Dedicated to
Satisfying our Community's
Water Needs

AGENDA
MESA WATER DISTRICT
BOARD OF DIRECTORS
Tuesday, January 21, 2020
1965 Placentia Avenue, Costa Mesa, CA 92627
3:30 p.m. Special Board Meeting

ENGINEERING AND OPERATIONS COMMITTEE MEETING
Tuesday, January 21, 2020 at 3:30 p.m.

CALL TO ORDER

PLEDGE OF ALLEGIANCE

PUBLIC COMMENTS

Items Not on the Agenda: Members of the public are invited to address the Board on items which are not on the agenda. Each speaker is limited to three minutes. The Board will set aside 30 minutes for public comments.

Items on the Agenda: Members of the public may comment on agenda items before action is taken, or after the Board has discussed the item. Each speaker is limited to three minutes. The Board will set aside 60 minutes for public comments.

CONSENT CALENDAR ITEMS:
Approve all matters under the Consent Calendar by one motion unless a Board member, staff, or a member of the public requests a separate action.

1. Developer Project Status Report
2. Mesa Water and Other Agency Projects Status Report
3. Water Quality Call Report
4. Committee Policy & Resolution Review
5. Water Operations Status Report

ACTION ITEMS:
Items recommended for approval at this meeting may be agendized for approval at a future Board meeting.

6. Committee Meeting Dates and Chair Appointment

PRESENTATION AND DISCUSSION ITEMS:

7. 2019 Public Health Goals Report
8. OCWD PFAS Program

REPORTS:

9. Report of the General Manager
10. Directors' Reports and Comments

INFORMATION ITEMS:

11. Smart Timer Distribution Workshop

In compliance with California law and the Americans with Disabilities Act, if you need disability-related modifications or accommodations, including auxiliary aids or services in order to participate in the meeting, or if you need the agenda provided in an alternative format, please contact the District Secretary at (949) 631-1206. Notification 48 hours prior to the meeting will enable Mesa Water District (Mesa Water) to make reasonable arrangements to accommodate your requests.

Members of the public desiring to make verbal comments utilizing a translator to present their comments into English shall be provided reasonable time accommodations that are consistent with California law.

Agenda materials that are public records, which have been distributed to a majority of the Mesa Water Board of Directors (Board), will be available for public inspection at the District Boardroom, 1965 Placentia Avenue, Costa Mesa, CA and on Mesa Water's website at ***www.MesaWater.org****. If materials are distributed to the Board less than 72 hours prior or during the meeting, the materials will be available at the time of the meeting.*

ADJOURNMENT

DEVELOPER PROJECT STATUS REPORT

PROJECT STATUS - DEVELOPER PROJECTS			
FILE NO.	PROJECT ADDRESS	PROJECT DESCRIPTION	PROJECT NOTES/STATUS
MC 2235	671 W 17th Street	177 Condos	Plans received and plan check fees paid on 1/21/16. Hydraulic model initiated 2/24/16. 2nd plan check submitted on 3/24/16 and picked up 4/17/16. Mylar drawings and fee payment received on 7/5/16. Permit issued on 7/11/16. Demolition of existing services on 8/16/16. Mainline installation on 12/6/16. Service laterals installed on 1/9/17. Meter box placement on 5/8/17. Follow-up site visit on 5/17/17. Service abandonment on 8/30/17. Valve cans raised on 9/22/17. Meter box placement on 10/19/17. Gravel base on 12/5/17. Meter box placement on 2/14/18. Meters installed and locked off on 6/1/18, 7/17/18, on 8/1/18, and again on 9/7/18. Backflow tested on 9/11/18. Meters installed and locked off on 9/18/18, 9/25/18, and again on 10/5/18. Backflows tested on 10/9/18, 2/27/19, 11/18/19 and again on 11/21/19. Meters installed and locked off on 11/27/18, 12/5/18, 12/18/18, 1/10/19, 2/8/19, 2/21/19, 3/4/19, 3/12/19, 4/26/19, 7/15, 7/16/19, and again on 10/15/19. Another batch of backflows tested on 12/20/19. Phase 2 construction still on-going.
C0056-18-01	2033 Republic Avenue	Single Family Home Service & Meter Upgrade	Plans received and plan check fees paid on 6/19/18. Comments returned for 2nd plan check review on 6/28/18. 2nd plan check submitted 7/26/18, and redlines picked up on 8/20/18. 3rd plan check submitted on 12/13/18, and redlines picked up on 1/15/19. Fourth and final plan check submitted on 1/24/19, and redlines picked up on 1/29/19. Final approval by District Engineer on 4/18/19. Final permit fees paid on 4/18/19. Permit issued on 4/30/19. Revised drawings issued 7/1/19 and returned 7/1/19. Precon held on 9/4/19. Hot tapping completed on 10/28/19. Waiting for contractor to complete work. (1/14/20)
C0058-19-01	585 & 595 Anton Boulevard (P2)	Apartment Complex	Plans received and plan check fees paid on 2/5/19. Customer picked up redlines on 2/8/19. 2nd plan check submitted 3/11/19, and redlines picked up on 3/25/19. Hydraulic Analysis received on 4/5/19. Received Water Service Agreement on 4/30; Final permit fees paid on 5/8/19. Permit issued on 5/8/19. Precon meeting held on 5/16/19. Waiting for revised Easements and Quit Claims regarding legal entities. Services installed 6/28/19. Pressure tests done on 7/2/19, Bac-T tests done on 7/8/19. Fireline charged on 9/12/19. Mesa Water staff removed two fire hydrants from jobsite on 9/18/19. Pipeline installed on 11/19/19. Waiting for contractor to complete work. (1/14/20)

DEVELOPER PROJECT STATUS REPORT

PROJECT STATUS - DEVELOPER PROJECTS			
FILE NO.	PROJECT ADDRESS	PROJECT DESCRIPTION	PROJECT NOTES/STATUS
C0062-19-01	1591 & 1593 Riverside	Two Single Family Homes	Plans received and plan check fees paid on 12/14/18. Final fees paid on 2/6/19. Permit issued on 2/13/19. Precon held on 2/28/19. Services installed on 3/4/19. Waiting for meter installation and flow thru testing to be scheduled. Waiting for contractor to complete work. (1/14/20)
C0063-19-01	1375 Sunflower	Commercial Building	Plans received and plan check fees paid on 12/14/18. Customer picked up redlines on 12/31/18. 2nd plan check submitted on 1/11/19, and redlines picked up on 1/29/19. 3rd plan check submitted on 1/31/19. Final permit fees paid on 6/20/19 and permit issued on 6/25/19. Precon held on 1/10/20. Mainline excavation done on 1/14/20.
C0071-19-01	2277 Harbor Boulevard	Commercial Building	Plans received and plan check fees paid on 1/7/19. Customer picked up redlines on 1/25/19. 2nd plan check submitted on 1/28/19, and redlines picked up on 1/31/19. Final permit fees paid on 5/28/19. Permit issued on 5/30/19. Precon held on 10/18/19 and two 4-inch services abandoned on 11/15/19. Waiting for contractor to complete work. (1/14/20)
C0072-19-01	168 & 170 Cabrillo	Two Single Family Homes	Plans received and plan check fees paid on 1/14/19.Customer picked up redlines on 1/24/19. Customer submitted 2nd plan check on 5/9/19. 2nd plan check submitted on 5/13/19 and redlines picked up on 5/20/19. Final permit fees paid on 9/26/19. Permit issued on 10/3/19. Precon meeting held on 1/9/20.
C0073-19-02	55 Fair Drive	Vanguard University East Annex Science Modular	Plans received and meter replacement fees paid on 3/14/19. 1st plan check completed on 5/9/19 and redlines mailed on 5/14/19. 2nd plan check submitted 7/3/19. Precon held on 7/3/19. Services installed on 8/8/19, Backflow prevention devices tested on 8/20/19. Concrete pad inspected on 1/14/20.
C0074-19-01	2538 Oxford Lane	Single Family Home	Plans received and plan check fees paid on 11/14/18. Customer picked up redlines on 1/31/19. 2nd plan check submitted on 2/1/19, and redlines picked up on 2/5/19. Waiting for 3rd plan check submittal. Received fire department approval on 5/31/19. Precon meeting held on 1/8/20. Meter installed on 1/9/20.

DEVELOPER PROJECT STATUS REPORT

PROJECT STATUS - DEVELOPER PROJECTS			
FILE NO.	PROJECT ADDRESS	PROJECT DESCRIPTION	PROJECT NOTES/STATUS
C0077-19-01	1922 Pomona	Commercial Building	Plans received and plan check fees paid on 1/28/19. Customer picked up redlines on 2/1/19. 2nd plan check submitted on 2/5/19, and redlines picked up again on 2/12/19. Final fees paid on 2/27/19. Permit issued on 3/11/19. Precon meeting held on 3/19/19. Meter installed 3/28/19. Letter of water terminaton sent to business on 1/9/20 for failure to complete backflow certification.
C0079-19-01	1957 Newport Boulevard	Meter Upgrade	Plans received and plan check fees paid on 2/5/19. Customer picked up redlines on 2/27/19. Meeting on 3/5/19 with customer to discuss easement. 2nd plan check was submitted on 4/23/19 and redlines to be picked up on 5/6/19. 3rd plan check submitted on 5/16/19. Permit approved on 8/23/19. Precon held on 9/3/19. Shutdown to tie in tee & valve service line placement and pipeline installation completed on 9/11/19. Services installed on 10/2/19 and 10/2/19. Pressure test performed on 10/9/19. Hot tapping comleted on 10/14/19. Shutdown to tie-in valves on 10/24/19. Meters installed on 12/23/19. Backflow tested on 1/10/20.
C0082-19-01	3323 Hyland Avenue	Pipeline relocation	Plans received and plan check fees paid on 2/20/19. Customer picked up redlines on 3/4/19. 2nd plan check submitted 3/26/19, and redlines picked up on 4/2/19. 2nd plan check submitted 6/11/19, and redlines picked up on 6/18/19. Final permit fees paid on 7/23/19 and permit issued on 8/6/19. Pre-con held on 12/5/19. Shutdown for valve connection on 1/7/20. Services installed on 1/13/20. Chlorination swab, Bac-T, pressure test and mainline charged on 1/14/20.
C0084-19-01	410 E 17th Street	Commercial Business	Plans received and plan check fees paid on 2/20/19. Customer picked up redlines on 3/4/19. 2nd plan check submitted on 9/4/19 and redlines picked up on 9/10/19. 3rd Plan check submitted on 9/26/19. Precon held on 11/20/19. Service modification and meter/meter box installed on 1/14/20.
C0086-19-01	285 22nd Street	Residential Care Facility	Plans received and plan check fees paid on 3/11/19. Customer picked up redlines on 3/19/19. 2nd plan check submitted on 5/9/19. Customer to pick up 2nd plan check redlines on 5/6/19. 3rd plan check submitted on 5/14/19 and picked up on 5/30/19. Precon held on 8/30/19. Service connection on 9/3/19. Abandonments completed on 9/6/19. Meter installed on 9/12/19. Waiting for contractor to complete work. (1/14/20)

DEVELOPER PROJECT STATUS REPORT

PROJECT STATUS - DEVELOPER PROJECTS			
FILE NO.	PROJECT ADDRESS	PROJECT DESCRIPTION	PROJECT NOTES/STATUS
C0089-19-01	3160 Airport Way	John Wayne Airport Taxilot	Plans received and plan check fees paid on 4/8/19. 1st Plan Check submitted on 4/9/19. 2nd plan check submitted 04/19/19 and redlines picked up on 4/25/19. Final permit fees paid on 6/18/19. Developer still on hold for construction as of 11/29/19. Waiting for contractor to complete work. (1/14/20)
C0090-19-01	2831 Bristol Street	Parking Lot	Plans received and plan check fees paid on 4/9/19. 1st Plan Check submitted on 4/11/19. Customer picked up redlines on 4/1619. 2nd plan check submitted 04/19/19 and redlines picked up on 4/25/19. Final permit fees paid on 5/2/19 and permit issued on 6/6/19. Precon held on 9/5/19. Backflow device tested on 4/25/19. Two abandonments occurred on 11/22/19. Waiting for contractor to complete work. (1/14/20)
C0091-19-01	368 Magnolia	Single Family Home	Plans received and meter replacement fees paid on 4/15/19. 1st plan check submitted on 4/18/19 and redlines picked up on 4/23/19. Final permit fees paid on 5/20/19 and permit issued on 5/20/19. Precon held on 8/8/19. Service laterals installed and approved on 8/27/19. Flowthru tested on 1/15/20.
C0092-19-01	Harbor and Hamilton	29 New Townhomes	Plans received and plan check fees paid on 4/23/19. 1st plan check submitted 4/23/19 and redlines to be picked up on 5/6/19. 2nd plan check submitted on 6/11/19 and redlines picked up on 6/18/19. 3rd Plan Check submitted on 11/25/19 and redlines returned to customer on 11/27/19. Waiting for contractor to complete work. (1/14/20)
C0095-19-01	272 Esther Street	Single Family Home	Plans received and plan check fees paid on 4/30/19. 1st Plan check submitted 4/30/19 and redlines to be picked up on 5/7/19. 2nd Plan check submitted 6/4/19 and redlines to be picked up on 6/11/19. Final permit fees paid on 8/27/19. Precon held on 10/30. Meter installed 11/18/19. Flowthru tested on 1/15/20.
C0101-19-01	1275 Bristol Avenue	Car Dealership	Plans received and plan check fees paid on 6/11/19. 1st Plan check submitted 6/11/19 and redlines picked up on 6/18/19. 2nd Plan check submitted on 8/13/19 and picked up on 8/20/19. 3rd Plan check submitted 9/3/19 and returned on 9/10/19. Final fees paid on 10/24/19. Existing services turned off. Permit is not yet approved due to Fire Department approval still unresolved.

