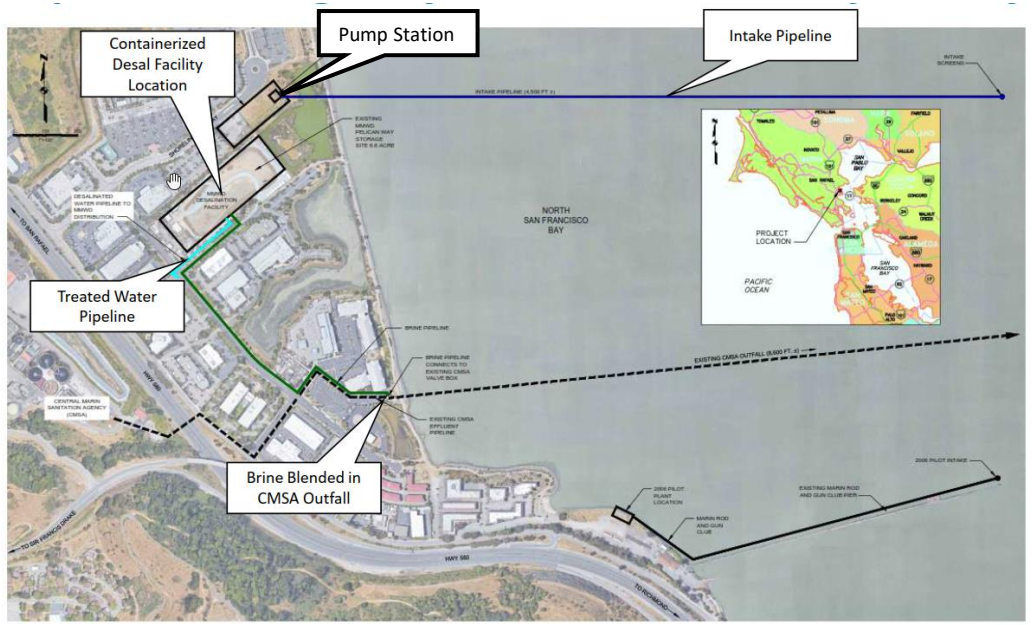
- Description
  - Permanent facility at Pelican Way storage site
  - Intake pump station on un-developed property north of PW site
  - 5-mgd capacity, expandable to 10 or 15 mgd
  - Treated water connections to existing distribution system in Forbes and Ross pressure zones
- Treatment Process
  - Open (screened) intake and pump station
  - Strainer (fine screen)
  - Micro- or ultra-filtration with coagulant feed
  - 1st pass reverse osmosis (RO)
  - 2nd pass RO (optional)
  - Post treatment (remineralization, disinfection, corrosion control and fluoridation)
  - Residuals treatment and offsite solids disposal
- Brine discharge to CMSA outfall
- Considerations
  - Update of EIR and CEQA
  - Considerable timeline to obtain all required permits
  - O&M strategy if used for drought mitigation only

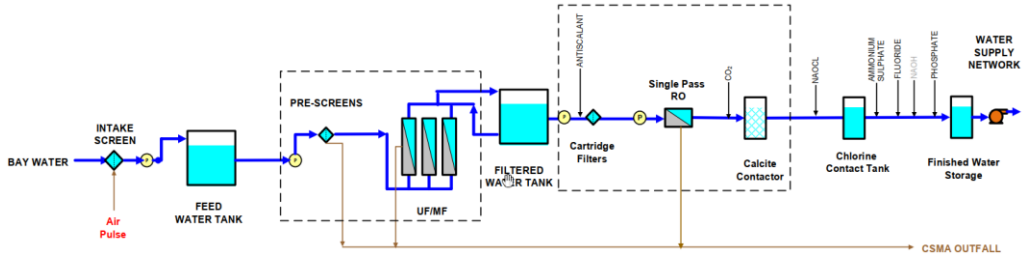




Option 2: Containerized Desalination Facility

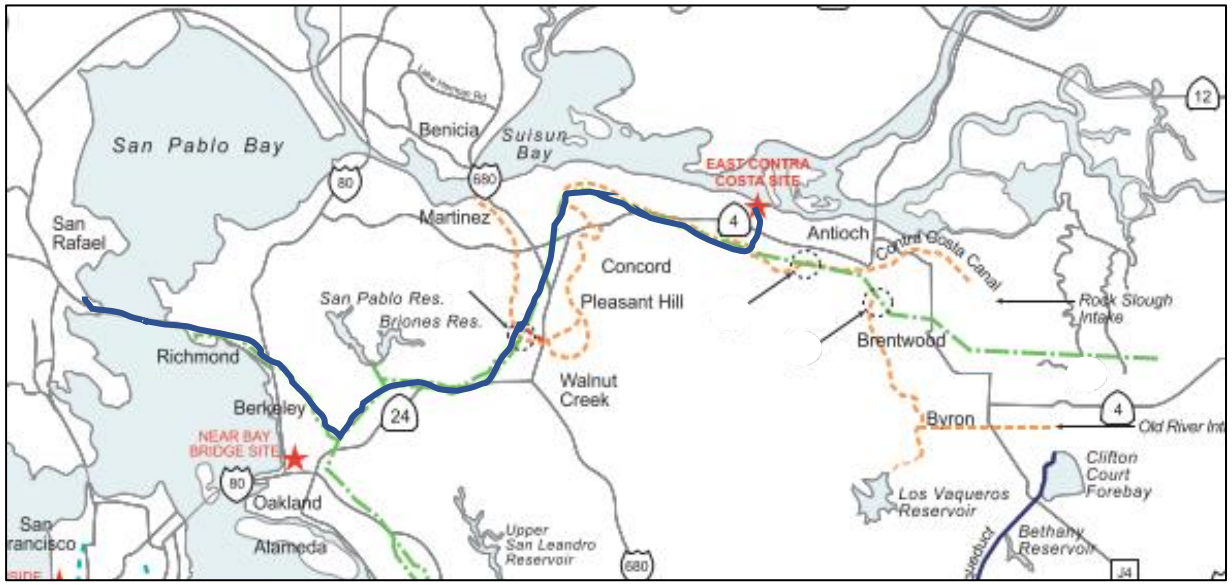
- Description:
  - 5.4-mgd capacity (three 1.8-mgd systems)
  - Integrated, containerized system for process equipment
  - Could be leased or purchased
  - Default provider: Osmoflo (Australia); other providers (Suez, Seven Seas)
- Treatment Process:
  - Open (screened) intake and pump station
  - Strainer (fine screen)
  - Micro- or ultra-filtration
  - 1st pass reverse osmosis (RO)
  - Post treatment (remineralization, disinfection, corrosion control and fluoridation)
  - Treated water
- Brine (and backwash waste) discharge to CMSA outfall
- Considerations:
  - Update of EIR and CEQA
  - Considerable timeline to obtain all required permits
  - O&M strategy if used for drought mitigation only
  - Equipment availability and reliability

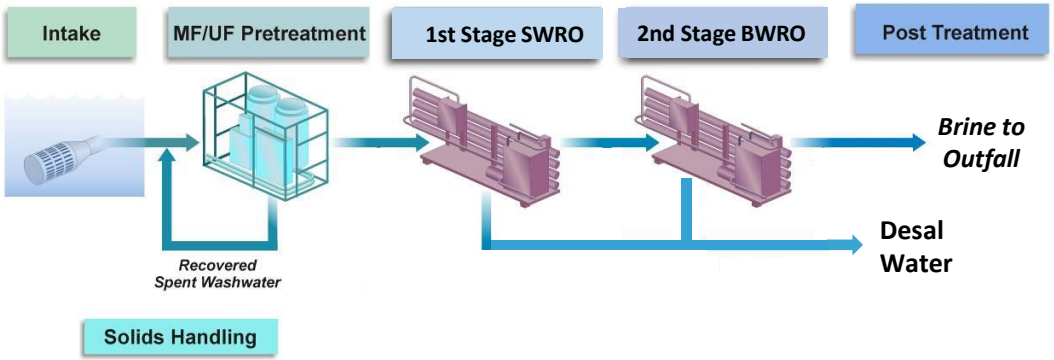




Option 3: Bay Area Regional Desalination Facility (BARDF)

