**NORTH MARIN WATER DISTRICT**  
**AGENDA - REGULAR MEETING**  
January 25, 2022 – 6:00 p.m.  
Location: Virtual Meeting  
Novato, California

Information about and copies of supporting materials on agenda items are available for public review at 999 Rush Creek Place, Novato, at the Reception Desk, or by calling the District Secretary at (415) 897-4133. A fee may be charged for copies. District facilities and meetings comply with the Americans with Disabilities Act. If special accommodations are needed, please contact the District Secretary as soon as possible, but at least two days prior to the meeting.

**ATTENTION:** This will be a virtual meeting of the Board of Directors pursuant to Assembly Bill 361 issued by the Governor of the State of California. There will not be a public location for participating in this meeting, but any interested member of the public can participate telephonically by utilizing the dial-in information printed on this agenda.

### Video Zoom Method

<table>
<thead>
<tr>
<th>CLICK ON LINK BELOW:</th>
<th>SIGN IN TO ZOOM:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Go to: <a href="https://us02web.zoom.us/j/82191971947">https://us02web.zoom.us/j/82191971947</a> OR</td>
<td>Meeting ID: 821 9197 1947</td>
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<tr>
<td>Password: 466521</td>
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### Call in Method:

Dial:  
+1 669 900 9128  
+1 253 215 8782  
+1 346 248 7799  
+1 301 715 8592  
+1 312 626 6799  
+1 646 558 8656  

Meeting ID: 821 9197 1947#  
Participant ID: #  
Password: 466521#  

For clarity of discussion, the Public is requested to MUTE except:  
1. During Open Time for public expression item.  
2. Public comment period on agenda items.

**Please note:** In the event of technical difficulties during the meeting, the District Secretary will adjourn the meeting and the remainder of the agenda will be rescheduled for a future special meeting which shall be open to the public and noticed pursuant to the Brown Act.

All times are approximate and for reference only. The Board of Directors may consider an item at a different time than set forth herein.
**CALL TO ORDER**

1. **OPEN TIME: (Please observe a three-minute time limit)**

   This section of the agenda is provided so that the public may express comments on any issues not listed on the agenda that are of interest to the public and within the jurisdiction of the North Marin Water District. When comments are made about matters not on the agenda, Board members can ask questions for clarification, respond to statements or questions from members of the public, refer a matter to staff, or direct staff to place a matter of business on a future agenda. The public may also express comments on agenda items at the time of Board consideration.

2. **LOCAL WATER SUPPLY ENHANCEMENT STUDY WORKSHOP**

3. **ADJOURNMENT**
Purpose

• Provide the Board and the Public a preview

• Review the following:
  o Developed water supply options
  o Criteria for evaluation
  o Criteria scoring and weighting
  o Next steps
Introductions

North Marin Water District
- Project Manager: Tony Williams, Assistant General Manager/Chief Engineer
- Drew McIntyre, General Manager
- Robert Clark, Operations/Maintenance Superintendent

West Yost
- Project Manager: Rhodora Biagtan
- Project Engineer: Megan McWilliams
- Technical Experts:
  - Groundwater and ASR: Ken Loy
  - Recycled Water: Anita Jain
  - Indirect Potable Reuse: Charles Hardy
  - Stormwater: Doug Moore
  - Treatment Plant Optimization: Craig Thompson, Charles Hardy
  - Treatment Optimization and Desalination: Kathryn Gies
  - Permitting and Regulation Compliance: Sandi Potter
Water Supply Alternatives
Developed Water Supply Alternatives/Variations

- Aquifer Storage Recovery in Novato Basin
- Recycled Water System Expansion
- Indirect Potable Reuse
- Improve Stafford Treatment Plant Process Water Recapture Efficiency
- Divert Captured Stormwater Into Stafford Lake
- Increase Stafford Lake Storage Capacity
- Desalination
Aquifer Storage Recovery in Novato Basin
Ken Loy
Aquifer Storage Recovery in Novato Basin

- Aquifer storage is very low
  - Estimated at 50-100 acre-feet (AF)
  - Estimate accounts for potentially usable acreage of the Novato Basin, basin thickness, and aquifer characteristics

- Storage and recovery rates are low

- Tens of gallons per minute
  - Estimate based on existing wells

- Costs per acre-foot would be infeasibly high
Regional Aquifer Storage Recovery

- NMWD may benefit from a regional ASR program, if excess treated water allocated to NMWD can be stored and recovered when needed.