DEVELOPER PROJECT STATUS REPORT

PROJECT STATUS - DEVELOPER PROJECTS			
FILE NO.	PROJECT ADDRESS	PROJECT DESCRIPTION	PROJECT NOTES/STATUS
C0102-19-01	3560 Cadillac Avenue	Commercial	Plans received and plan check fees paid on 6/18/19. 1st Plan check submitted 6/18/19 and redlines to be picked up on 7/2/19. 2nd Plan check submitted on 7/9/19 and picked up on 7/16/19. Final permit fees paid and permit issued on 8/6/19. Customer has not picked up permit approvals and inspection card. (1/14/20)
C0104-19-01	413 E. 20th Street	Single Family Home	Plans received and plan check fees paid on 7/1/19. 1st Plan check submitted 7/1/19 and redlines picked up on 7/1/19. 2nd Plan check submitted on 1/7/20.
C0105-20-01	3333 Avenue of the Arts	Commercial	Plans received and plan check fees paid on 7/24/19. 1st Plan check submitted 7/26/19 and redlines to be picked up on 7/26/19. 2nd Plan check submitted on 8/30/19 and resubmitted on 9/11/19. 3rd plan check resubmitted on 10/8/19. Permit approved and final fees paid on 10/24/19. Precon held on 11/24/19. Temporary RW pipeline inspected and approved on 11/27/19 and report sent to DDW on 12/4/19.
C0106-20-01	224 Flower	Single Family Home	Plans received and plan check fees paid on 7/24/19. 1st Plan check submitted 7/26/19 and redlines picked up on 7/26/19. 2nd plan check submitted on 9/10/19 and picked up on 9/24/19. 3rd plan check resubmitted on 10/3/19. Final fees paid on 10/24/19. Permit approved and issued on 11/19/19.
C0110-20-01	861 Governor Street	Single Family Home	Plans received and plan check fees paid on 7/15/19. 1st Plan check submitted 7/26/19 and redlines picked up on 7/26/19. Developer still on hold for construction. (1/14/20)
C0113-20-01	1588 South Coast Drive (Vans Headquarters)	Commercial	Plans received and plan check fees paid on 8/13/19. 1st Plan check submitted 8/13/19 and redlines picked up on 8/20/19. 2nd plan check submitted 9/12/19 and picked up on 10/1/19. 3rd plan check submitted 10/21/19 and redlines picked up on 11/5/19. Permit issued 1/6/20. Precon on 1/7/20.
C0115-20-01	2179 Miner Street	Single Family Home	Plans received and plan check fees paid on 8/20/19. 1st Plan check submitted 8/27/19 and redlines picked up on 8/27/19. 2nd Plan check submitted on 1/9/20.
C0116-20-01	418 E. 18th Street	Single Family Home	Plans received and plan check fees paid on 10/7/19. 1st Plan check submitted 10/7/19 and redlines picked up on 10/16/19. Precon held on 11/27/19 and meter installed on 12/2/19.

DEVELOPER PROJECT STATUS REPORT

PROJECT STATUS - DEVELOPER PROJECTS			
FILE NO.	PROJECT ADDRESS	PROJECT DESCRIPTION	PROJECT NOTES/STATUS
C0117-20-01	192 Flower Street	Single Family Home	Plans received and plan check fees paid on 10/7/19. 1st Plan check submitted 10/7/19 and redlines picked up on 10/16/19. 2nd Plan check submitted on 10/29/19. Precon held on 11/26/19 and meter installed on 12/2/19. As of 1/13/20, Waiting for contractor to complete work. (1/14/20)
C0118-20-01	487 Abbie Way	Single Family Home	Plans received and plan check fees paid on 10/14/19. 1st Plan check submitted 10/21/19 and redlines picked up on 10/21/19.Permit approved and final fees paid on 10/22/19. Permit issued on 10/24/19.
C0120-20-01	934 Congress Street	Single Family Home	Plans received and plan check fees paid on 10/28/19. 1st Plan check submitted 10/28/19 and redlines picked up on 11/5/19.
C0121-20-01	372 Bucknell Road	Single Family Home	Plans received and plan check fees paid on 10/28/19. 1st Plan check submitted 10/28/19 and redlines picked up on 10/29/19.
C0122-20-01	925 W 18th Street	Commercial	Plans received and plan check fees paid on 10/28/19. 1st Plan check submitted 10/28/19 and redlines picked up on 10/29/19. 2nd plan check submitted 12/4/19. 3rd Plan check submitted on 1/2/20 and redlines picked up on 1/6/20.
C0123-20-01	449 W Bay Street	Commercial	Plans received and plan check fees paid on 11/18/19. 1st Plan check submitted 11/18/19 and redlines picked up on 11/22/19. 2nd Plan check submitted on 1/7/20.
C0124-20-01	2209 Fairview Road	Commercial	Plans received and plan check fees paid on 11/18/19. 1st Plan check submitted 11/5/19 and redlines picked up on 11/19/19. 2nd Plan check submitted on 11/21/19 and redlines picked up on 11/27/19.
C0125-20-01	3080 Airway Avenue	Commercial	Plans received and plan check fees paid on 11/18/19. 1st Plan check submitted 11/7/19 and redlines picked up on 11/27/19.
C0126-20-01	1646 Santa Ana Avenue	Single Family Home	Plans received and plan check fees paid on 11/18/19. 1st Plan check submitted 11/18/19 and redlines picked up on 11/26/19. 2nd Plan Check submitted on 1/2/20 and redlines picked up on 1/6/20.
C0128-20-01	901 B South Coast Drive	Commercial	Plans received and plan check fees paid on 11/25/19. 1st Plan check submitted 11/25/19 and redlines picked up on 12/3/19.
C0129-20-01	3590 Cadillac Avenue, Suite B	Commercial	Plans received and plan check fees paid on 11/25/19. 1st Plan check submitted 11/25/19 and redlines picked up on 12/4/19.

DEVELOPER PROJECT STATUS REPORT

PROJECT STATUS - DEVELOPER PROJECTS			
FILE NO.	PROJECT ADDRESS	PROJECT DESCRIPTION	PROJECT NOTES/STATUS
C0102-20-01	3560 Cadillac Avenue	Commercial	Plans received and plan check fees paid on 11/25/19. 1st Plan check submitted 11/25/19 and redlines picked up on 12/4/19.
C0102-20-02	3550 Cadillac Avenue	Commercial	Plans received and plan check fees paid on 11/25/19. 1st Plan check submitted 11/25/19 and redlines emailed on 12/4/19.
C0130-20-01	2940 College Avenue	Commercial	Plans received and plan check fees paid on 11/25/19. 1st Plan check submitted 11/25/19 and redlines picked up on 12/3/19. 2nd Plan check submitted on 12/9/19 and redlines emailed on 12/14/19.
C0131-20-01	1975 Wallace Avenue	6 Unit Apartments	Plans received and plan check fees paid on 11/18/19. 1st Plan check submitted 11/18/19 and redlines picked up on 11/22/19. 2nd Plan check submitted on 12/2/19 and redlines picked up on 12/3/19.
C0132-20-01	3070, 3080, 3090 Bristol Street	Commercial	Plans received and plan check fees paid on 12/5/19.
C0133-20-01	3100 Bristol Street	Commercial	Plans received and plan check fees paid on 12/5/19.

MESA WATER AND OTHER AGENCY PROJECTS STATUS REPORT
January 2020

Project Title: OC-44 Replacement and Rehabilitation Evaluation and Cathodic Protection Study

File No.: M 2034

Description: Evaluate potential repair and replacement options.

Status: Request for Bids sent out to contractors on February 6, 2019. Six bids received on 3/6/19. E&O Committee recommended award of the contract to lowest bidder (E.J. Meyer Company) on 3/19/19. Kick-off meeting held on 4/25/2019. Staff is working on reviewing submittals. Met with SARWQB on 5/24/19 and discussed water discharge permit requirements w/Susan Beeson. On 5/30/19 met with OCSD and went over requirements for the Special Purpose Discharge Permit (SPDP). Held Project Progress meeting on 6/6/19 and coordination meeting with Metropolitan Water District on 6/20/19. Held Permit Status Meeting on 7/11/2019, Traffic Coordination Meeting with Fletcher Jones Mercedes Dealership on 7/23/2019 and Project Progress Meeting on 7/23/2019. Submitted Application Package to OCSD for SPDP on 7/31/2019. Received Special Purpose Discharge Permit from OCSD on September 1, 2019. Coordination meeting with Fletcher Jones and Project Progress Meeting was held on 9/11/19. Contractor mobilized on 9/15/19 and started dewatering efforts. Approximately 95% of the pipeline installation has been completed as of 1/8/20. Final completion is scheduled for early March 2020. (1/9/20)

Project Title: Pipeline Testing Program

File No.: MC 2141

Description: Implement Resolution No. 1442 Replacement of Assets to annually perform non-destructive testing of 1% of the distribution system, and destructive testing of segments that are shown to have less than 70% of original wall thickness by non-destructive testing.

Status: Three miles of AC pipe constructed in 1956 were selected for non-destructive wall thickness measurement, which occurred during the week of January 14, 2019. The report was received on February 8, 2019. Five AC pipe samples are planned to be collected and sent for wall thickness measurements as part of routine valve replacements in April 2019. Samples were sent to the testing lab in May 2019, and the wall thickness measurement report was received on June 24, 2019. With more data collected from AC pipe samples, a proposed update the Res. 1442 Replacement of Assets was approved by the E&O Committee in September 2019. Staff developed a process for classifying pipeline breaks, and provided a class to the Distribution crews on November 21, 2019. Staff is planning for nondestructive testing of 3 miles of CMLC steel distribution pipelines in March 2020. (1/13/20)

Project Title: Chandler & Croddy Wells and Pipeline Project

File No.: M18-113

Description: Design, documentation, and permitting for two new wells located on Chandler Avenue and Croddy Way in the City of Santa Ana and the distribution pipeline connecting the wells to Mesa Water's supply system.

Status: Tetra Tech has been contracted to complete the design, documentation, and permitting for the Chandler and Croddy Wells and Pipeline Project. Initial data request sent to Tetra Tech on September 7, 2017. Met with Division of Drinking Water regarding well locations on September 20, 2017. Preliminary hydrological evaluation received on September 29, 2017. Board approved demolition of existing structures and dedicated well facility with option to evaluate long-term lease potential as market conditions dictate at both sites at November 2017 E&O. Butier Engineering has been contracted to provide Construction Management Services. Preliminary Design Report (PDR) for the distribution pipeline was reviewed and returned on March 6, 2018. Well site layouts were presented to the Board in May. DDW waiver for 50-foot control zone is currently being drafted. The revised PDR for the pipeline and the well sites was received in June 2018. A workshop to discuss review comments was held on August 14, 2018. 50% design for the Croddy Pipeline was received and the design review workshop occurred on November 26, 2018. 50% design for the wells is scheduled for submittal in February 2019. The draft CEQA Mitigated Negative Declaration was received on January 22, 2019, and filed for 30-day public comment on February 20, 2019 and completed on March 22, 2019. Four agencies submitted minor comments. A public meeting to adopt the Mitigated Negative Declaration has been noticed for the April 11, 2019 Board of Directors meeting. The revised Preliminary Design Report for the Chandler and Croddy Wells was received on March 5, 2019. 50% design documents for the existing building demolitions and well drilling were received on April 16, 2019. 50% design documents for well equipping were received on September 9, 2019 and reviewed by staff. The design team met on October 7, 2019, to review design options for the Croddy Pipeline. A corrosion potential report for the Croddy pipeline alignment was received on December 23, 2019, and reviewed by staff. (1/13/20)

Project Title: Meter Technology Evaluation

File No.: MC 2248

Description: The lifespan of a water meter is approximately 15 years. As a meter ages, the accuracy drops off due to wear. In preparation for its annual water meter replacement, staff has been reviewing water meter technology determining what water meter and reading solutions would be the best fit for Mesa Water's aging register technology. With today's technology, there are several types of meters and meter reading solutions available. The most common are as follows: Fixed Network, Automatic Meter Reading (AMR) System, Handheld or Touch Technology, and Advanced Metering Analytics - Cellular Endpoint.