- Partners
  - CCWD, EBMUD, SFPUC, Valley Water, Zone 7 Water Agency
- Description
  - Intake (existing) and desal facility at CCWD Mallard Slough site
  - 20-mgd capacity; 5 mgd dedicated to MMWD
  - Treated water wheeled to Pelican Way site
  - Store and pump from Pelican Way into distribution system (similar to Option 1)
- Treatment Process
  - Similar to Desal options 1 and 2 except:
    - 2-stage seawater/brackish RO system
    - Higher recovery (82 versus 45%)
- Brine discharge to CCCSD or DDSD outfall
- Considerations
  - Availability of water given other partner's needs
  - Minimal MMWD permit requirements
  - Fewer project permits and shorter permitting





Desalination Options Cost Estimate Summary

Alternative	Option 1A: Marin Regional Desal Facility-5 mgd	Option 1B: Marin Regional Desal Facility-10 mgd	Option 1C: Marin Regional Desal Facility-15 mgd	Option 2: Containerized/Leased Desal Facility	Option 3: Bay Area Desal Facility (1,2,3)	Option 4: Petaluma Brackish Desal
Capital Cost	$356,728,000	$431,835,000	$502,032,000	$143,648,000	$703,372,600	In progress
Annual O&M Cost	$ 14,999,000	$25,265,000	$35,076,000	$9,369,300	$6,873,324	
Total Annualized Cost	$33,199,000	$47,297,000	$60,689,000	$59,226,507	$21,840,324	
Yield, AFY	5600	11200	16800	6048	5600	2240
Cost per AFY	**$5,900**	**$4,200**	**$3,600**	**$9,793**	**$4,040**	**$1700-2500**

** Cost estimates should be considered DRAFT. Updates are likely as evaluation continues to progress. Typical expected accuracy range for this class estimate (Class 5) is –20 to –50 percent on the low side and +30 to +100 percent on the high side.

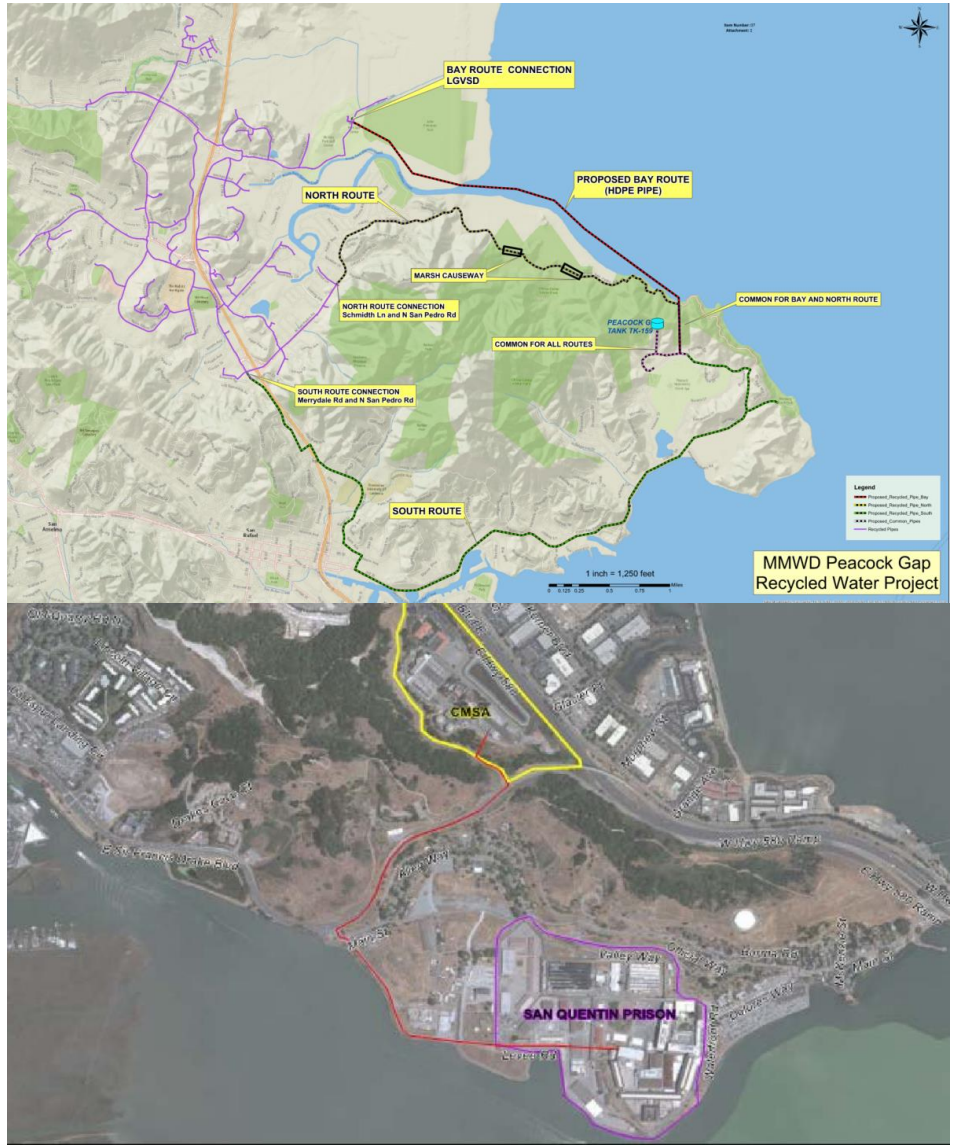
Water Reuse

Water Reuse

1. Recycled Water – expansion of non-potable reuse system (LGVSD-Peacock Gap; CMSA-San Quentin)
2. Indirect Potable Reuse (IPR) – Advanced treatment, discharge to Kent Lake
3. Environmental releases – Discharge to Kent Lake (same as IPR)
4. Direct Potable reuse (DPR) – Advanced treatment for DPR, CMSA to distribution system, or discharge to Bon Tempe Lake for Bon Tempe WTP intake