- Regional groundwater banking on other basins (Santa Rosa Plain, Sonoma Valley, Petaluma)
Aquifer Storage Recovery
Preliminary Conclusions and Recommendations

• Continued regional coordination is recommended
• Estimated yield – 50 to 100 AF
• Cost estimate for local ASR is in progress
Discussion and Questions
Recycled Water System Expansion
Anita Jain
Recycled Water Expansion

• Focus of this effort:
  • Evaluate expansion of the existing distribution system
  • Explore other opportunities to increase recycled water use without expanding the existing distribution system
Recycled Water Expansion North and Central

<table>
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<tr>
<th>Service Area</th>
<th>Projected Recycled Water Demand, AFY</th>
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<tr>
<td>North</td>
<td>100</td>
</tr>
<tr>
<td>Central</td>
<td>100</td>
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<tr>
<td>Total</td>
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Recycled Water Expansion South

<table>
<thead>
<tr>
<th>Service Area</th>
<th>Projected Recycled Water Demand, AFY</th>
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</thead>
<tbody>
<tr>
<td>South</td>
<td>20</td>
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</table>
Recycled Water Expansion

<table>
<thead>
<tr>
<th>Service Area</th>
<th>Projected Recycled Water Demand, AFY</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>100</td>
</tr>
<tr>
<td>Central</td>
<td>100</td>
</tr>
<tr>
<td>South</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>220</td>
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</table>

Potential potable water offset of 220 AFY
Other Near-Term Opportunities Without Distribution System Expansion

- Construct additional hydrants or commercial fill stations
  - NMWD installed two new hydrants in 2021

- Optimize residential fill station operations to increase use

- Facilitate connection of in-fill sites
  - Update District regulations (Reg 18)

- Assess dual-plumbing requirements for toilet flushing
Recycled Water Use Opportunities for Future Study

- Privately-owned recycled water storage tanks
- Delivery of recycled water to residential customers
- Livestock watering
  - Prohibited by current regulations
Recycled Water System Expansion

Next Steps

• Conduct planning level hydraulic analysis to determine infrastructure sizing

• Work with the District to prioritize alignments and phasing plan for construction

• Develop planning level cost estimate

• Future Study – pending expansion timeline, confirm recycled water supply reliability to meet demand
Recycled Water Expansion
Preliminary Conclusions and Recommendations

• Potential potable water offset of up to 220 AFY with distribution system expansion

• Cost estimate for expanding the distribution system is in progress

• Continue to assess opportunities for increasing recycled water use within existing distribution system
Discussion and Questions
Indirect Potable Reuse

Charles Hardy
Indirect Potable Reuse Requirements

- State regulations allow “indirect” potable reuse through:
  - Groundwater replenishment (augmentation)
  - Surface water source augmentation

- “Full Advanced Treatment” required:
  - Disinfected Secondary Effluent
    - Las Gallinas and Novato San treat up to this point
  - Microfiltration Units
  - Reverse Osmosis Units
  - Ultraviolet/Advanced Oxidation Process
  - Storage
Indirect Potable Reuse Feasibility

- IPR water cannot mix directly with potable water

- No viable local IPR storage options
  - Groundwater aquifer
  - Surface water storage

- Groundwater Augmentation (in local groundwater basin)
  - Limited local aquifer storage available ~50-100 AF