Status: Mesa Water prepared a Technical Memo with information of the existing aging metering technology in comparison with proposed new meter reading solutions. The Technical memo was presented to the April E&O Committee and approved by the Board at the May 2019 Board meeting. Recommendations approved by the Board for early implementation include ensuring competitive pricing from the standardized meter supplier, making cellular endpoint meters available to customers who wish to have access to real-time water use data, and working with the meter reading software vendor to configure a software upgrade. Staff has complied the total installed cost of the cellular endpoint meters and presented an implementation plan to the Engineering and Operations Committee on August 20, 2019. Staff also negotiated a contract with National Meter and Automation for preferred customer pricing and limiting annual price escalation, and presented the contract to the Engineering and Operations Committee on August 20,2019. Staff is working with Badger Meter and Cogsdale to add cellular endpoints to large customer meters to automate meter reading and billing. Staff evaluated each Route 600 meter and vault for meter, register, and end point replacement, to assist with installation activities. (1/13/20)

Project Title: Reservoirs 1 & 2 Chemical Systems Design

File No.: M18-117

Description: Improve disinfection and mixing in both reservoirs to improve water quality and minimize nitrification.

Status: Final Design Contract awarded to Hazen & Sawyer on February 14, 2018. 50% design report received on July 17, 2018. Design review workshop took place in September 2018. A site visit to Laguna Beach County's El Morro reservoirs occurred on November 8, 2018, to evaluate the Vortex mixing system. Staff met with the designer on December 5, 2018, to incorporate design-for-reliability and design-for-maintainability principals into the mixing system design. The consultant provided a Technical Memo summarizing the options for maintainability and reliability of the Vortex mixer system on April 4, 2019. The 90% design deliverable was received on June 4, 2019, and is being reviewed by staff. Per the E&O Committee's request, the Preliminary Design Report describing the basis of this project was included in the October E&O Committee package. The consultant is working with the reservoir management system supplier to use Mesa Water's standardized analytical equipment to maintain disinfectant residual in the reservoirs. (1/13/20)

Water Quality Call Report
December 2019

Date: 12/5/2019
Source: Phone
Address: 580 Anton
Description: Customer was concerned about the water leaving deposits in the kettle and cups and wanted to know if we can recommend a solution.

Outcome: Explained to customer that the deposits are likely due to water hardness which is naturally present in the water. Assured customer that the water meets or exceeds all drinking water standards and possesses no health risk. Should the customer prefer to remove the water hardness for aesthetic reasons, they can look into getting a water softener.

Date: 12/27/2019
Source: Phone
Address: 325 Nassau Road
Description: Customer inquired about PFOA and wanted to know if we've tested for it and what level was detected.

Outcome: Explained to customer that Mesa Water has tested for PFOA and it was ND. Customer was happy with the information given.

COMMITTEE POLICY &
RESOLUTION REVIEW

ENGINEERING and OPERATIONS COMMITTEE

Policy Assignments for 2020

Policy Name	Resolution No.	Date Adopted	Revision Schedule	Last Reviewed
Replacement of Assets Including Pipeline and Well Rehabilitation	1525	10/10/19	Review and update every 5 years	10/10/19
Rules and Regulations for Water Service	1527	11/25/19	Review and update as needed	11/25/19
Standard Specifications and Standard Drawings		05/03/18	Review and update as needed	05/03/18
Urban Water Management Plan	1477	06/09/16	Review and update as required every 5 years	06/09/16

Water Operations Status Report
July 1, 2019 - December 31, 2019

Operations Department Status Report	**Wk Unit**	**Plan Days**	**Act Days**	**Plan Qty**	**Act Qty**	**Plan Cost**	**Actual Cost**
01 - HYDRANTS							
WD-0101 - HYDRANT MAINTENANCE	HYDRANTS	85	56	1692	1097	$33,561	$23,269
WD-0102 - HYDRANT PAINTING	HYDRANTS	7	14	211	402	$2,507	$5,000
WD-0103 - HYDRANT REPAIR	HYDRANTS	26	22	30	38	$8,559	$10,239
Program 01 TOTAL		118	92			$44,627	$38,508
02 - VALVES							
WD-0201 - DISTRIBUTION VALVE MAINTENANCE	VALVES	60	50	1203	1052	$26,039	$21,268
WD-0202 - NIGHT VALVE MAINTENANCE	VALVES	6	0	82	0	$2,786	$0
Program 02 TOTAL		66	50			$28,825	$21,268
03 - METERS							
WD-0305 - ANGLE STOP/BALL VALVE REPLACE	REPLACE	13	14	26	28	$8,234	$5,121
Program 03 TOTAL		13	14			$8,234	$5,121
04 - MAIN LINES							
WD-0401 - MAIN LINE REPAIR	REPAIRS	60	41	10	6	$30,230	$20,436
WD-0402 - AIR VAC MAINTENANCE/REPAIR	REPAIRS	13	7	80	27	$4,900	$2,451
Program 04 TOTAL		73	48			$35,130	$22,887
05 - SERVICE LINES							
WD-0501 - SERVICE LINE REPAIR	REPAIRS	28	58	10	20	$11,973	$27,608
Program 05 TOTAL		28	58			$11,973	$27,608
06 - CAPITAL							
CAP AV - CAPITAL AIR VACUUM REPLACE	AIR VACS	30	39	5	18	$12,405	$17,673
CAP BI - CAPITAL BYPASS & METER INSTALL	REPLACE	6	0	1	0	$3,212	$0
CAP FH - CAPITAL HYDRANT UPGRADE	HYDRANTS	119	47	18	8	$91,766	$38,063
CAP MV - CAPITAL MAINLINE VALVE REPLACE	VALVES	99	61	18	7	$66,531	$32,124
CAP SL - CAPITAL SERVICE LINE REPLACE	SERVICES	19	20	5	5	$10,264	$10,282
CAP SS - CAPITAL SAMPLE STATION REPLACE	STATIONS	5	1	5	1	$2,488	$184
Program 06 TOTAL		278	168			$186,666	$98,326
VACANT POSITIONS	2		231				
TOTAL						$315,455	$213,718

MEMORANDUM

Dedicated to Satisfying our Community's Water Needs

TO: Engineering and Operations Committee

FROM: Phil Lauri, P.E., Assistant General Manager

DATE: January 21, 2020

SUBJECT: Committee Meeting Dates and Chair Appointment

RECOMMENDATION

Confirm the 2020 Engineering and Operations Committee regular meetings for the third Tuesday of each month, starting at 3:30 p.m., and appoint the Committee Chair.

STRATEGIC PLAN

Goal #1: Provide a safe, abundant, and reliable water supply.
Goal #2: Practice perpetual infrastructure renewal and improvement.
Goal #3: Be financially responsible and transparent.
Goal #4: Increase public awareness about Mesa Water® and about water.
Goal #5: Attract and retain skilled employees.
Goal #6: Provide outstanding customer service.
Goal #7: Actively participate in regional water issues.

PRIOR BOARD ACTION/DISCUSSION

This item is annually updated at a meeting of the Engineering and Operations (E&O) Committee.

DISCUSSION

Annually, the E&O Committee appoints a Committee Chair and approves the regular meeting date and time. Historically, the E&O committee has met at 3:30 p.m. on the third Tuesday of each month.

In 2020, staff recommends that the E&O Committee continue to meet at 3:30 p.m. on the third Tuesday of each month.

Following are the proposed 2020 E&O Committee Meeting dates:

- January 21
- February 18
- March 17
- April 21
- May 19
- June 16
- July 21
- August 18
- September 15
- October 20
- November 17
- December 15

FINANCIAL IMPACT

None.

ATTACHMENTS

None.

MEMORANDUM

Mesa Water DISTRICT®

Dedicated to Satisfying our Community's Water Needs

TO: Engineering and Operations Committee
FROM: Phil Lauri, Assistant General Manager
DATE: January 21, 2020
SUBJECT: 2019 Public Health Goals Report

RECOMMENDATION

This item is provided for information.

STRATEGIC PLAN

Goal #1: Provide a safe, abundant, and reliable water supply.

PRIOR BOARD ACTION/DISCUSSION

At its July 11, 2019 meeting, the Board of Directors (Board) received and filed Mesa Water District's 2019 Public Health Goals.

BACKGROUND

Drinking water compliance is based upon state and federal Maximum Contaminant Levels (MCLs) developed and adopted by the United States Environmental Protection Agency (USEPA) or California State Water Resources Control Board Division of Drinking Water (DDW). Mesa Water District (Mesa Water®) is in full compliance with all drinking water regulations.

Senate Bill (SB) 1307 (Calderon-Sher; effective 01/01/97) added new provisions to the California Health and Safety Code which mandate that a Public Health Goals (PHG) report be prepared by July 1, 1998, and every three years thereafter. The PHG Report is intended to provide information to the public in addition to the annual Consumer Confidence Report that is made available online to customers each year.

California Health and Safety Code Section 116365 requires the State to develop a PHG for every contaminant with a primary drinking water standard (maximum contaminant level (MCL), any contaminant with a maximum contaminant level goal (MCLG), or for any contaminant California is proposing to regulate with a primary drinking water standard. A PHG is the level which poses no significant health risk if consumed for a lifetime. A PHG is developed using a risk assessment based strictly on human health considerations.

Mesa Water's 2019 PHG Report was presented to the Engineering and Operations (E&O) Committee on June 18, 2019 and to the Board on July 11, 2019. It compares Mesa Water's drinking water quality with PHGs adopted by California Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA) and with the maximum contaminant level goals (MCLG) adopted by the USEPA. The report also provides an order of magnitude cost estimate to treat each constituent to below the PHG. PHGs and MCLGs are not enforceable standards and no action to meet them is mandated. The 2019 PHG Report indicates that Mesa Water has three constituents with levels above the recommended PHG. These constituents include Arsenic, Uranium, and Radium. It should be noted that the PHG levels are set lower than the technological ability to accurately measure the constituents. For instance, the PHG for arsenic is set to 0.004 micrograms per liter, which is three orders of magnitude below the Detection Limit for the purposes of Reporting (DLR) of 2 micrograms per liter. However, as a proactive measure, the Board requested that staff provide further analysis on the feasibility of treating groundwater produced by Mesa Water to the PHG standards, and to provide a cost estimate for capital and operating costs more detailed than the general cost in the triennial PHG report.

Mesa Water's system complies with all health-based drinking water standards and maximum contaminant levels. No additional measures are recommended to achieve compliance.

DISCUSSION

Separation Processes, Inc. (Consultant) was retained to provide a feasibility analysis of wellhead treatment systems to achieve treatment at or less than the recommended PHGs, and to provide a planning level cost estimate for capital and operating costs of a feasible treatment system (see Attachment A).

Treatment Feasibility

The Consultant reviewed Mesa Water's water quality data, and considered the following treatment technologies for achieving the PHGs:

- Ion Exchange (IX)
- Reverse Osmosis (RO)
- Electrodialysis (ED)
- Activated Alumina (AA)
- Coagulation Filtration (CF)
- Lime Softening (LS)
- Oxidation/Filtration (OF)

The Consultant used weighted evaluation criteria to determine which treatment technologies would most effectively and efficiently remove the aforementioned constituents to the recommended PHG levels. The evaluation criteria included the following categories:

- Operational Reliability
- Constituent Interface
- Water Recovery
- Facility Footprint
- Operational Requirements
- Capital Cost
- Operations and Maintenance (O&M) Cost

Three of the eight technologies are potentially capable of achieving the PHGs within the aforementioned evaluation criteria:

- Ion Exchange (IX)
- Reverse Osmosis (RO)
- Coagulation Filtration (CF)

The footprint for an effective Coagulation Filtration (CF) system exceeds the space available at the well sites and at the Mesa Water Reliability Facility (MWRF), and CF was therefore eliminated from further consideration. IX and RO are both effective and could likely fit in the space available at the well sites and the MWRF. Comparing the two technologies based on the aforementioned evaluation criteria, RO was determined to be the overall preferred and more reliable process. The raw water chemistry makes operation of an IX system too challenging to reliably achieve the PHG. Thus, cost estimates were completed for RO treatment systems for each well site and for the MWRF using this as the preferred alternative to achieve a PHG level of treatment. The RO system design recovery rate is 80%. This means that 20% of the water pumped from each well would be discharged to sewer as concentrate while still being subject to the Replenishment Assessment. In addition, during the high demand summer months, additional water supply would be required.

Treatment Costs

Table 1 summarizes the estimated capital costs for the RO treatment train at each well site and at the MWRF. The estimated capital costs for the five clear water wells is $46M and for the MWRF is approximately $9M for a total estimated capital investment of $55M.