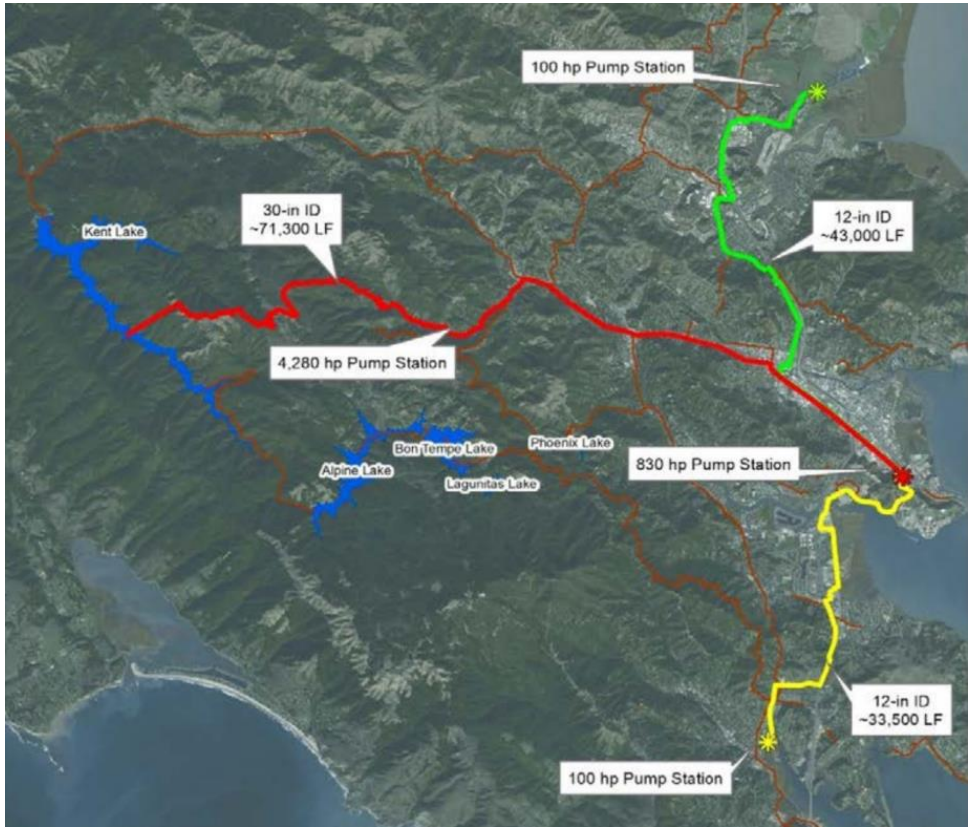
Option 1: Non-Potable Reuse Expansion

- Description:
  - Expansion of LGVSD RW distribution system to provide disinfected tertiary RW to Peacock Gap Golf Course (166 AFY)
    - Ongoing project, using existing 5 MGD LGVSD recycled water treatment plant for disinfected tertiary
    - CIP budgeted $11M
    - Annual Demand 166 AFY
  - Installation of membrane (MF) at CMSA, provide disinfected tertiary RW to San Quentin Prison (154 AFY)
    - Identified in Water Supply Plan 2040, constructing microfiltration-based disinfected tertiary treatment plant
    - Delivery of recycled water to San Quentin Prison for non-potable reuse
    - 6-inch, 3,800 LF distribution pipeline
    - 50 HP 290 gpm pump station
    - Annual Demand 154 AFY
- Considerations
  - Demand is seasonal, limited volume
  - Other non-potable reuse options considered are small yield (less than 150AFY)



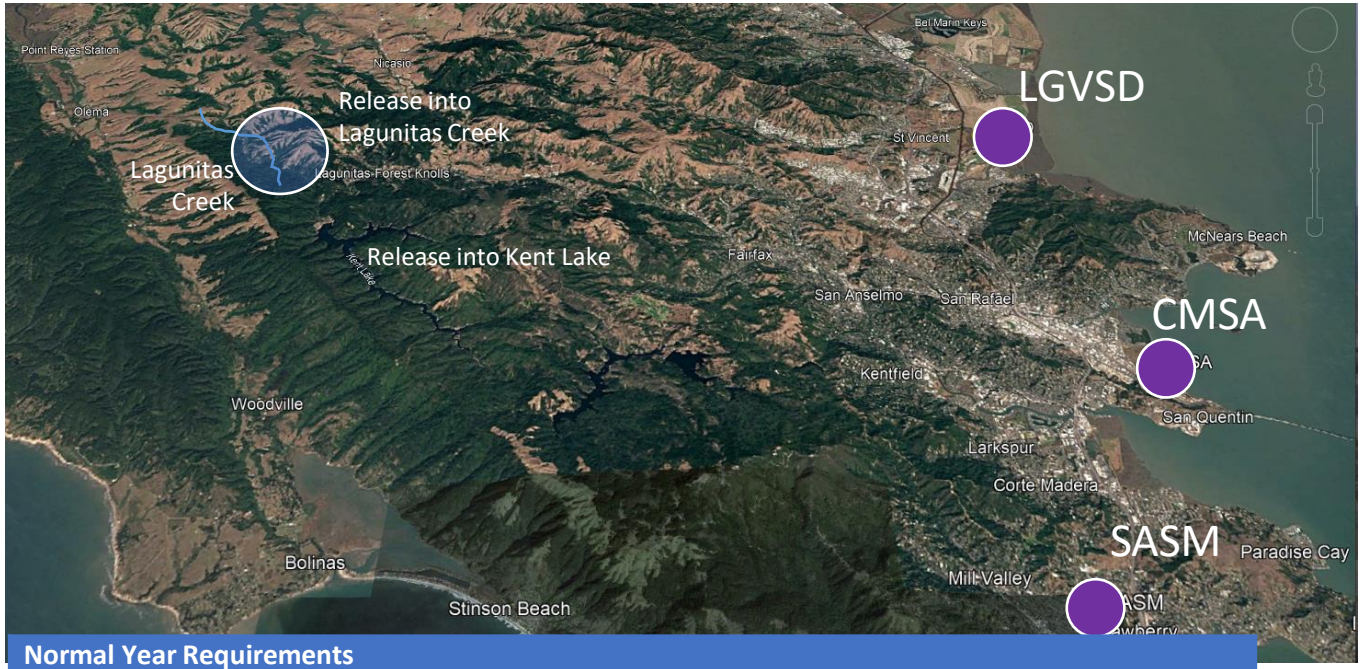
Option 2: Indirect Potable Reuse (IPR)

- Description
  - Collect secondary effluent from LGVSD and SASM to CMSA
  - Provide Advanced Water Purification Facility up to 8.8 mgd (7 mgd yield = 7,840 AFY)
    - Ultrafiltration, Reverse Osmosis, UV-AOP, RO reject to CMSA outfall
  - Advanced Water Purification Facility designed to meet Surface Water Augmentation IPR treatment requirements:
  - Convey purified water to Kent Lake
  - Discharge RO reject to CMSA effluent
  - Purified water delivered to Kent Lake could be considered as either surface water augmentation IPR or in-lieu stream flow
- Considerations
  - Water balance (secondary effluent availability for IPR)
  - Discharge permit for RO reject
  - CMSA footprint to accommodate the AWPF
  - Kent Lake is primary release for Lagunitas Creek



Option 3: In-lieu for Streamflow Release

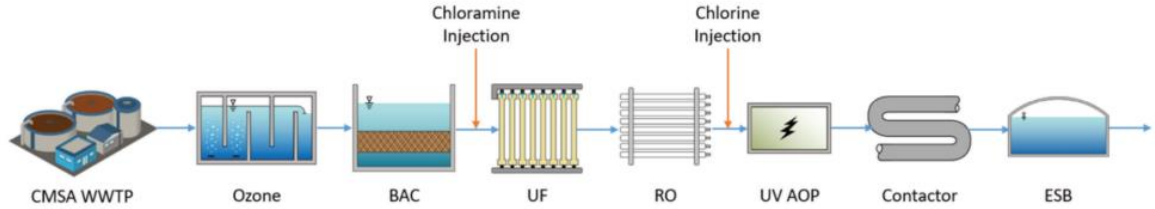
- Description
  - Provide disinfected tertiary RW, cool to adjust temperature, release to Lagunitas Creek, or
  - Provide IPR as described, discharge purified water to Kent Lake to provide both IPR and streamflow augmentation
- Considerations
  - Effluent temperature will be higher than Lagunitas Creek temperature (need temperature adjustment or discharge to larger water body - Kent Lake)
  - Tertiary effluent may not meet some of quality requirements (e.g., nutrients, TDS/EC, metals)
  - Due to seasonal minimum flow requirements, potentially available effluent (7,840 AFY) exceeds requirements during dry season, not enough during wet season
  - In dry year, dry season, only 4,300 AFY flow is recognized for in-lieu streamflow release
  - Fold into the Regional IPR concept – dual benefit between IPR and Streamflow, recognize entire available effluent flow



Normal Year Requirements				
Time Period			Flow, cfs	Flow, AFY
November 1/15*	-	December 31	20	14,500
January 1	-	March 15	25	18,100
March 16	-	March 31	20	14,500
April 1	-	April 30	16	11,600
May 1	-	June 15	12	8,700
June 16	-	November 1/15*	8	5,800
Dry Year Requirements				
Time Period			Flow, cfs	Flow, AFY
November 1/15*	-	March 31	20	14,500
April 1	-	April 30	14	10,100
May 1	-	June 15	10	7,200
June 16	-	November 1/15	6	4,300