- Surface Water Source Augmentation (at Stafford Lake)
  - Regulations require blending ratio of ≤ 10 percent and retention time ≥ 60 days
  - IPR limited by volume of Stafford Lake, even if the lake is kept full
  - Maximum potential is approximately 100 - 400 AF
Indirect Potable Reuse Infrastructure

• Unit cost of treatment prior to storage at least $3,000 per AF without economy of scale seen by other agencies with IPR

• Additional costs for groundwater recharge, injection and extraction wells and associated infrastructure

• New conveyance pipeline would be required for Stafford Lake augmentation
  o Estimated pipeline length – 28,000 linear feet
    ▪ From Novato San to Stafford Lake
  o Estimated cost - $20 million +
    ▪ 16-inch diameter transmission pipeline
Indirect Potable Reuse
Preliminary Conclusions and Recommendations

• Suggest no further analysis of (local) IPR
  o Groundwater Augmentation ~ 50 – 100 AF
  o Surface Water Augmentation ~ 100 – 400 AF

• Unit cost of treatment prior to storage ~ $3,000 per AF
  o No economy of scale seen by other agencies with IPR

• Regional IPR may be viable: potentially ~ 3,100 AFY from Novato San

• Direct potable reuse potentially viable option in future as regulations and public acceptance evolve (at least 10+ years out)
Discussion and Questions
Improve Stafford Treatment Plant Process Water Recapture Efficiency

Charles Hardy
Improve Stafford Treatment Plant Process Water Recapture Efficiency

- STP potable water production limited by wastewater discharge permit.

- STP has several reject water streams:
  - Hydrocyclone return accounts for 80-90% of total wastewater discharge
  - Potential hydrocyclone modifications could reduce discharge by 50-75%

- Modifications subject to performance testing and regulatory approval

- Additional yield of at least 100 AFY by 50% reduction of hydrocyclone discharge during a dry year

- Potentially achieve additional yield of 600 AFY
  - During average rainfall year
  - Or, if supplemental water stored during a dry year
Improve Stafford Treatment Plant Process Water Recapture Efficiency

- District staff previously conducted plant-scale study of modifying hydrocyclone return to reduce reject flow volume

- Recommend additional plant-scale study of modified hydrocyclone operation with external technical support to confirm capital/operations changes needed:
  - Change to sludge diversion point
  - Change to diversion return point

- Raw water intake also may need modifications for more consistent intake water quality

- Should account for replacing 4-inch discharge pipeline to Novato San sewer to reduce maintenance efforts
Improve Stafford Treatment Plant Process
Water Recapture Efficiency
Preliminary Conclusion and Recommendations

• Recommended for District to conduct additional plant-scale testing with technical support

• Potential estimated yield ~ 100 - 600 AFY

• Cost estimate is in progress
Discussion and Questions
Divert Captured Stormwater Into Stafford Lake
Doug Moore
Divert Captured Stormwater Into Stafford Lake

- **Divert Captured Stormwater Into Stafford Lake**

- **Delineate Watersheds**
- Quantify Rainfall to Runoff Relationship
- Calculate Leveroni and Bowman Canyon Yield (Runoff)
- Evaluate Increased Water Supply to Stafford Lake
- Evaluate Costs

**Stafford Lake** 5,309 Acres
**Leveroni Canyon** 1,206 Acres
**Bowman Canyon** 2,115 Acres

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[Map showing watershed analysis and water supply areas]
Divert Captured Stormwater Into Stafford Lake

Runoff Rate from Daily Data, 2016-2017 Fiscal Year

- Delineate Watersheds
- Quantify Rainfall to Runoff Relationship
- Calculate Leveroni and Bowman Canyon Yield
- Evaluate Increased Water Supply to Stafford Lake
- Evaluate Costs

Stafford Lake 2016-2020 Average Watershed Yield: 4,000 AFY from 5,309 acres

No significant runoff for first 8 - 10 inches of rain

Watershed Yields 353 AF/inch of rain after first 8 – 10 inches
Divert Captured Stormwater Into Stafford Lake Lake