Table 1. Estimated Capital Costs

Capital Cost	Wells	MWRF
Mechanical	$ 15,380,670	$ 5,187,030
Electrical	$ 3,488,110	$ 713,730
Site work	$ 12,985,412	$ 479,622
Subtotal	$ 31,854,192	$ 6,380,382
Contingency (30%)	$ 9,556,258	$ 1,914,115
Engineering (15%)	$ 4,778,129	$ 957,057
Total Capital Cost	**$ 46,188,578**	**$ 9,251,554**
Annual Capital Recovery (30 years @ 4%)	$ 2,715,888	$ 535,017
Amortized $/AF	**$ 226**	**$ 71**

Table 2 summarizes the annual operating costs for the wells and MWRF with the RO system. The total annual operating costs at the five well sites increase from $8.5M currently to $14M, and the cost per acre foot of water produced (capital + O&M) increases from $569/AF currently to $1,396/AF. The annual operating costs at the MWRF increase from $7.4M currently to $10.6M. The amortized cost per acre foot of water produced increases from $782/AF to $1,469/AF. The large increase per acre foot is a result of the basin replenishment assessment on all of the groundwater pumped, including the approximately 20% of the groundwater pumped being rejected by the RO membranes.

Table 2. Annual Operating Costs

O&M Cost	Wells	MWRF
Equipment Power	$ 2,141,900	$ 2,315,800
Chemicals	$ 1,984,400	$ 2,049,900
Labor	$ 180,600	$ 30,900
Parts	$ 585,200	$ 336,800
Miscellaneous	$ 9,144,600	$ 5,880,800
Total O&M Cost	$ 14,036,700	$ 10,614,200
O&M $/AF	**$ 1,170**	**$ 1,398**
Total $/AF (O&M + Amortized Capital)	**$ 1,396**	**$ 1,469**

FINANCIAL IMPACT

In Fiscal Year 2020, no funds are budgeted for Public Heath Goals.

ATTACHMENTS

Attachment A: Separation Processes, Inc.'s Public Heath Goals Treatment Cost Estimate

Public Health Goals Treatment Cost Estimate

Prepared for:
Mesa Water
1965 Placentia Avenue
Costa Mesa, CA 92627

MesaWater DISTRICT

January 13, 2020

Prepared by:
Separation Processes, Inc.

SPi

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EXECUTIVE SUMMARY

Drinking water compliance is based upon state and federal Maximum Contaminant Levels (MCLs) developed and adopted by the United States Environmental Protection Agency (USEPA) or California State Water Resources Control Board Division of Drinking Water (DDW). Mesa Water District (Mesa Water®) is in full compliance with all drinking water regulations.

Public Health Goals (PHGs) are set by the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA) and are based solely on public health risk considerations. PHGs are established using health related information and do not consider other factors including the cost or type of treatment necessary to achieve the goal.

As part of its routine monitoring, Mesa Water has identified two constituents (arsenic and uranium) that are below the MCL's and above the PHG. Arsenic and uranium are regulated at 10 µg/L and 20 pCi/L respectively. Monitoring has identified maximum concentrations of 2.1 µg/L for arsenic and 2.29 pCi/L for uranium respectively. The PHG has been established at 0.004 µg/L for arsenic and 0.43 pCi/L for uranium. These levels are near the available detection limits for constituent measurement. Removal of 99.8 percent of arsenic and 81.2 percent of uranium would be required to achieve the PHG.

After considering the available Best Alternative Technologies (BAT), Reverse Osmosis (RO) was selected as the method to achieve compliance, with the caveat that a demonstration would be necessary, and an analytical method to determine compliance would need to be established. It is noted that BAT's are established to achieve MCL compliance and may not be applicable to PHG compliance, however RO appeared to be the most likely alternative.

Five wells (1B, 3B, 5, 7, and 9B) and the MWRF were considered. The total capital cost to add RO treatment to these facilities was estimated at 56 million dollars. The annual operating cost would increase by an estimated 3.2 million dollars. The cost of water which was currently estimated at $652/acre-foot (AF) would increase by $610/AF to $1,424/AF. The stated unit values reflect the loss of water production associated with concentrate.

While it is recognized that there may be other RO treatment and facility configuration(s) that would increase the amount of usable water and reduce the cost of waste disposal, these alternatives would not be incremental to the overall magnitude associated with the overall costs developed. Should Mesa Water decide to proceed with further investigations, these types of analysis should be performed. In addition, is should be recognized that there may be other costs, such as the loss of well production capacity that would have to be offset.

INTRODUCTION

Drinking water compliance is based upon state and federal Maximum Contaminant Levels (MCLs) developed and adopted by the United States Environmental Protection Agency (USEPA) or California State Water Resources Control Board Division of Drinking Water (DDW). Mesa Water District (Mesa Water®) is in full compliance with all drinking water regulations. California public water systems serving more than 10,000 connections are required to prepare a triennial report that includes information on the detection of any constituents above the Public Health Goals (PHGs), as well as an estimate of the cost to reduce the constituents to the PHGs. Public Health Goals (PHGs) are set by the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA) and are based solely on public health risk considerations. The Association of California Water Agencies (ACWA) publishes a guidance document to assist water agencies with preparation of the PHG report. This guidance document includes information to assist with preparation of a cost estimate to reduce constituents to the PHG. The cost references are somewhat dated and intended for conceptual or general order of magnitude cost estimates as required by the triennial report.

Separation Processes Inc., (SPI) was retained by Mesa Water District (Mesa Water) to investigate the treatment technologies and associated costs to reduce constituents recently measured above the PHGs in groundwater wells to levels below the PHG. Arsenic and uranium were the only constituents measured above the PHGs and two treatment cases were considered – treatment only for arsenic, and treatment for both arsenic and uranium. Each of these cases were evaluated for Mesa Water's five groundwater wells and the Mesa Water Reliability Facility (MWRF).

This report provides an assessment of treatment options to achieve removal to achieve the PHG, level of removal or treatment required, development and evaluation of treatment process alternatives, and preparation of feasibility level capital and annual operations and maintenance cost estimates for the most viable treatment alternative to meet the PHGs. An assessment of this treatment alternative's capabilities to remove emerging perfluoralkyl substances (PFAS) based on literature review is also included for the treatment alternative.

PUBLIC HEALTH GOALS

As previously indicated PHGs are set by the California OEHHA and are based solely on public health risk considerations. None of the practical risk-management factors that are considered by the United States Environmental Protection Agency (USEPA) or the State Water Resources Control Board, Division of Drinking Water (DDW) in setting drinking water standards (Maximum Contaminant Levels or MCLs) are considered in setting the PHGs. These factors include analytical detection capability, treatment technology availability, benefits, and costs.

When calculating a PHG, OEHHA identifies the level of that chemical in drinking water that would not cause significant adverse health effects in people who drink two liters of that water every day for 70 years. The PHGs are not enforceable and are not required to be met by any public water system. Maximum Contaminant Level Goals (MCLGs) are the analogous federal equivalent to PHGs.

Laboratory results include a Reporting Limit (RL) or Reported Detection Limit (RDL). An RDL is the method specific limit of detection for a specific target analyte for a sample after any adjustments have been made for dilutions or other factors associated in the preparation of the sample. In the case of arsenic, the regulatory limit has been established at 10 µg/L, with a typical RDL of 1 or 2 µg/L (method dependent). For arsenic the PHG of 0.004 µg/L is significantly lower than the RDL for the currently approved analytical methods. Thus, it may be problematic to confirm that a water stream is meeting the PHG because the PHG is lower than the limit of detection for the approved analytical methods.

For arsenic the MCL is set at 10 µg/L with a MCLG of zero, whereas California has established a PHG of 0.004 µg/L. For uranium the MCL is 30 µg/L with a MCLG of zero. However, uranium is most commonly measured in terms of its activity (pCi/L) which can be approximated using a OEHHA conversion factor of 0.79 pCi/µg. The PHG limit based on activity in California is 0.43 pCi/L. The RDL for uranium are also method dependent with more levels of less than 0.1 pCi/L obtainable. Therefore, methods exist for the determination of uranium at low concentration.

WATER QUALITY

EXISTING WELL WATER QUALITY

Water quality monitoring data for the seven groundwater wells (1B, 3B, 5, 6, 7, 9B and 11) was provided by Mesa Water for the years 2016 to 2018. The data relevant for evaluation of treatment technologies was extracted and summarized in the following tables.

Ranges for general well water quality constituents are summarized in Table 1 for the well facilities and Table 2 for the MWRF wells.

Table 1 - Existing General Well Water Quality Range

Constituents	Units	Well 1B	Well 3B	Well 5	Well 7	Well 9B
Aluminum	µg/L	ND - 1.9	ND - 1.3	ND - 4.6	ND - 5.7	ND - 1.3
Ammonia	mg/L as N	--	--	--	--	--
Barium	µg/L	--	43.4 - 44.1	19.9 - 25	31.8 - 40.2	58.5 - 78.3
Bicarbonate	mg/L as CaCO3	134 - 142	129 - 181	89.3 - 113	124 - 132	152 - 161
Calcium	mg/L	40 - 55	43.1 - 49	19 - 22	42 - 54	82 - 110
Carbonate	mg/L as CaCO3	--	--	--	--	--
Chloride	mg/L	31.7 - 53	32 - 39	14.3 - 18.7	39 - 62	78 - 96
EC	µm/cm	484 - 657	481 - 564	276 - 332	475 - 622	848 - 971
Fluoride	mg/L	0.24 - 0.34	0.27 - 0.44	0.48 - 0.7	0.21 - 0.35	0.16 - 0.25
Iron	mg/L	ND - 2.5	ND - <5	0.032 - 8.5	ND - 17.7	ND - 60.9
Magnesium	mg/L	8.1 - 12	9.2 - 11	3.4 - 4.4	8.2 - 11	18 - 26

Constituents	Units	Well 1B	Well 3B	Well 5	Well 7	Well 9B
Manganese	µg/L	2.4 - 5.7	4.1 - 5.2	ND - <1	ND - 4.1	3.6 - 9.5
Nitrate	mg/L	ND - 0.6	3.3 - 3.9	5 - 7.4	3.6 - 4.4	1.7 - 2.3
Phosphate	mg/L	--	0.02 - 0.03	--	--	--
Potassium	mg/L	1.7 - 2	1.7 - 2	1.4 - 1.7	1.7 - 2.1	2.4 - 2.8
Silica	mg/L	--	--	--	--	--
Sodium	mg/L	46.6 - 55	43.9 - 51	28 - 42	44 - 56	61 - 71
Specific Conductance	umho/cm	480 - 610	460 - 580	270 - 320	480 - 610	820 - 1100
Sulfate	mg/L	53.3 - 79	57 - 87	16 - 26.3	49.5 - 79	150 - 220
Total Alkalinity	mg/L as CaCO3	134 - 142	129 - 181	89.3 - 113	124 - 132	152 - 161
Total Dissolved Solid (TDS)	mg/L	278 - 360	260 - 330	150 - 202	280 - 380	440 - 680
Total Hardness	mg/L as CaCO3	133 - 190	145 - 170	63.9 - 73	140 - 180	280 - 380
Total Organic Carbon (TOC)	mg/L	ND - 0.61	ND - 0.4	0.09 - 0.43	ND - 0.4	0.3 - 0.46
pH	--	7.78 - 8.42	7.64 - 8.81	7.9 - 8.62	7.7 - 8.51	7.54 - 8.19
LSI	@ 25 C	0.5 - 0.66	0.43 - 0.71	-0.013 - 0.25	0.39 - 0.69	0.58 - 0.96

Table 2 - MWRF Existing General Well Water Quality Range

Constituents	Units	Well 6	Well 11
Aluminum	µg/L	--	20.9 - 24
Ammonia	mg/L as N	0.23 - 0.35	0.17 - 0.31
Barium	µg/L	10.7 - 14.2	4.6 - 8.9
Bicarbonate	mg/L as CaCO3	162 - 187	161 - 180
Calcium	mg/L	8.9 - 11	6.9 - 10
Carbonate	mg/L as CaCO3	4 - 23.8	9.3 - 22.5
Chloride	mg/L	82 - 131	56 - 98
EC	µm/cm	671 - 809	551 - 687
Fluoride	mg/L	0.43 - 0.85	0.46 - 0.66
Iron	mg/L	ND - 0.065	ND - 61.5
Magnesium	mg/L	0.54 - 1.2	ND - 1.2
Manganese	µg/L	ND - 4.2	ND - 5
Nitrate	mg/L	ND - 1	ND - 0.7
Phosphate	mg/L	0.05 - 0.06	--
Potassium	mg/L	ND - 1.1	ND - 1.1
Silica	mg/L	16	16
Sodium	mg/L	140 - 160	109 - 146

Constituents	Units	Well 6	Well 11
Specific Conductance	umho/cm	78 - 800	520 - 680
Sulfate	mg/L	2.1 - 12	1.4 - 8
Total Alkalinity	mg/L as CaCO3	177 - 198	178 - 199
Total Dissolved Solid (TDS)	mg/L	370 - 470	292 - 720
Total Hardness	mg/L as CaCO3	24 - 32	19 - 30
Total Organic Carbon (TOC)	mg/L	3.5 - 8.3	4 - 7.01
pH	--	8.29 - 8.98	8.5 - 8.99
LSI	@ 25°C	-1.7 - 0.68	0.52 - 0.68

The general water quality was similar for all seven wells. Values for certain constituents were not reported such as ammonia for wells 1B, 3B, 5, 7, and 9B; aluminum for well 6; carbonate for wells 1B, 3B, 5, 7, and 9B; phosphate for wells 1B, 5, 7, 9B, and 11; and silica for all the wells.