Option 4: Direct Potable Reuse (DPR)

- Description
  - Advanced Water Purification Facility at CMSA
    - Only treat CMSA effluent, connection to exiting distribution (treated water augmentation) at up to 4 mgd, or
    - Convey secondary effluent from LGVSD and SASM, treat up to 8.8 mgd produce up to 7 mgd purified water and convey to Bon Tempe Lake (raw water augmentation)
  - Advanced Water Purification Facility targeted to meet current DRAFT DPR treatment requirements:
  - Treatment Trains include:
    - Ozone/BAC
    - Ultrafiltration
    - Reverse Osmosis
    - UV-Advanced Oxidation
    - Chlorine contact
    - Dechlorination (for Bon Tempe discharge only)
    - Purified water transfer pump station
    - Engineered Storage/Bon Tempe Lake discharge
    - RO reject disposal to CMSA outfall
- Considerations
  - Water balance (secondary effluent availability for DPR)
  - Discharge permit for RO reject
  - CMSA footprint to accommodate the AWPF



Water Reuse Options Cost Estimate Summary

Alternative	Option 1A: Non-Potable CMSA	Option 1B: Non-Potable Peacock Gap	Option 2: Regional IPR (3-In lieu Streamflow)	Option 4A: CMSA DPR (Treated Water Augmentation)	Option 4B: Regional DPR (Raw Water Augmentation)
Capital Cost	$ 10,819,000	$ 11,932,000	$ 451,965,000	$ 124,395,000	$ 382,679,000
Annual O&M Cost	$ 147,000	$ 1,080,865	$ 9,964,000	$ 8,834,000	$ 15,747,000
Total Annualized Cost	$ 699,000	$ 166,000	$ 33,023,000	$ 15,328,000	$ 35,039,000
Yield, AFY	200	166	7840	4480	7840
Cost per AF	**$ 3,500**	**$ 4,700**	**$ 4,200**	**$ 3,400**	**$ 4,500**

** Cost estimates should be considered DRAFT. Updates are likely as evaluation continues to progress. Typical expected accuracy range for this class estimate (Class 5) is –20 to –50 percent on the low side and +30 to +100 percent on the high side.

Local Storage Augmentation

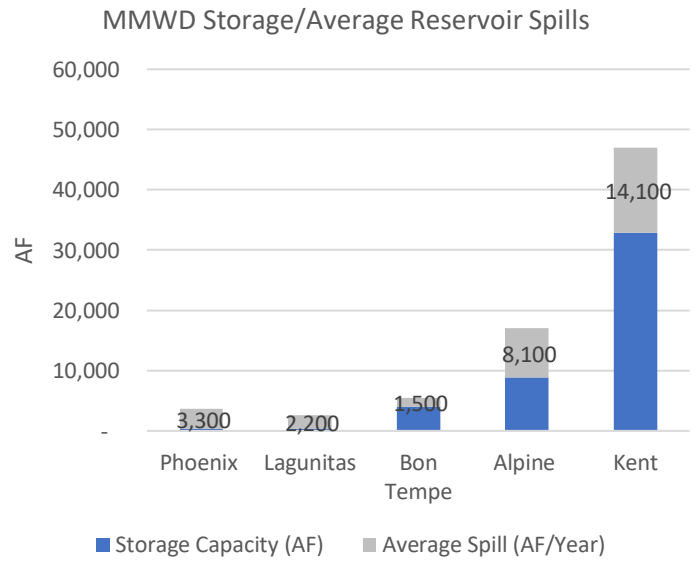
Local Storage Augmentation

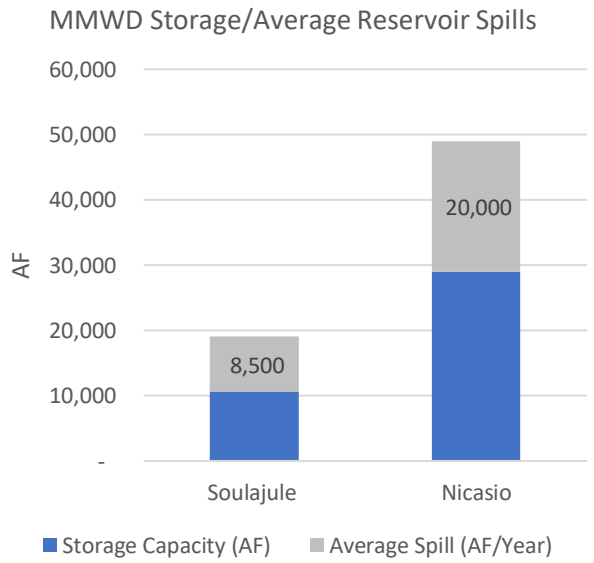
1. Raising Soulajule Dam
2. Dredging Nicasio Lake
3. Movable Spillway Gates

Source: Salix "Expert desilting or dredging of ponds, lakes, and reservoirs" (http://www.salixrw.com/techniques/lake-desilting/)

Storage Expansion Options Opportunities

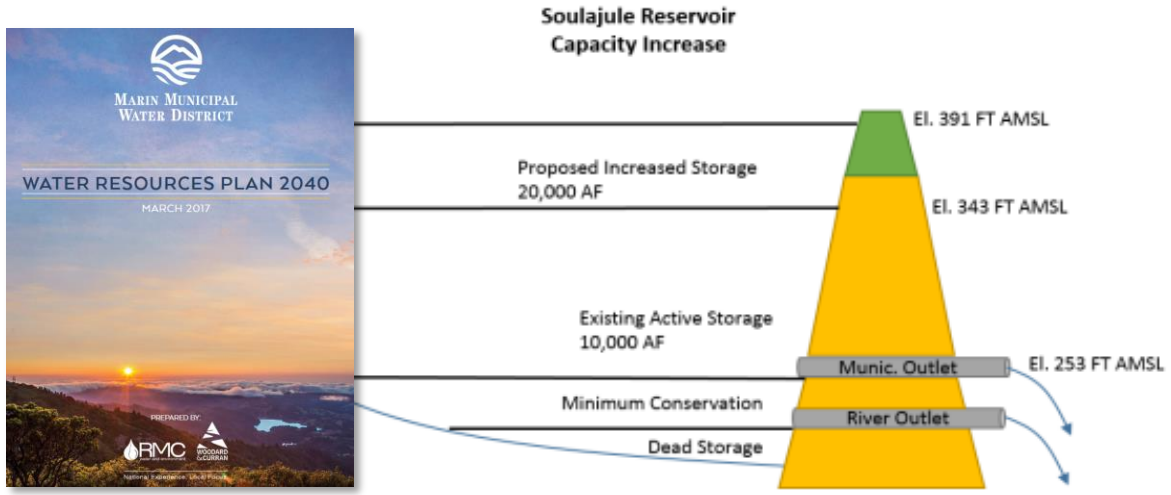
- MMWD reservoirs spills average ~53,000 AFY (Last 12 years), Average environmental releases ~ 10,000 AFY
- Environmental releases not being proportionally scaled during critical dry years