- Delineate Watersheds
- Quantify Rainfall to Runoff Relationship
- Calculate Leveroni and Bowman Canyon Yield
- Evaluate Increased Water Supply to Stafford Lake for a Range of Pump Station Capacities
- Evaluate Costs

2016-2020 Estimated Yields:
- Leveroni: 910 AFY
- Bowman: 1,590 AFY
- Combined: 2,500 AFY

Alternative only works if there is stormwater runoff available
Divert Captured Stormwater Into Stafford Lake

- Delineate Watersheds
- Quantify Rainfall to Runoff Relationship
- Calculate Leveroni and Bowman Canyon Yield
- **Evaluate Increased Water Supply to Stafford Lake**
- Evaluate Costs

**Leveroni and Bowman Canyon Annual Water Supply with Basin and 10 cfs Pump:**
788 AFY
Divert Captured Stormwater Into Stafford Lake

### Capital Costs

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Cost, $ million</th>
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<tbody>
<tr>
<td>Basin (80 AF)</td>
<td>9.6</td>
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<tr>
<td>Pump Station (10 cfs)</td>
<td>1.5</td>
</tr>
<tr>
<td>Pipeline (15-inch)</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12.7</strong></td>
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</tbody>
</table>

### Total Annual Cost per AF
(O&M plus Annual Cost of Capital)

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Cost, $ per AF</th>
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</thead>
<tbody>
<tr>
<td>Combined (788 AF w/ Basin)</td>
<td>$1,352 per AF</td>
</tr>
<tr>
<td>Leveroni Canyon (no basin)</td>
<td>$182 per AF for 245 AF</td>
</tr>
<tr>
<td>Bowman Canyon (no basin)</td>
<td>$143 per AF for 433 AF</td>
</tr>
<tr>
<td>Combined (no basin)</td>
<td>$101 per AF for 628 AF</td>
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</table>
Divert Captured Stormwater Into Stafford Lake
Preliminary Conclusions and Recommendations

Conclusions
- Use of Leveroni and Bowman Canyon water is cost feasible
- Use of the detention basin is cost prohibitive (unless there is cost sharing)

Future Considerations
- Evaluate long-term benefit of Bowman and Leveroni Canyon flow diversion using 20-40 years of rain data, but adjusted for future climate change
- Begin monitoring flows and water quality from Leveroni and Bowman Canyons
Discussion and Questions
Increase Stafford Lake Storage Capacity

Modify Spillway
Remove Sediment

Doug Moore
Increase Stafford Lake Storage Capacity
Slide Gate on Spillway Notch

Increase in Storage Volume: 726 ac-ft

Increased storage volume is only useful when there is enough rain to overtop the spillway notch.
Increase Stafford Lake Storage Capacity
Slide Gate on Spillway Notch

- Total Capital Cost: $710,000
- Capital Cost per AF of Increased Storage Volume: $1,000 per AF

An Inverted Slide Gate is a Standard Product from Waterman Industries (and other manufacturers)
Increase Stafford Lake Storage Capacity – Remove Sediment, Excavate Lake Bottom

<table>
<thead>
<tr>
<th>Excavation Depth, feet</th>
<th>Storage Volume, AF</th>
<th>Cost, $ million</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>49</td>
<td>2.4</td>
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<tr>
<td>10</td>
<td>411</td>
<td>19.9</td>
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<tr>
<td>15</td>
<td>551</td>
<td>26.7</td>
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</table>

Capital Cost per AF of Increased Storage Volume (for 15 ft Depth): $48,500 per AF

- Location is based on constructability of the sediment removal
- Minor Benefit: Removal of nutrient rich soils temporarily helps the treatment process
Conclusions
• The Slide Gate is cost feasible
• Excavation of sediment from the lakebed is cost prohibitive