The major constituents that affect the viability of various treatment technologies include iron, nitrate, sulfate, silica, TDS, TOC, and pH. Along with pH, alkalinity and hardness are also important for producing a treated water that is non-corrosive and has a similar corrosion index to the existing water in the distribution system.

The corrosion index included with the well water quality data was the Langelier Saturation Index (LSI). LSI is a calculated parameter to predict the calcium carbonate stability of water. An LSI value of zero means the water is in equilibrium. A water is scale-forming if the water has a positive LSI. A negative LSI means the water is corrosive.

The MWRF wells have significantly higher levels of TOC and color (not indicated in the tables) compared to the other wells, which is why the MWRF wells are currently treated with nanofiltration (NF) to remove color and TOC.

PHGs

The California PHG for arsenic has been established at a concentration of 0.004 ug/L. For the period 2016-2018, two constituents exceeded the PHG. Arsenic was detected in well 3B in May 2017 at 2.0 µg/L. Well 5 exceeded the PHG for Arsenic in June 2017 and October 2017 with values of 2.0 µg/L and 2.1 µg/L, respectively. The other samples were below the RDL of 2.0 µg/L.

The activity-based California PHG for uranium is 0.43 pCi/L with a RDL of 1 pCi/L. Uranium was detected above the PHG Well 9B three times in 2017 with values of 1.47 pCi/L (February), 2.29 pCi/L (May) and 1.21 pCi/L (August). These results are summarized in Table 3.

Table 3 – Arsenic and Uranium Detection 2016-2018

Constituents	Units	Well	Values	PHG
Arsenic	µg/L	Well 3B	2.0	0.004
Arsenic	µg/L	Well 5	2.0, 2.1	0.004
Uranium	pCi/L	Well 9B	1.21, 1.47, 2.29	0.43

Arsenic is a naturally occurring element and can be weathered from rocks and soils in groundwater. Arsenic is also released through manufacturing processes, use of agricultural pesticides and herbicides, petroleum refining, pharmaceutical, and other production processes. Long term health effects of arsenic may be carcinogenic, in 2001 the United States Environmental Protection Agency (USEPA) reduced the MCL of arsenic to 10 µg/L.

Arsenic has a variety of inorganic (Arsenite (+3) or As(III), Arsenate(+5) or As(V)) as well as organic (Monomethyl arsenic acid (MMA), Dimethyl arsenate (DMA) and Trimethyl arsenate (TMA)) forms. Each form of arsenic has a different solubility in water with organic forms of arsenic having a higher water solubility than inorganic forms. Thus, the form of arsenic may be an additional factor to consider when extremely low concentrations are required by treatment.

Uranium is a naturally occurring radionuclide. In nature it is found as a mineral which can leach into groundwater through rocks and soil, similar to arsenic and other constituents. Long term health effects include kidney failure and carcinogenic issues.

It is noted, that for arsenic the RDL for current methods is higher than the PHG. This is because the current approved analytical methods do not achieve the level of detection required to achieve the PHG. For uranium, there are other approved laboratory methods to obtain a RDL that is less than the PHG, meaning that current methods are available for PHG compliance measurement.

PROPOSED DESIGN WATER QUALITY

The water quality data was analyzed to develop feed water quality for use with evaluation of treatment technologies. Average values for each constituent were used for the design water quality for Wells 1, 3B, 5, 7, and 9B. For the MWRF, the values for Well 11 was used for the design water quality.

Table 4 and Table 5 show the proposed design water quality for the wells and MWRF, respectively.

Table 4 - Proposed Well Design Water Quality

Constituents	Units	Well 1B	Well 3B	Well 5	Well 7	Well 9B
Aluminum	µg/L	ND	ND	3.233	4.15	1.15
Ammonia	mg/L as N	ND	ND	ND	ND	ND
Barium	µg/L	46.4	43.75	23.288	34.733	65

Constituents	Units	Well 1B	Well 3B	Well 5	Well 7	Well 9B
Bicarbonate	mg/L as CaCO3	139.5	146.25	99.83	126.4	158
Calcium	mg/L	43.58	45.82	21.077	49.278	91.466
Carbonate	mg/L as CaCO3	<1	<1	<1	<1	<1
Chloride	mg/L	36.19	36.48	16.26	53.146	83.836
EC	µm/cm	516.31	520.421	300.516	551.955	883.421
Fluoride	mg/L	0.305	0.398	0.59	0.308	0.219
Iron	mg/L	ND	ND	4.79	11.575	16.608
Magnesium	mg/L	9.07	9.927	3.844	9.546	21.022
Manganese	µg/L	4.4	4.563	ND	2.955	5.67
Nitrate	mg/L	0.5	3.55	5.975	3.863	1.96
Phosphate	mg/L	0.02	0.023		0.02	
Potassium	mg/L	1.9	1.873	1.555	1.908	2.555
Silica	mg/L	--	--	--	--	--
Sodium	mg/L	50.59	47.536	35.261	50.085	66.222
Specific Conductance	umho/cm	513.63	522.222	293	565	918.571
Sulfate	mg/L	59.17	66.731	20.455	67.853	172.909
Total Alkalinity	mg/L as CaCO3	139.5	146.25	99.83	126.4	158
Total Dissolved Solid (TDS)	mg/L	309.067	315.231	181.75	334.133	564
Total Hardness	mg/L as CaCO3	146.86	155.273	68.444	161.769	315
Total Organic Carbon (TOC)	mg/L	0.29	0.233	0.236	0.286	0.378
pH	--	8.06	8.03	8.22	7.97	7.79
LSI	@ 25 °C	0.56	0.56	0.153	0.494	0.768
Arsenic	µg/L	2.1	2.1	2.1	2.1	2.1
Uranium	pCi/L	2.29	2.29	2.29	2.29	2.29

Table 5 - Proposed MWRF Well Design Water Quality

Constituents	Units	MWRF Wells
Aluminum	µg/L	22.45
Ammonia	mg/L as N	0.231
Barium	µg/L	7.8
Bicarbonate	mg/L as CaCO3	171.286
Calcium	mg/L	8.266
Carbonate	mg/L as CaCO3	15.929

Constituents	Units	MWRF Wells
Chloride	mg/L	88.112
EC	µm/cm	651.75
Fluoride	mg/L	0.607
Iron	mg/L	7.734
Magnesium	mg/L	0.69
Manganese	µg/L	3.283
Nitrate	mg/L	0.55
Phosphate	mg/L	0.05
Potassium	mg/L	0.943
Silica	mg/L	16
Sodium	mg/L	131.533
Specific Conductance	umho/cm	639
Sulfate	mg/L	3.082
Total Alkalinity	mg/L as CaCO3	187.428
Total Dissolved Solid (TDS)	mg/L	392.353
Total Hardness	mg/L as CaCO3	23.073
Total Organic Carbon (TOC)	mg/L	5.165
pH	--	8.71
LSI	@ 25 C	0.57
Arsenic	µg/L	2.1
Uranium	pCi/L	2.29

The maximum detected values for arsenic and uranium from the period of 2016-2018 were used for the wells and the MWRF design water quality.

TREATMENT OBJECTIVES

The Mesa Water wells and MWRF currently produce water that meets all of the drinking water standards. In order to meet PHGs for arsenic and uranium, additional treatment would be necessary.

The treatment goals for meeting PHGs are summarized in Table 6.

Table 6 – Treatment Goals for PHGs

Constituent	Units	Value	% Removal	Log Reduction	Type
Arsenic	µg/L	< 0.004	99.8	2.72	Public Health Goal Value
Uranium	pCi/L	< 0.43	81.2	0.73	Public Health Goal Value
pH	--	8.5 to 9.0	--	--	Finished water quality goal
LSI	--	>0.1	--	--	Finished water quality goal
CCPP	mg/L	4 to 10	--	--	Finished water quality goal

Treatment goals for pH, LSI and Calcium Carbonate Precipitation Potential (CCPP) were included to emphasize the importance of producing treated water that meets these goals. LSI provides a measure of the stability of the water with respect to its degree of calcium carbonate saturation. CCPP can provide a quantitative measure of the calcium carbonate deficit or excess in the water. Since treatment to meet PHGs would likely require a much higher degree of treatment than currently employed, many of the constituents that affect the pH, LSI and CCPP could be removed. Any treatment alternative considered would need to include chemical dosing, if needed, to achieve acceptable values for these parameters in order deliver a balanced, non-corrosive water to the distribution system.

Since the PHGs for arsenic are one to two orders of magnitude below the available laboratory detection limits or RDL, new or special methods may be required to obtain laboratory detection for arsenic.

TREATMENT TECHNOLOGIES TO ACHIEVE PHG

BEST AVAILABLE TECHNOLOGY

The Best Available Technology (BAT) is a technology approved by regulators for meeting removal standards for a particular contaminant or class of contaminants. The USEPA typically provides a listing of BATs when publishing rules on specific constituents.

BATs are designed for treatment to achieve compliance with the corresponding MCL only, and not PHGs or MCLGs. The BATs to reach such low levels of arsenic and uranium in the Mesa Water groundwater have not been defined and may not realistically be available. The PHGs for arsenic and uranium are lower than laboratory tests can detect, so it would be impossible to confirm whether treated groundwater actually has arsenic lower than the PHG level because it cannot be measured at that level. Removal performance to obtain PHG is uncertain and would require a field evaluation on the actual water source to verify removal to a measurable level.

Nevertheless, the BATs for arsenic and uranium are the treatment technologies that have the most potential to achieve removal to less than the MCL and were considered for this report.

The oxidation state of arsenic, as well as the form of arsenic (organic vs. inorganic), plays a significant role in the ability of the technologies to remove arsenic. The reduced form of arsenic, As(III), is not as readily removed as the oxidized form, As(V). Thus, oxidation of As(III) with an oxidant such as chlorine may be a necessary pretreatment step to maximize arsenic removal. Organic forms of arsenic have higher solubility in water than the inorganic forms and may not be removed to the same degree by the various treatment technologies.

BATS FOR ARSENIC AND URANIUM

Technologies discussed in this section are grouped into four broad categories: ion exchange processes, separation (membrane) processes, adsorption processes, and precipitative processes.

A brief description of each technology and their general effectiveness at removing arsenic and uranium from water is presented below.

Ion Exchange

Ion Exchange (IX) is a BAT for arsenic and uranium removal from water with nominal removal efficiencies of 95% and 99%, respectively. IX is a physical-chemical process in which ions are exchanged between an aqueous solution phase and solid resin phase. The solid resin is typically a synthetic resin which has been selected to preferentially exchange with the particular contaminant of concern.

To accomplish this exchange of ions, feed water is continuously passed through a packed bed of ion exchange resin beads in a downflow or upflow configuration until the resin is exhausted. Exhaustion occurs when all sites on the resin beads have been filled by contaminant ions. At this point, the bed is regenerated by rinsing the IX column with a regenerant - a concentrated solution of ions initially exchanged from the resin. The number of bed volumes (BV) that can be treated before exhaustion varies with resin type and influent water quality. Typically, from 300 to 60,000 BV can be treated before regeneration is required. In most cases ,regeneration of the bed can be accomplished with only 1 to 5 BV of regenerant followed by 2 to 20 BV of rinse water.

Important considerations in the applicability of the IX process for removal of a contaminant include water quality parameters such as pH, competing ions, resin type, alkalinity, and influent contaminant concentration. Other factors include the affinity of the resin for the contaminant, spent regenerant and resin disposal requirements, secondary water quality effects, and design operating parameters.

The exchange affinity of various ions is a function of their net surface charge as well as the pH of the solution. The efficiency of the anionic IX process for arsenic or uranium removal depends strongly on the concentration of other anions, most notably sulfate and nitrates. These sulfates and nitrates and other anions compete for sites on the IX resin according to the following selectivity sequence:

High levels of total dissolved solids (TDS) can also adversely affect the performance of an IX system. In general, the IX process is not an economically viable treatment technology if source water contains over 500 mg/L of TDS or over 50 mg/L of sulfate. Although these relationships may differ for various water sources, it does provide a general indication of the impact of TDS and sulfate on IX treatment.