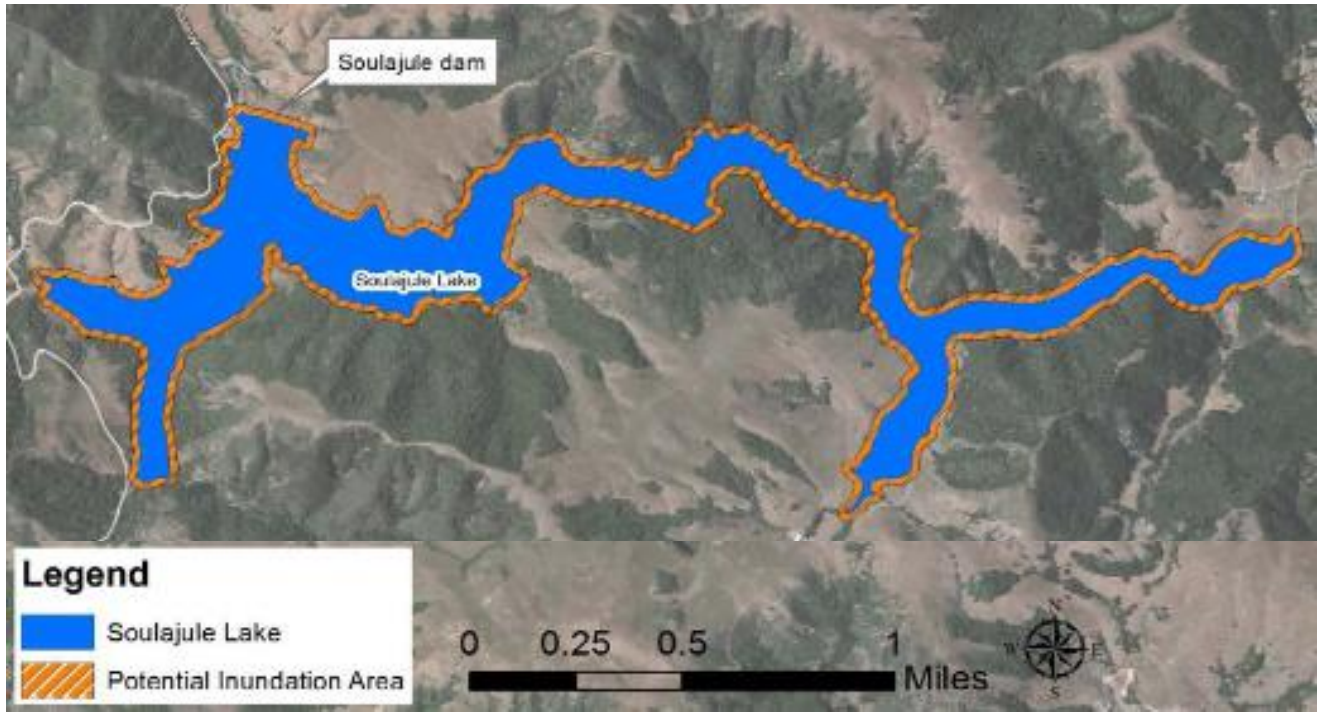




Option 1: Raising Soulajule Dam

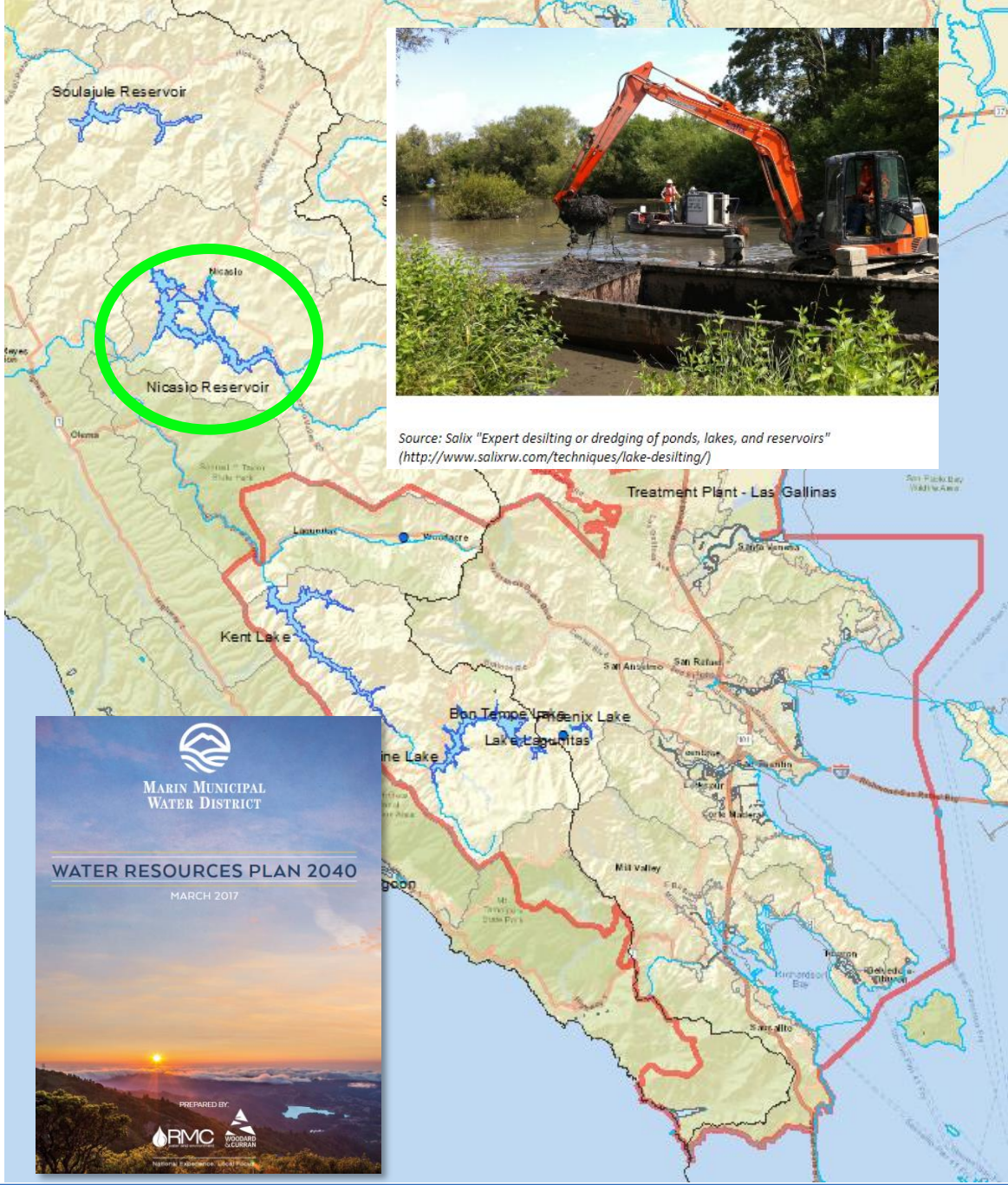
- Description
  - Increase Soulajule Dam height by 48 feet
  - Additional 20,000 AF of storage in Soulajule (Total storage from 10,000 AF to 30,000 AF).
  - Potential Yield ~4,000 AFY
  - Electrification of Soulajule
- Considerations
  - Dam adequacy and structural integrity
  - New inundated areas
  - Water rights





Option 2: Dredging Nicasio Lake

- Potential yield ~ 1,000 AFY for 10 years
- Challenges: Environmental and fishing interests may oppose the dredging due to potential negative impacts associated with dredging large amounts of sediment, including mobilizing contaminants that have settled in the sediment.