Future Considerations
• Evaluate long-term benefit of slide gate using 20-40 years of rain data, but adjusted for future climate change
• Evaluate long-term benefit of slide gate combined with Leveroni and Bowman Canyon flow diversion using 20-40 years of rain data, but adjusted for future climate change
Discussion and Questions
Desalination
Kathryn Gies
Desalination

• Must be pursued as a regional partnership to be viable
  o Economy of scale
  o Environmental considerations
  o No viable intake or brine discharge locations for NMWD
Desalination

- **MMWD**
  - Completed study in 2008, opted not to pursue
  - Reviewed again in 2021, opted not to pursue
  - Currently investigating a pipeline connection with EBMUD for emergency supply
  - Proceeding with an EIR, which looks at desalination as an alternative
    - 2021 estimated 15 MGD desal plant at approximately $230 million
  - Any desalination partnership would be a long-term project (15+ years)

- **Sonoma Water is preparing a regional study**
  - Desalination is one opportunity being evaluated at the regional level
  - If Sonoma Water Study is not available, findings cannot be incorporated into this local study
Discussion and Questions
Evaluation Criteria
Evaluation Criteria

- Cost
- Water Supply Yield and Reliability
- Operational Impacts
- Regulations and Permitting
- Public and Institutional Considerations
- Other Considerations
Cost

Planning level cost estimate:
• Capital Cost + Operations and Maintenance cost estimate
• Cost estimates to include additional labor, materials, energy, and chemicals needed, as applicable
• Compare using $ per AF for each water supply alternative
• Translatable to NMWD’s rates
• Revenue impacts will be relative to the volume of water generated, except for new recycled water uses
Water Supply Yield and Reliability

• Estimate of the expected water supply yield

• Reliability: Likelihood of the water supply alternative producing the anticipated yield
  o Climate change may impact the reliability
Operational Impacts

• Evaluate the impact to distribution and treatment operations

• Consider the following items:
  o Challenges to blending from different supply sources
  o Additional chemicals required to produce and maintained high-quality of water
  o Energy intensity
  o Additional staff resources or special certifications required
Regulations and Permitting

• Identify required permits

• Evaluate applicable regulations and anticipated permitting requirements

• Considerations:
  o Environmental impacts
  o Conformance with CEQA
  o Permitting requirements specific to the water supply alternative
  o Water rights (only for alternatives that may have water rights issues)
Public and Institutional Considerations

- Public acceptance
- Coordination and collaboration with other entities
- Need for partnerships or agreements
- Required easements from other entities
Other Considerations

- Each water supply alternative is unique
  - May have other important considerations that are relevant to each water supply alternative

- Will be discussed but not scored
Discussion and Questions
Criteria Ranking/Weighting
### Criteria Scoring

#### Quantitative Criteria:

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<thead>
<tr>
<th>Criteria</th>
<th>Measure</th>
<th>Units</th>
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<tbody>
<tr>
<td>Cost</td>
<td>Quantitative</td>
<td>$ per AF</td>
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<tr>
<td>Water Supply Yield</td>
<td>Quantitative</td>
<td>Volume, AF</td>
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#### Qualitative Criteria:

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<tr>
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<td>Operational Impacts</td>
<td>Operational Demands</td>
<td>Least Impacted</td>
<td>Most Impacted</td>
<td>Least Impacted</td>
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<tr>
<td>Regulations and Permitting</td>
<td>Complexity</td>
<td>Least Complex</td>
<td>Most Complex</td>
<td>Least Complex</td>
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<tr>
<td>Public and Institutional</td>
<td>Challenges</td>
<td>Least Challenging</td>
<td>Most Challenging</td>
<td>Least Challenging</td>
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Qualitative Criteria Priorities and Weight

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weight (%)</th>
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<tbody>
<tr>
<td>Water Supply Reliability</td>
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<td>Public and Institutional Considerations</td>
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<tr>
<td>Total</td>
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Discussion and Questions
Next Steps

- **Prepare Evaluations and Complete Study**
- **Present Findings to Board and Public (Spring 2022)**
- **Board Acceptance**
Discussion and Questions