One of the primary concerns related to IX treatment is the phenomenon known as chromatographic peaking, which can cause levels of target constituents (e.g. arsenic) in the treatment effluent to exceed those in the influent stream. This can occur if a competing constituent (e.g. sulfate) is present in the raw water and the bed is operated past exhaustion. In this example, because sulfate is preferentially exchanged, incoming sulfate anions may displace previously adsorbed arsenic. In most groundwaters, sulfate is present in concentrations that are orders of magnitude greater than arsenic. Therefore, the level of sulfate is one of the most critical factors to consider for determining the number of bed volumes that can be treated.

The spent brine solution and rinse water produced during regeneration must be disposed of appropriately or reused for further regeneration following treatment. Depending on the local discharge regulation, discharge of high TDS spent regenerant solution can be a challenge. Off-site regeneration of the IX resin may be possible using a regeneration service provider. The resin would be removed from the vessels and replaced with fresh resin. The spent resin would be sent off-site to a facility dedicated to regeneration.

Reverse Osmosis

Reverse Osmosis (RO) is a BAT for removal of both arsenic and uranium from water. RO can achieve greater than 95% removal of arsenic, and 99% removal of uranium. RO is a pressure-driven membrane separation process capable of removing constituents from water by means of particle size, dielectric characteristics, and hydrophilicity/hydrophobicity. RO is relatively insensitive to pH, although pH adjustment may be required to protect the membrane from fouling. For maximum removal by RO, arsenic should be in the oxidized form As(V). RO is likely more effective at removing organic arsenic compared to other technologies since removal by RO is typically a function of molecular weight. Organic forms of arsenic have a higher molecular weight than inorganic forms.

Common RO membrane materials include polyamide thin film composites, with the membrane material being spiral wound around a tube to produce a RO element. RO elements are loaded into pressure vessels and multiple pressure vessels comprise a RO unit.

RO produces treated water by maintaining a pressure gradient across the membrane greater than the osmotic pressure of the feed water. Osmotic pressure becomes high in RO systems compared to other membrane processes due to the concentration of salts on the feed side of the membrane. The majority of the feed water passes through the membrane, with the rest of the water discharged along with the rejected salts and other constituents as a concentrated stream. Discharge concentrate, or brine, can be substantial, for groundwater between 10 to 25 percent of the influent flow depending on influent water quality and membrane properties. The disposal of RO brine or concentrate can be a challenging issue that needs to be addressed at an early stage in the design of a membrane treatment system.

A RO pretreatment system consists of chemical dosing and cartridge filtration. Acid is sometimes used to lower the pH to assist with scaling and fouling control of the RO system. Antiscalant is also dosed to the RO feed stream to assist with scaling control. The cartridge filters (generally 5 microns) remove particulate material from the stream before the RO system.

After pretreatment, the feed water is pumped to the RO units with high pressure pumps. RO units are typically arranged in multiple stages to achieve the desired recovery. For example, in a two-stage system, the concentrate from the first stage becomes the feed water for the second stage and permeate from the second stage is blended with the permeate from the first stage.

The presence of elevated levels of sulfate, iron, barium, magnesium, calcium, silica, and strontium may affect the operation of RO. These constituents may not necessarily impact the removal efficiency of a particular target constituent such as arsenic or uranium, but they can result in scaling and fouling of the membranes which can decrease membrane performance and increase operating costs due to increased operating pressures or membrane cleaning or replacement frequency.

Electrodialysis

Electrodialysis (ED) is a BAT for removal of arsenic from water but is not a BAT for uranium removal. ED is capable of achieving 85% removal of arsenic from water.

ED is a process in which ions are transferred through membranes that are selectively permeable towards cations or anions under the influence of direct electric current. The ions travel from a lower to a higher concentrated solution. In this process, the membranes are arranged in an array or stack placed between opposite electrodes, with alternating cation and anion exchange membranes. The mobility of the cations or anions is restricted to the direction of the attracting electrodes, and this results in alternating sets of compartments containing water with low and high concentrations of the ions.

The electrodialysis reversal (EDR) process is an ED process with periodic reversal of the direction of travel of the ions caused by reversing the polarity of the electrodes. The advantage of polarity reversal is the decreased potential for fouling of the membranes, which also minimizes the pretreatment requirements.

ED is designed specifically for each application based on the desired quantity and quality of product water. Equipment at an ED plant includes the membrane stacks, feedwater pumps, recycle pumps, valving, stream switching, product water diversion, pressure regulation, and electrode stream control. ED systems typically do not require chemical addition. ED systems, however, are typically more expensive than RO systems. EDR systems are often used in treating brackish water to make it suitable for drinking. In terms of effluent water quality, ED can produce water in quality that is comparable to RO.

Activated Alumina

Activated alumina (AA) is a BAT for removal of arsenic from water but is not a BAT for uranium removal. AA is however a Small System Compliance Technology (SSCT) for uranium. AA can remove up to 90% of arsenic and 99% of uranium from water.

AA is a physical/chemical process by which ions in the feed water are adsorbed to an oxidized surface of a porous, granular aluminum-based material. Feed water is continuously passed through a packed bed of AA media to remove contaminants. When adsorption sites on the AA surface become filled, the bed must be regenerated. Regeneration is accomplished through a sequence of rinsing with regenerant, flushing with water, and neutralizing with acid. The regenerant is a strong base, typically sodium hydroxide; the neutralizer is a strong acid, typically sulfuric acid.

Factors such as pH, competing ions, empty bed contact time (EBCT), and regeneration have significant effects on the removals achieved with AA. Other factors include spent regenerant disposal, alumina disposal, and secondary water quality. Similar to IX, off-site regeneration of the AA media may be possible using a regeneration service provider.

The pH of the water to be treated typically needs adjustment for AA removal of some constituents such as arsenic. Optimum pH for arsenic removal by AA is in the range of 5.5 to 6.0.

Similar to ion exchange processes, AA exhibits preference for some ions. However, AA may not be as sensitive as ion exchange to competing constituents such as sulfate, chloride, TOC, and TDS. Arsenic removal is significantly impacted by sulfate and TDS at levels of 360 mg/L and 1,000 mg/L, respectively.

Coagulation/Filtration

Coagulation/filtration (CF) is a BAT for removal of both arsenic and uranium from water. CF can nominally remove 95% of arsenic and 90% of uranium from water.

CF is a treatment process by which the physical or chemical properties of dissolved colloidal or suspended matter are altered by the addition of a coagulant to the water. This results in enhanced agglomeration to an extent that the resulting particles will settle out of solution by gravity or will be removed by filtration. Coagulants change surface charge properties of solids to allow agglomeration and/or enmeshment of particles into a flocculated precipitate. In either case, the final products are larger particles, or floc, which more readily filter or settle under the influence of gravity.

The CF process has traditionally been used to remove solids from drinking water supplies. However, the process is not restricted to the removal of particles. Coagulants render some dissolved species, such as natural organic matter (NOM), inorganics, and hydrophobic synthetic organic compounds, insoluble. The metal hydroxide particles produced by the addition of metal salt coagulants (typically aluminum sulfate, ferric chloride, or ferric sulfate) can adsorb other dissolved species. The efficiency and economics of CF are contingent upon several factors, including the type and dosage of coagulant, mixing intensity, and pH. Coagulation and filtration may not be effective if any of the arsenic is in the organic form, as the equilibrium may be higher than the PHG.

Major components of a basic coagulation/filtration facility include chemical feed systems, mixing equipment, basins for rapid mix, flocculation, settling, filter media, sludge handling equipment, and filter backwash facilities. Settling may not be necessary in situations where the influent particle concentration is very low. Treatment plants without settling are known as direct filtration plants.

The semi-liquid residual consists of the sludge from the settling basin and the filter backwash water. The residual will contain constituents removed by the coagulation process and may need treatment before disposal or sent to a sanitary sewer.

Lime Softening

Lime Softening (LS) is a BAT for arsenic and uranium removal from water with nominal removal efficiencies of 80% and 95%, respectively.

LS removes hardness due to calcium and magnesium compounds by creating a shift in the carbonate equilibrium. The addition of lime to water raises the pH. Bicarbonate is converted to carbonate as the pH increases, resulting in precipitation of calcium as calcium carbonate. Soda ash (sodium carbonate) is added if insufficient bicarbonate is present in the water to remove hardness to the desired level. Softening for calcium removal is typically accomplished at a pH of 10.5 or higher. For magnesium removal, excess lime is added beyond the point of calcium carbonate precipitation. Magnesium hydroxide precipitates at pH levels greater than 10.6. Neutralization is required if the pH of the softened water is higher than the acceptable potable water pH. The most common form of pH adjustment in softening plants is recarbonation with carbon dioxide.

LS has been widely used in the U.S. for reducing hardness in large municipal water treatment systems. Considerable amounts of sludge are produced in a LS system and its disposal can be expensive. Construction of a new LS plant for the removal of arsenic or uranium would not generally be feasible unless hardness must also be reduced.

Oxidation/Filtration

Oxidation/Filtration (OF) is a BAT for removal of arsenic from water but is not a BAT for uranium removal. OF is capable of achieving 80% removal of arsenic from water.

OF refers to precipitative processes that are designed to remove naturally occurring iron and manganese from water. The viability of this process is dependent upon having iron naturally present in the water supply. Most systems include a contact basin. The process involves the oxidation of the soluble forms of iron and manganese to their insoluble forms that are then removed by filtration. Arsenic can be removed via two primary mechanisms: adsorption and coprecipitation. First, soluble iron and As(III) are oxidized. The As(V) then adsorbs onto the iron hydroxide precipitates that are ultimately filtered out of solution. The arsenic removal efficiency is strongly dependent on the initial iron and arsenic concentrations. In general, the Fe:As mass ratio should be at least 20:1, which assumes 1 mg/Fe removes 50 µg/As. Arsenic removals decrease with increasing pH. In addition, high levels of natural organic matter (NOM), orthophosophates, and silicates weaken arsenic removal efficiency by competing for sorption sites on iron hydroxide precipitates.

BAT SCREENING

Table 7 provides a summary of the BATs for both arsenic and uranium discussed in the previous section.

Table 7 - BAT for Arsenic and Uranium

Treatment Technology	Arsenic		Uranium	
	BAT?	Removal Efficiency	BAT?	Removal Efficiency
Ion Exchange (IX)	✓	95%	✓	99%
Reverse Osmosis (RO)	✓	>95%	✓	99%
Electrodialysis (ED)	✓	85%	X	-
Activated Alumina (AA)	✓	90%	X	-
Coagulation Filtration (CF)	✓	95%	✓	90%
Lime Softening (LS)	✓	80%	✓	90%
Oxidation/Filtration (OF)	✓	80%	X	-

Screening of these technologies was performed to identify the technologies to carry forward for use in development of treatment alternatives. Since treatment to the PHG requires a significant level of treatment; 99.8% removal for arsenic and 81.2% for uranium – the primary screening criterion was the ability of the technology to achieve a high removal percentage.

IX, RO, and CF are capable of 95% or greater removal of arsenic for the case of arsenic treatment only. For treatment of arsenic and uranium, the same three technologies could achieve 95% or greater removal of arsenic and 90% or greater removal of uranium.

The secondary screening criterion of footprint requirements was applied to the IX, RO, and CF technologies. The PHG treatment facilities would likely be located at or near the wellhead sites or the existing MWRF site, all of which have limited space available for new treatment equipment. CF has the largest footprint requirement of the three candidate technologies and the space needed for CF would exceed the available space. IX and RO have compact footprint requirements compared to CF.

Based on the results of the technology screening, only IX and RO have the potential for significant removal of both arsenic and uranium, while also having footprint requirements potentially compatible with the physical space available. These two technologies will be used to develop treatment alternatives.

PHG TREATMENT ALTERNATIVES ASSESSMENT

ALTERNATIVE DEVELOPMENT

Treatment alternatives for the arsenic only and arsenic and uranium treatment cases were developed using IX and RO for both the wells and MWRF. Consideration was given to developing an alternative that included both IX and RO as treatment technologies operated in series. However, the equipment requirements, facility footprint, and capital and O&M costs would be significantly higher than a treatment alternative employing only a single technology. Furthermore, given the high level of removal required to achieve the PHGs, there is limited information available suggesting any benefit from combining these two technologies for this application.

An alternative was included to supplement the existing nanofiltration (NF) system with IX at the MWRF. Although NF is not a BAT for either arsenic or uranium, some lab scale studies have shown it can achieve greater than 90% removal of arsenic. However, no data on arsenic removal at a full-scale NF facility was found in the literature.

In order to maximize removal of arsenic, pre-oxidation of the groundwater stream before treatment would be required for all the treatment alternatives. Pre-oxidation would convert As(III) to the more readily removed As(V) form.

For the arsenic and uranium case, arsenic would be the controlling contaminant for treatment because of the higher removal requirement (99.8%) to meet the PHG compared to uranium (82.1%). Thus, the treatment approach for each technology would essentially be the same for the case of arsenic only and arsenic and uranium.