Source: Salix "Expert desilting or dredging of ponds, lakes, and reservoirs" (http://www.salixrw.com/techniques/lake-desilting/)

Option 3: Movable Spillway Gates

- Description
  - Increase reservoir storage through installation of movable spillway gates
  - Gates to be installed and operated to retain additional storage during wet periods
  - Likely limited to 3 feet of increase
- Considerations
  - Adequacy of spillway and dam
  - Increased inundated lake area

Relative Increase in Storage Capacity with Increase in Spillway Height

Elevation Increase (ft)	Kent Lake (acre-feet)	Nicasio (acre-feet)	Soulajule (acre-feet) (earthen)	Lagunitas (acre-feet)	Alpine Lake (acre-feet)
1	440	750	300	20	230
2	880	1520	620	40	460
3	**1330**	**2310**	**930**	**60**	**700**
4	1780	3110	1250	80	930
5	2240	3920	1580	100	1180

Local Storage Options Cost Estimate Summary

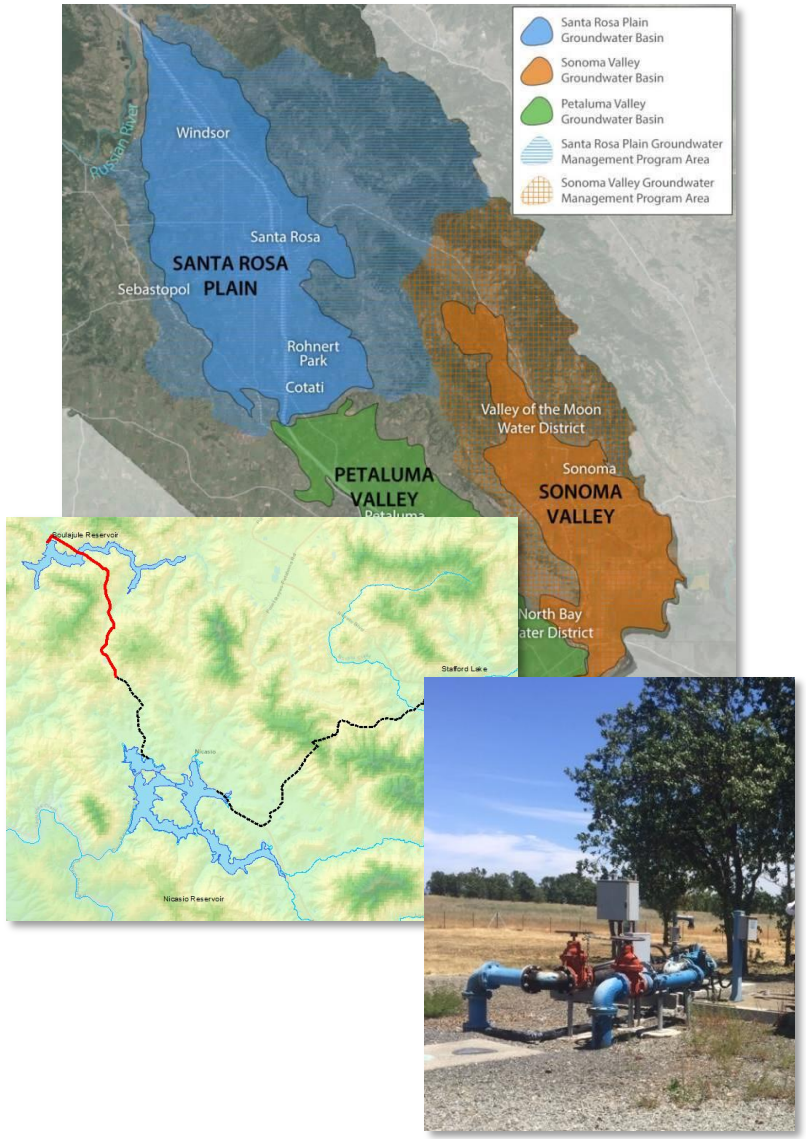
Alternative	Option 1: Raising Soulajule	Option 2: Dredging Nicasio	Option 3: Movable Spillway Gates
Capital Cost	$128,824,000	$166,062,000	$5,000,000
Annual O&M Cost	$4,177,000	$-	$20,000
Total Annualized Cost	$10,750,000	$19,468,000	$71,000
Yield, AFY	4000	1000	350
Cost per AFY	**$2,700**	**$19,500**	**$800**

** Cost estimates should be considered DRAFT. Updates are likely as evaluation continues to progress. Typical expected accuracy range for this class estimate (Class 5) is –20 to –50 percent on the low side and +30 to +100 percent on the high side.

Sonoma-Marin Partnerships

Sonoma-Marin Partnerships

1. Maximize Use of Sonoma Water in Winter
2. Develop Dedicated Conveyance to Soulajule or Nicasio Reservoirs
3. Groundwater Well Rehabilitation
4. Regional Groundwater Bank



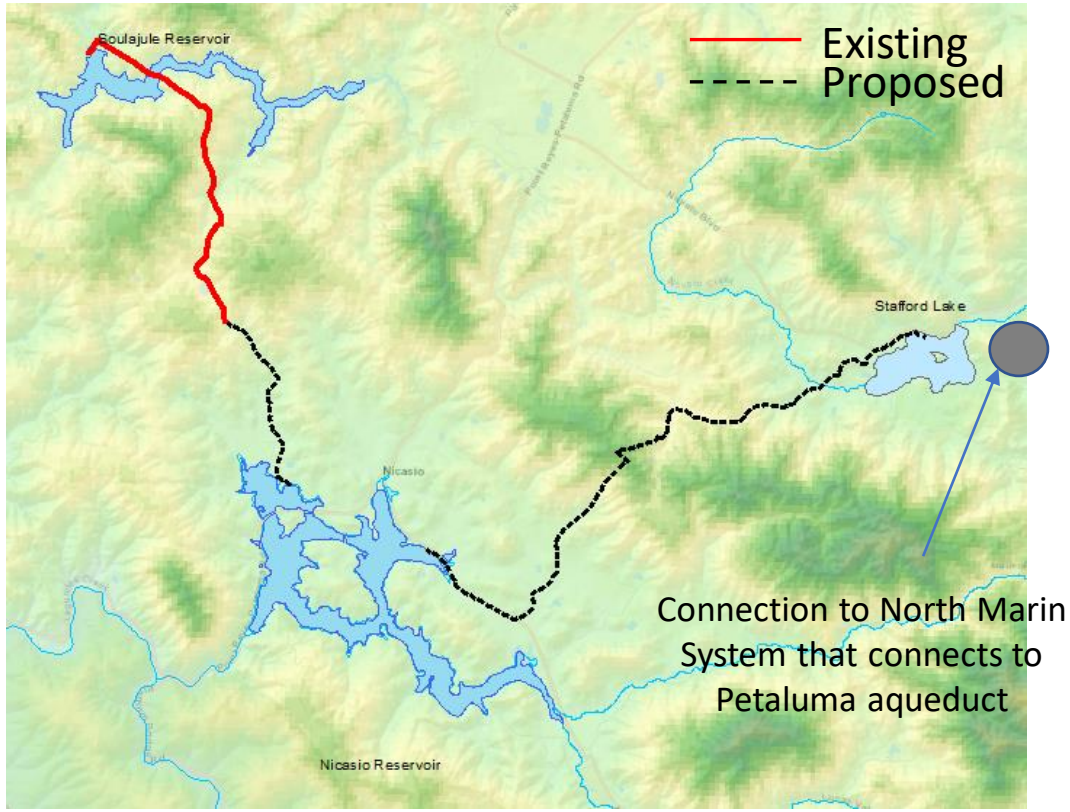
Option 1: Maximize Use of Sonoma Water in Winter

- Operate to Maximize Use of Surplus Russian River Water in Winter
  - Maximize use in Winter
  - Maximize take of Sonoma Water up to contractual amount 14,300 AFY (12.8 mgd)
  - Reduce use of MMWD local reservoir water supply
- Existing Conveyance Limitations
  - Kastania (21.5 mgd) Pump Station Improvements and Ignacio Pump Stations (14.8 mgd)
  - Bottleneck becomes system winter demands (14 mgd)
- Develop Integrated Reservoir Operational Strategy
  - Optimize the balance of MMWD reservoir and Sonoma Water supplies dependent on hydrology, storage conditions, and demand

Russian River Collectors, Diversion Dam, and Fish Passage

Option 2: Develop Dedicated Conveyance to Soulajule or Nicasio Reservoirs

- Description
  - Maximize use of Sonoma Winter Water through dedicated conveyance
  - South Transmission System pipeline to increase conveyance between Cotati tanks and Kastania
  - Connection between Lake Stafford and Soulajule or Nicasio reservoirs.
  - Pump station to augment delivery of water
  - Electrification of Soulajule pump station
- Considerations
  - North Marin Water District seeking similar operation
  - Pumping to watershed divide or all the way to reservoir
  - Potential risk of spill if prolonged wet period occurs
  - Could be linked with storage augmentation