Table 8 presents a summary of the treatment alternatives for the groundwater wells and MWRF, respectively.

Table 8 - Preliminary Treatment Alternatives

Alternative	Treatment Technologies	Applicability	
		Wells	MWRF
1	IX	✓	-
2	RO	✓	✓
3	NF-IX	-	✓

Alternative 1

Alternative 1 for the wells would involve installation of an IX system downstream of the existing well pump. Pressure from the well pump would convey the groundwater through the IX system and on to a wet well. A High lift pump would convey the final treated water to the distribution system.

For the MWRF, the existing NF system is needed for color removal. Although IX is capable of color removal, the IX resin type and optimum operating conditions for arsenic removal may be different than for color removal. Thus, an IX only treatment approach was not considered for the MWRF.

Alternative 2

This alternative for the wells would include a RO system downstream of the existing well pump. A RO feed pump would boost the pressure to force water through the RO system and on to a wet well. A High lift pump would convey the final treated water to the distribution system.

The existing NF system would be modified/replaced with a RO system for this alternative. NF and RO membranes are identical in terms of construction, with the difference being the higher level of removal and higher operating pressure that is associated with the use of a RO membrane. Removal of color, the primary function of the MWRF NF system would be maintained or improved with the use of RO. The MWRF well pumps would convey the groundwater to the suction of a RO feed pump through cartridge filters. The RO feed pump will pump the water through the RO system and on to the existing MWRF post-treatment system. Final treated water would be pumped to the distribution system with the existing MWRF high lift pumps.

Alternative 3

This alternative is only applicable to the MWRF. An IX system would be installed between the existing NF system and the existing post -treatment system. Blended NF permeate would be pumped through the IX system to the existing post-treatment system by IX feed pumps. The existing high lift pumps would convey the final treated water to the distribution system.

ALTERNATIVE EVALUATION

In this section of the report, the treatment alternatives developed in the previous section will be evaluated and compared to determine which alternative best meet the treatment goals. Alternatives will be screened and only one treatment alternative will be carried forward for cost estimation.

Screening Criteria

The following criteria were used for screening of the treatment alternatives:

- Operational Reliability - The ability of the alternative to consistently produce the desired water quality and quantity through all operating conditions. A higher rating was assigned for alternatives with higher reliability.
- Constituent Interference – The impact of interference by other constituents in the groundwater on the removal efficiency of the target compounds. A lower rating was assigned for alternatives with higher potential for constituent interference.
- Water Recovery – The amount of treated water produced by the alternative compared to the feed water quantity. Higher recovery was assigned a higher rating.
- Facility Footprint – The land area required by all the equipment and components of the alternative. A higher rating was assigned for alternatives with a smaller footprint.

- Operational Requirements - The number and time commitment of staff to operate the alternative. The option with lower staff requirements was assigned a higher rating.
- Capital Cost – Costs that include major equipment and installation. A higher rating was assigned for alternatives with lower capital cost. Note that for the initial screening evaluation, a conceptual cost estimate (AACE Class 5) was used. This level of estimate is for the basis of relative project cost at a conceptual level.
- O&M Cost - Annual estimated O&M cost including energy, chemicals, short-lived asset replacement, operating labor, and residuals disposal. A higher rating was assigned for the alternative with a lower O&M cost.

Each alternative was evaluated with respect to each criterion and assigned a rating (1, 2 or 3, with 3 being best) corresponding to its performance with each criterion. The scores for each criterion were summed and the alternative with the highest score will be carried forward for further analysis.

Wells

Table 9 presents the completed screening table for the well treatment alternatives.

Table 9 - Well Treatment Alternatives Screening

Criterion	Alternative 1 - IX	Alternative 2 - RO
Operational Reliability	1	3
Constituent Interference	1	3
Water Recovery	3	1
Facility Footprint	2	3
Operational Requirements	2	3
Capital Cost	3	2
O&M Cost	3	1
Total	15	16

Alternative 2 - RO was rated higher than Alternative 1 - IX for Operational Reliability and Constituent Interference. RO offers better reliability for producing consistent treated water quality. Since RO is a separation process, the mechanisms for rejection of constituents by the membranes is not too dependent on feed water quality such as pH and TDS. IX performance is sensitive to pH, alkalinity and target constituent feed concentration that can impact the removal performance. IX is also subject to chromatographic peaking, which could result in levels of target compounds in the treated water higher than the PHG or even the MCL.

Other constituents present in the groundwater can affect IX more than RO. All the wells except wells 5, 6, 11 had sulfate levels that could interfere with removal of arsenic by IX, while well 5 had nitrate levels and well 11 had TDS levels above the recommended values to avoid impacts on arsenic removal.

Alternative 1 - IX was rated higher than Alternative 2 - RO for water recovery. For groundwater with water quality like the Mesa Water groundwater wells, RO systems can operate with a recovery of about 75-80%, with 20-25% of the feed water sent to waste as a concentrate stream from the RO. IX systems can operate with a recovery of 94-98%. Off-site regeneration of spent IX resin could be considered for IX which would improve recovery, although there would be an additional cost for off-site regeneration service.

A higher rating was assigned to Alternative 2 - RO for the Facility Footprint and Operational Requirements. RO has a slightly lower footprint requirement for the capacities evaluated, as only one or two RO trains, plus ancillary pretreatment, membrane Clean-In-Place (CIP), and chemical storage and dosing equipment would be needed for each well treatment process. IX would require 2 or more vessels, regeneration system tanks and pumps, and chemical storage and dosing equipment. IX requires more operator attention than RO. Since the performance of IX is dependent on the feed water pH and number of BVs per exchange cycle, the operators must manage these parameters to maximize removal of target constituents.

Alternative 1 - IX received a higher rating than Alternative 2 - RO for both the capital and O&M cost criteria. RO's higher capital cost is due to more equipment components than IX. Since RO removes not only the target constituents but many other constituents that may result in corrosive permeate, chemicals are needed to adjust the pH and alkalinity of the RO permeate stream before disinfection and discharge to the distribution system. RO utilizes more consumable materials than IX, including pre-treatment cartridge filters and RO membranes. RO membranes need replacement approximately every 5 years, while IX resins can last up to 7-10 years before needing replacement. RO concentrate disposal costs would be higher than spent brine solution and rinse water from IX.

Based on the results of the well treatment alternative screening, Well Treatment Alternative 2 - RO will be carried forward for further development and cost estimation.

MWRF

The MWRF alternatives screening results are shown in Table 10.

Table 10 - MWRF Treatment Alternatives Screening

Criterion	Alternative 2 - RO	Alternative 3 - NF-IX
Operational Reliability	3	1
Constituent Interference	3	1
Water Recovery	1	2
Facility Footprint	3	1
Operational Requirements	3	1
Capital Cost	2	2
O&M Cost	1	2
Total	16	10

For the MWRF, the discussion of performance with each criterion for Alternative 2- RO is the same as in the preceding section.

Alternative 3 – NF-IX was assigned the same or lower ratings than Alternative 2 – RO for all the criteria except Water Recovery. The existing NF system plus IX would be capable of achieving higher recovery than a RO system.

NF-IX would have the largest footprint of the two alternatives since the existing NF building could not be used for the new IX treatment equipment, whereas the RO alternatives could utilize the space in the existing NF building if the existing NF system were to be removed.

The O&M cost for the RO alternative would be higher than NF-IX due to the lower RO recovery.

MWRF Alternative 2 – RO will be carried forward for further development and cost estimation based on the results of the alternative screening.

TREATMENT ALTERNATIVE DEVELOPMENT

The design water quality for both the wells and MWRF was used to develop a RO treatment system for each facility. The conceptual design of the RO system involved balancing three major interrelated considerations that impact the cost to produce treated water – Pre-Treatment, RO Recovery, and Post-Treatment. Figure 1 provides a graphical representation of these considerations.

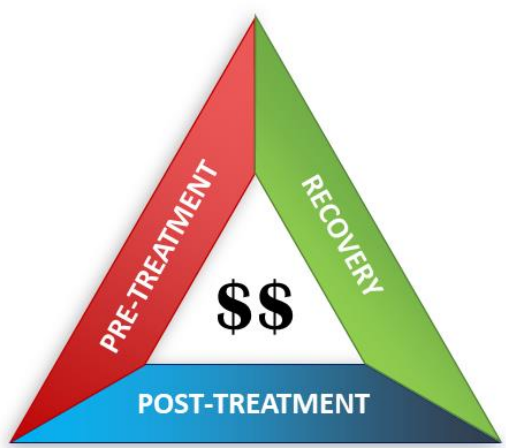

Figure 1 – Major RO Design Considerations

The approach taken to develop the RO system for cost estimating purposes was to minimize pre-treatment by avoiding acid addition to lower the RO feed pH. This approach was employed in the design of the existing NF system at the MWRF in order to avoid adding sulfates to the water via acid addition with sulfuric acid. No acid addition would also decrease the post-treatment requirements since the pH of the RO permeate would by higher and less chemical would be required to raise the pH to the desired range.

However, the recovery achievable by the RO system with no acid addition (approximately 80-82%) would be lower than if acid were dosed to the RO feed stream. This is because acid addition would lower the pH and would decrease the scaling potential of the RO concentrate stream, which would allow the recovery to be higher (approximately 85-87%). Thus, a reasonable recovery rate of 80% (with 20% waste stream to be disposed) could be achieved while lowering the pre-and post-treatment chemical requirements.

An alternative approach, for example, would be to add acid to the RO feed. This would be offset by the increased water production and decreased sewer disposal costs. This would increase the recovery, lower the concentrate disposal requirements, but increase both the pre- and post-treatment chemical requirements, all of which impact the cost of water treated.

Even higher recovery could be potentially achieved with the use of a “closed coupled” RO (CCRO) or similar type of system that operates temporarily above saturation limits. Information suggests that a CCRO may be able to achieve a recovery in the range of 92-96 percent, however this approach would require demonstration. Water quality could be an issue with the use of CCRO which produces a lower quality, and individual constituent removal would have to be verified.

It is recognized that RO involves a reduction in well production capacity which may require an additional source (i.e. additional wells or imported water purchases) to match existing conditions. RO also has considerable disposal costs that are included as part of the evaluation. In addition, the approach used for the purpose of this evaluation was based on “site specific” or “well head” treatment. Another approach would be to consolidate the treatment facilities in a single location and pump the well water to a single RO facility. This alternative may provide a lower capital cost as a single facility would involve fewer components, and the RO treatment units and ancillary equipment would be consolidated, simplifying operations.

These types of evaluations are beyond the scope of this project but would be necessary if Mesa Water moves forward with implementation of treatment for PHGs.

WELLS

Well Treatment Alternative 2 – RO would utilize the existing well pump, sand separator, and static mixers. The first treatment step would be Pre-Oxidation to oxidize As(III) to As(V) by dosing sodium hypochlorite to the groundwater stream. Since RO membranes have limited tolerance to chlorine, any residual chlorine in the stream would be quenched with sodium bisulfite.

The next treatment step would be RO Pre-Treatment. Antiscalant would be dosed to the stream to assist with scaling control of the RO membranes, followed by cartridge filtration. The cartridge filters would remove any particulate material from the stream before the RO system.

There would be residual pressure from the well pump supplied to the suction of the RO Feed Pump which would decrease the horsepower requirement for that pump. The RO Feed Pump would force the pre-treated feed through the RO train, separating the stream into a purified permeate stream and a concentrated brine stream.

Each RO train would be configured as two stages with an approximately 2:1 array of pressure vessels. Each pressure vessel would contain 7 RO elements. The design recovery for the RO system would be 80% at an average temperature of 25ºC. The concentrate stream from the RO trains would be collected in a header pipe and sent to the sewer. The concentrate would contain trace levels of arsenic and uranium.

Following RO, the Post-Treatment step would provide stabilization of the treated water to prevent corrosion of the downstream facilities. The resulting RO permeate would have very low levels of TDS, hardness, and alkalinity. Post-Treatment would consist of dosing sodium hydroxide, carbon dioxide, and calcium chloride. Sodium hydroxide and carbon dioxide would assist with adding alkalinity back into the water and adjusting the pH. Calcium chloride would assist with adding hardness back into the water.

The post-treated water would be disinfected with the existing disinfection system and then flow to a new Distribution Wetwell. A high lift pump would convey the treated water to the distribution system.

Each of the major treatment steps described above may have subsystems to assist with their operation. These subsystems are indicated below:

- Pre-Oxidation
- Sodium Hypochlorite Feed System
- Sodium Bisulfite Storage and Feed System
- Pre-Treatment
- Antiscalant Storage and Feed System
- Cartridge Filters
- RO System
- RO Feed Pump
- RO Train
- CIP System
- Post-Treatment
- Sodium Hydroxide Storage and Feed System
- Carbon Dioxide Storage and Feed System
- Calcium Chloride Storage and Feed System
- Disinfection
- Existing Sodium Hypochlorite Storage and Feed System
- Existing Ammonia Storage and Feed System
- Distribution
- Distribution Wetwell
- High Lift Pump

A process flow diagram for Well Treatment Alternative 2 is shown on Figure 2.