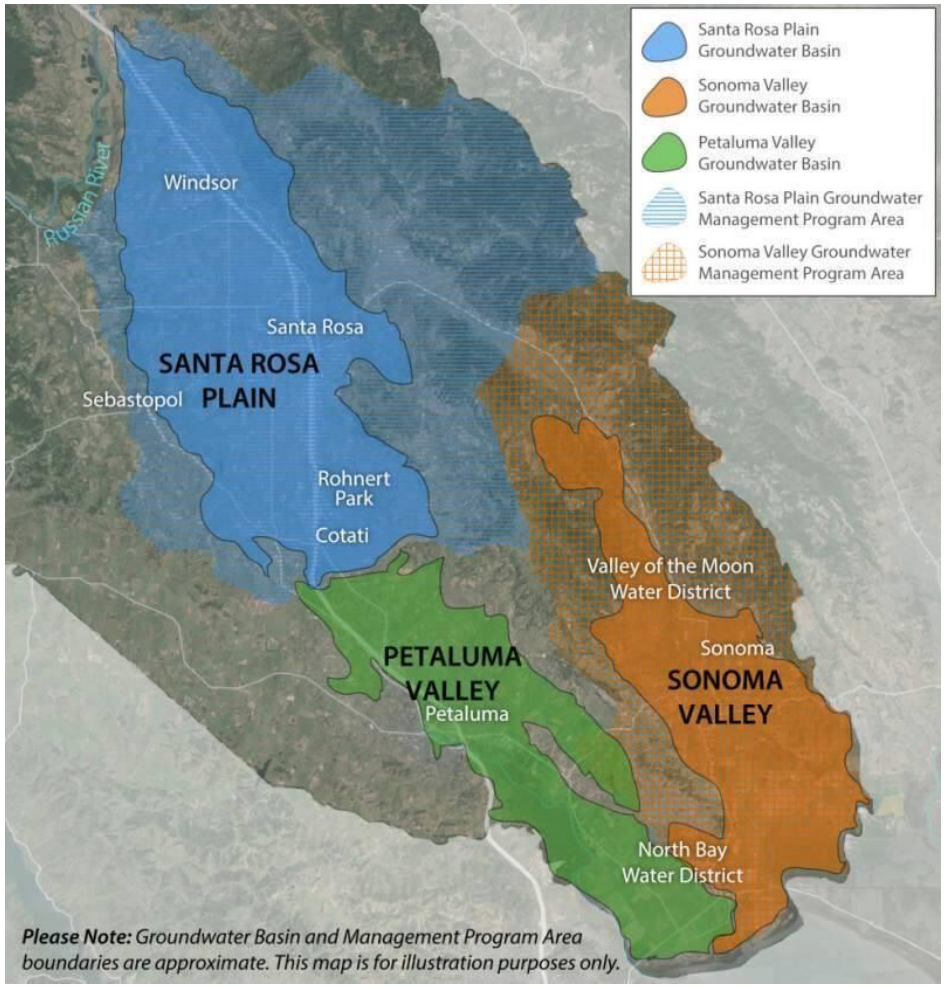


Option 3: Groundwater Well Rehabilitation

- Sonoma Water operates groundwater production wells in the San Rosa Plain
- Wells have not been activated in recent years
- Rehabilitation of wells is underway (5.5 mgd or ~6,000 AFY)
  - Todd Road Well (1.4 mgd)
  - Sebastopol Road Well (2.1 mgd)
  - Occidental Road Well (2.0 mgd)
- Increasing production will provide more reliable delivery to MMWD

Option 4: Regional Groundwater Bank

- Potential Regional Groundwater Bank
  - Santa Rosa Plain
  - Sonoma Valley
  - Petaluma Valley
- Facilities
  - ASR Wells in Each Basin
  - Connections to aqueduct
  - Treatment?
- Water Storage Operation
  - Put: Winter or Recycled Water
  - Storage: Participant Pools + contribution to basin
  - Take: Drought year pumping
- Delivery
  - Direct delivery or in-lieu exchanges
- Considerations
  - Groundwater Sustainability Agencies (GSAs) developing Plans
  - Alignment with benefits for overlying pumpers
  - Exchange agreements and accounting systems



Sonoma-Marin Partnership Options Cost Estimate Summary

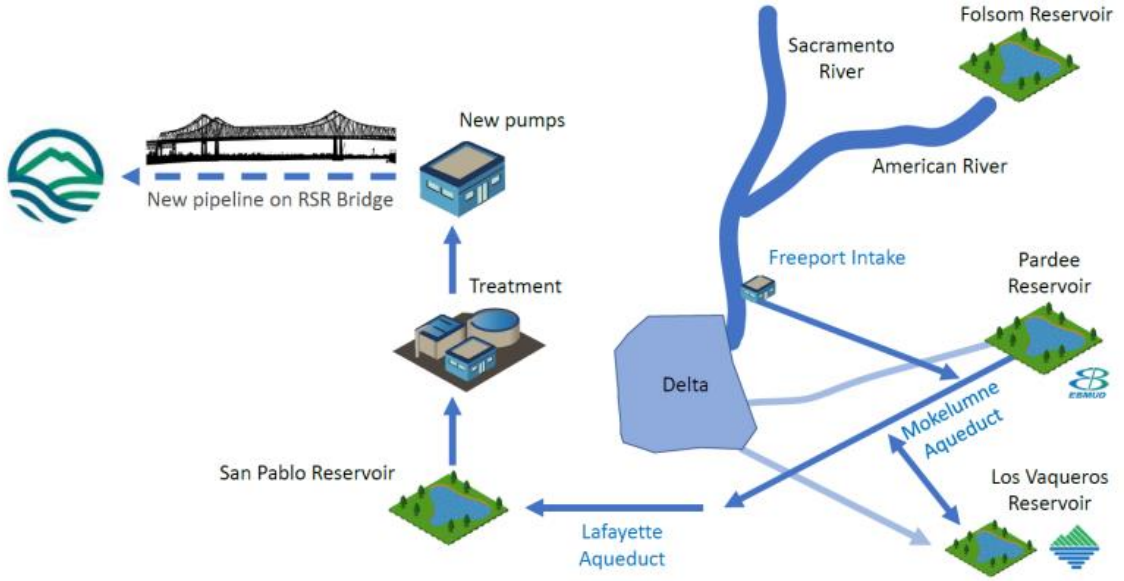
Alternative	Option 1: Maximize Use of Winter Water	Option 2: Dedicated Conveyance to MMWD Reservoirs	Option 3: Sonoma Water Well Rehabilitation	Option 4: Regional Groundwater Bank
Capital Cost		$139,000,000	$7,000,000	$20,000,000
Annual O&M Cost	$6,500,000	$-	$2,600,000	$3,900,000
Total Annualized Cost	$6,500,000	$20,400,000	$2,957,000	$4,920,000
Yield, AFY	5000	8000	2000	3000
Cost per AFY	**$1,300**	**$3,400**	**$1500**	**$1600**

** Cost estimates should be considered DRAFT. Updates are likely as evaluation continues to progress. Typical expected accuracy range for this class estimate (Class 5) is –20 to –50 percent on the low side and +30 to +100 percent on the high side.

Water Purchases with Conveyance through Bay Interties

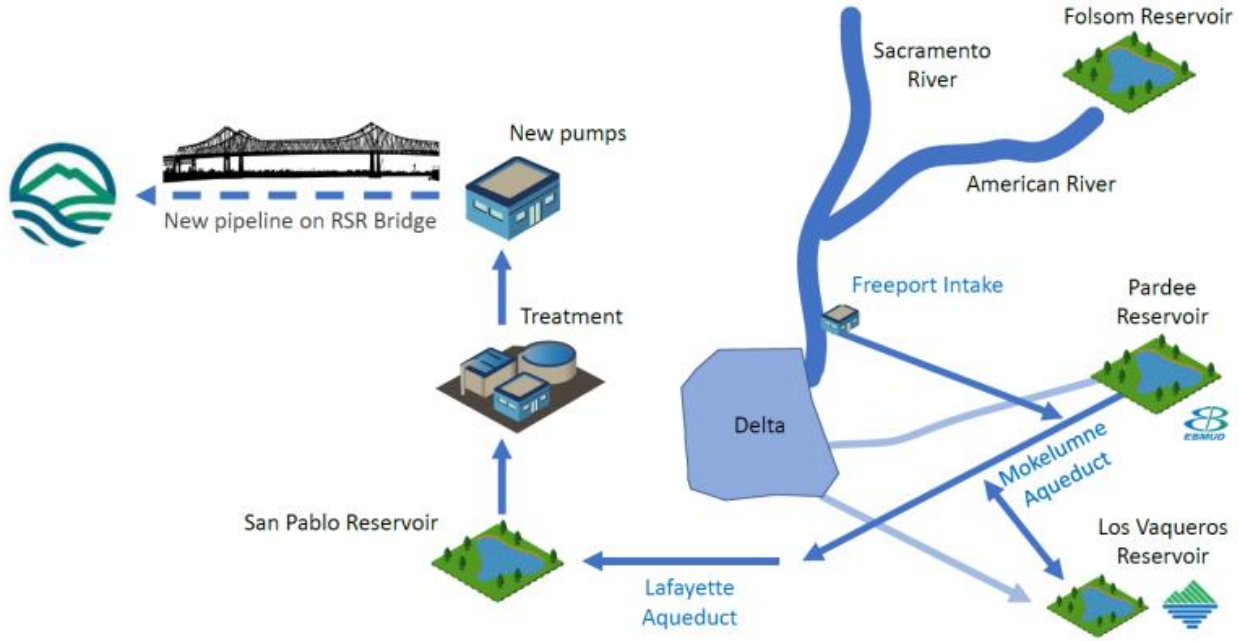
Water Purchases with Conveyance through Bay Interties

- EBMUD Intertie (Sac Valley purchases)
- CCWD Intertie (Sac Valley purchases)
- North Bay Aqueduct Intertie (Sac Valley purchases)
- SFPUC Intertie (Golden Gate Bridge)



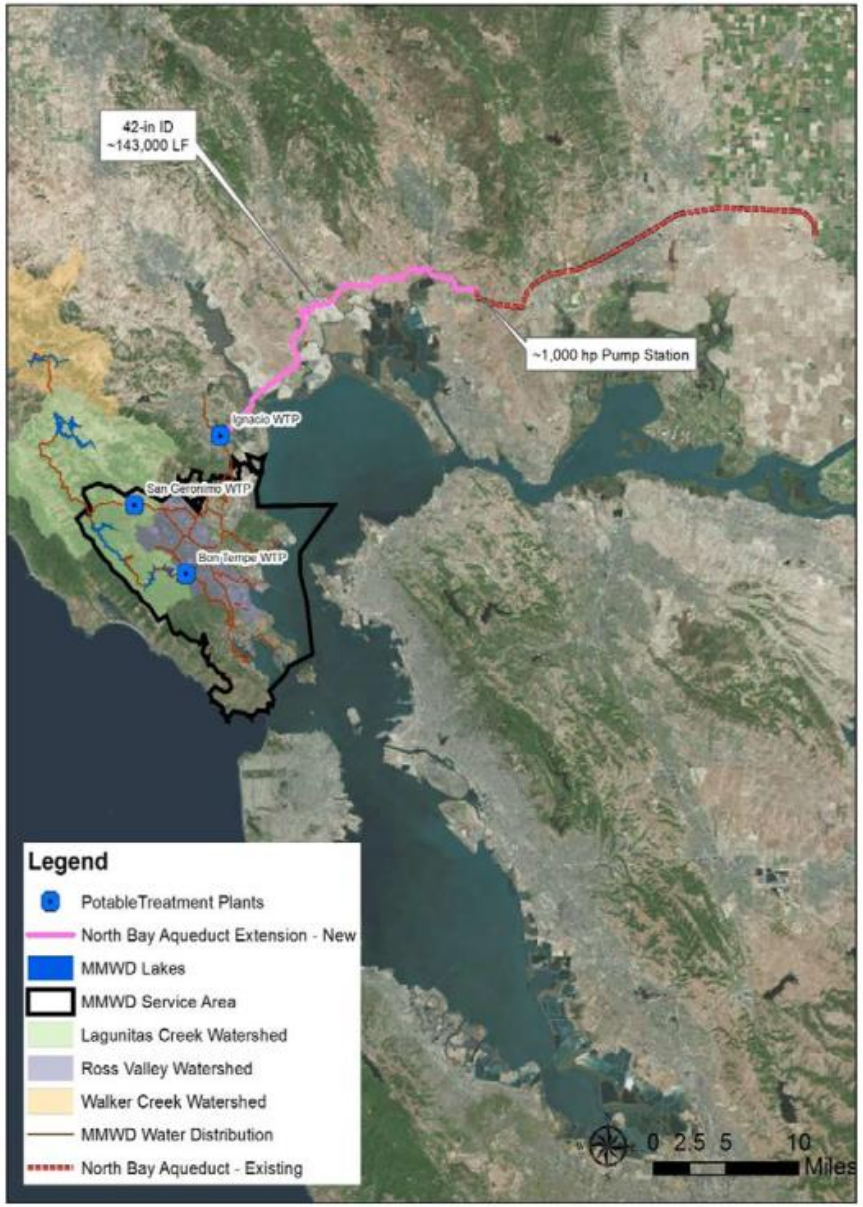
EBMUD or CCWD Intertie

- Sac Valley water purchases conveyed through EBMUD or CCWD systems
- Pipeline to connect to EBMUD or CCWD systems and across San Rafael Bridge (27”)
- MMWD tie in near CMSA
- Richmond distribution improvements for EBMUD customers
- Alternative to connect to CCWD, rather than EBMUD
- Significant permitting requirements



North Bay Aqueduct - Intertie

- Sac Valley water purchases conveyed through North Bay Aqueduct
- Pipeline and pump station to connect to MMWD system
- Potential connection to Sonoma Water system for regional supply



Water Purchases through Bay Intertie Options Cost Estimate Summary

Alternative	Option 1: EBMUD Intertie	Option 2: CCWD Aqueduct Intertie	Option 3: North Bay Aqueduct Intertie	Option 4: SFPUC Intertie
Capital Cost	$159,900,000	$485,000,000	$300,000,000	In progress
Annual O&M Cost	$14,202,000	$11,457,000	$6,365,000	
Total Annualized Cost	$22,360,000	$36,201,000	$21,651,000	
Yield, AFY	9000	9000	5000	
Cost per AFY	**$2,500**	**$4,000**	**$4,300**	

** Cost estimates should be considered DRAFT. Updates are likely as evaluation continues to progress. Typical expected accuracy range for this class estimate (Class 5) is –20 to –50 percent on the low side and +30 to +100 percent on the high side.

Status and Next Steps

Work in Progress

- Water management alternatives, costs, and other evaluation criteria being further progressed
- Integration of water management alternatives into decision support model is **necessary** to evaluate yield of supplies when integrated into system
- Structure for forecast-based decision-making on integrating and optimizing supplies
- Detailed evaluation criteria

Strategic Water Supply Assessment: Schedule

- June 28 (5pm-7pm) – Initial Review of Water Management Options
- **July 12 (5pm-7pm) – Review Desalination and Recycled Water**
- July 19 (7:30pm – 9:30pm) – Review Interties, Local Supply Enhancement and Sonoma options
- July TBD – Public Workshop
- August 9 (5pm-7pm) – Evaluation of Water Management Alternatives
- August 23 (5pm-7pm) – Evaluation of Water management alternatives
- August TBD – Public Workshop

Q & A