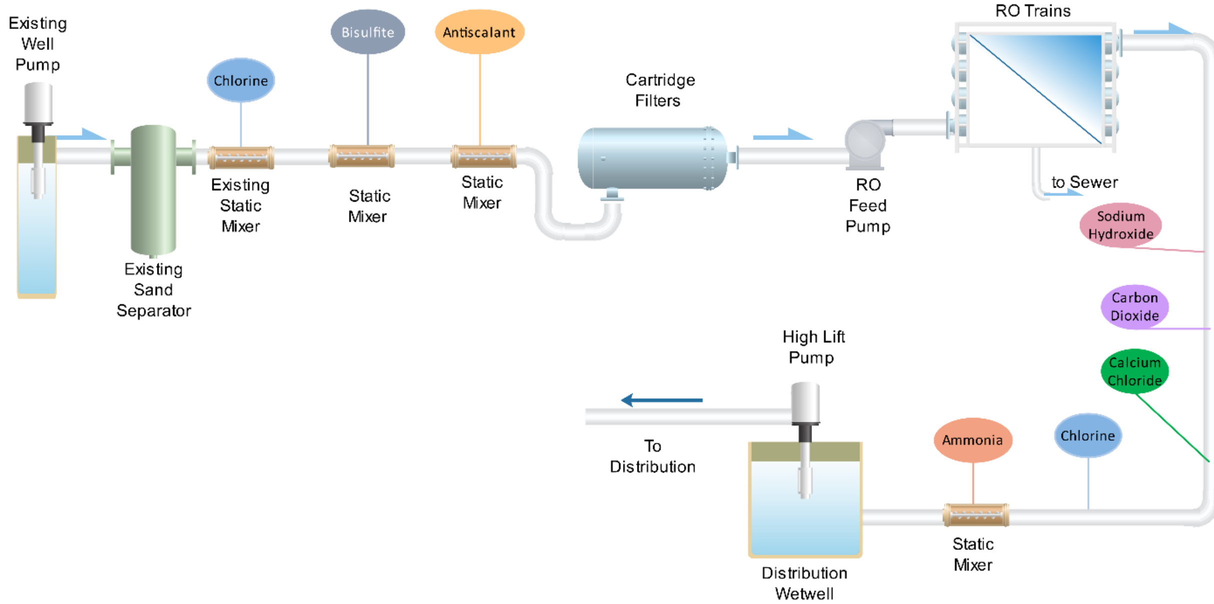

Figure 2 – Well Treatment Alternative 2 Process Flow Diagram

MWRF

MWRF Treatment Alternative 2 – RO would also utilize the existing well pump, sand separator, and static mixers.

The descriptions of the Pre-Oxidation, Pre-Treatment, RO, and Post-Treatment processes for the MWRF Treatment Alternative 2 – RO are identical to the descriptions for the Well Treatment Alternative 2 – RO in the previous section. The NF system would be replaced with a RO system and the RO permeate would undergo post-treatment to approximate the water quality of the existing blended NF permeate stream. The existing downstream methane/hydrogen sulfide removal system, disinfection system, and treated water storage and distribution system would be utilized. The existing NF system antiscalant storage and feed system, cartridge filters and CIP system would be repurposed for the RO system.

A summary of the major treatment step subsystems is provided below:

- Pre-Oxidation
- Sodium Hypochlorite Feed System
- Sodium Bisulfite Storage and Feed System
- Pre-Treatment
- Existing Antiscalant Storage and Feed System
- Existing Cartridge Filters
- RO System
- RO Feed Pump
- RO Train
- Existing CIP System

- Post-Treatment
- Sodium Hydroxide Storage and Feed System
- Carbon Dioxide Storage and Feed System
- Calcium Chloride Storage and Feed System
- Methane/Hydrogen Sulfide Removal
- Existing Anti-Foam Storage and Feed System
- Existing Carbon Dioxide Storage and Feed System
- Existing Sodium Hydroxide Storage and Feed System
- Existing Sodium Hypochlorite Storage and Feed System
- Existing Degasifiers
- Existing Scrubbers
- Disinfection
- Existing Sodium Hypochlorite Storage and Feed System
- Existing Ammonia Storage and Feed System
- Distribution
- Existing Product Transfer Pump System
- Existing Ground Storage Tank
- Existing High Lift Pumps

Figure 3 shows a process flow diagram of MWRF Treatment Alternative 2.

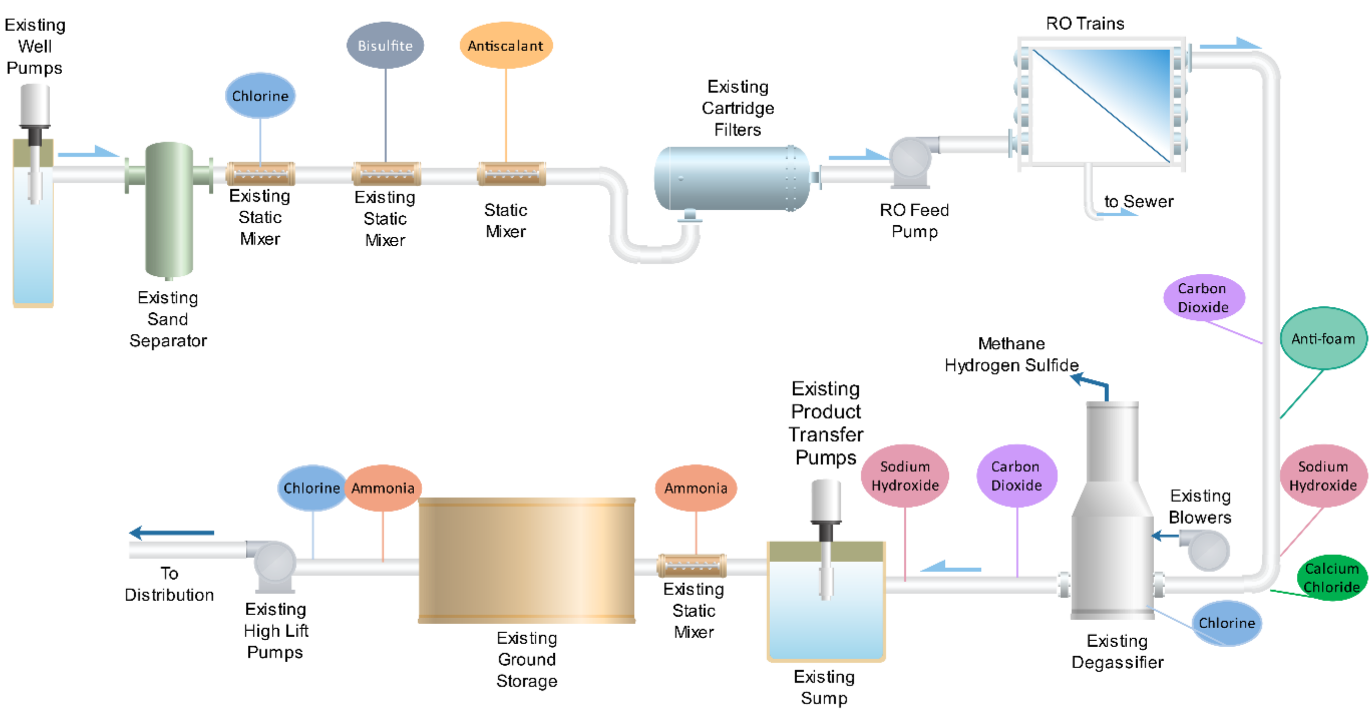

Figure 3 – MWRF Treatment Alternative 2 Process Flow Diagram

DESIGN CRITERIA

The following tables summarize the design criteria for the RO system and chemical dosing that were used to develop the cost estimates and treatment facility footprint requirements.

Wells

The design criteria for the Well Treatment Alternative 2 - RO systems are shown in Table 11.

Table 11 – Well Treatment Alternative 2 RO System Design Criteria

Description	Units	Design Value				
		Well 1B	Well 3B	Well 5	Well 7	Well 9B
Feed Flow (gpm)	--	2,400	1,650	2,200	1,450	1,800
Permeate Flow (gpm)		1,920	1,320	1,760	1,160	1,440
Membrane Model	--	Hydranautics CPA7-LD				
Membrane Material	--	Composite Polyamide				
Membrane Area per Element	ft^2	400				
Number of Installed RO Trains	--	2	1	2	1	1
Operating Configuration	--	2 Duty	1 Duty	2 Duty	1 Duty	1 Duty
Nominal Design Flux	gfd	14.9	15.0	15.0	14.2	14.5
Minimum Recovery	%	80% @ Average Temperature 25°C				
Train Configuration	--	22:11	30:15	20:10	28:14	34:17
Number of Elements per Pressure Vessel	--	7				
Design Pressure	psig	138.4	139.7	136.9	132.3	138.6
Concentrate Flow	gpm	480	330	440	290	360

MWRF

The design criteria for the MWRF Treatment Alternative 2 - RO systems are shown in Table 12.

Table 12 – MWRF Treatment Alternative 2 Design Criteria

Description	Units	Design Value MWRF
Feed Flow (gpm)		6,000
Permeate Flow (gpm)	--	4,800
Membrane Type	--	Hydranautics CPA7-LD
Membrane Material	--	Composite Polyamide
Membrane Area per Element	ft^2	400
Number of Installed RO Trains	--	3

Description	Units	Design Value MWRF
Operating Configuration	--	3 Duty
Nominal Design Flux	gfd	15.2
Minimum Recovery	%	80% @ Average Temperature 25°C
Train Configuration	--	36:18
Number of Elements per Pressure Vessel	--	7
Design Pressure	psig	144.1
Concentrate Flow	gpm	1197

Table 13 presents the chemical dosing design criteria applicable to both the Well and MWRF Treatment Alternative – 2.

Table 13 – Chemical Dosing Design Criteria

Description	Dose (mg/L) MWRF
PRE-OXIDATION	
Sodium Hypochlorite	2.5
Sodium Bisulfite	4
RO PRETREATMENT	
Antiscalant	3.5
POST-TREATMENT	
Sodium Hydroxide	90
Carbon Dioxide	95
Calcium Chloride	23

PFAS

Per- and Polyfluoroalkyl Substances (PFAS) are emerging contaminants because they have a pathway to enter the environment, may pose a human health or environmental risk, and currently do not have federal regulatory standards. These chemicals were widely used in Teflon and non-stick cookware, in firefighting foams, fabric protectants, consumer packaging and even certain manufacturing processes. The characteristics that make them useful are the reason they persist in the environment and can bioaccumulate, or build up, in our bodies and the bodies of animals. PFAS are water soluble and due to their chemical properties, they are difficult to remove with traditional drinking water treatment technologies. Hydrogeological modeling and results from Mesa Water suggest that PFAS is not of immediate concern, however, there is a general concern with regards to the presence and any future regulations associated with these compounds. These compounds appear to be effectively removed by advanced water treatment technologies such as RO.

USEPA has listed the following PFAS compounds as suspected drinking water contaminants:

- Perfluorooctanoic acid (PFOA)
- Perfluorooctane sulfonate (PFOS)
- Perfluorononanoic acid (PFNA)
- Perfluorohexane sulfonic acid (PFHxS)
- Perfluorohexanoic acid (PFHxA)
- Perfluorobutanesulfonic acid (PFBS)

There are several treatment options available that may be effective for the removal of PFAS including activated carbon, anion exchange, membrane filtration (RO or NF), and advanced oxidation processes (AOP).

Limited research information shows that RO membranes are typically effective at removing more than 90% of PFAS compounds, including short-chain compounds, from water at typical groundwater RO conditions (80% recovery, low to moderate pressure). Similar to the evaluation for arsenic and uranium removal in this report, RO may be able to provide the highest level of removal for PFAS. However, the effectiveness of RO, or any technology or combination of technologies, will depend on the treatment goal and the initial concentration of the target constituent relative to the treatment goal.

RADIUM AND OTHER EMERGING CONSTIUENTS

Radium (molecular weight 226, charge +2) is also regulated at an activity of 5 pCi/L. It is a radioactive species, similar to uranium. While there is a tendency in the regulatory framework to use activity-based measurement (pCi/L) as a surrogate, water utilities should be aware that there may be concentration-based limits (usually expressed in µg/L) which may also apply. For contaminants that exhibit activity it may be necessary to measure the concentration or constituent associated activity instead of overall activity in order to determine compliance with the regulations. Radium, like uranium would be effectively removed by RO.

Regarding the potential of other constituents, there are too many potential candidates to consider. However, the following statement is applicable to the general use of RO as a treatment process. RO is generally considered an effective treatment process for the removal of most constituents that are contained in water supplies. The process is most effective at removing constituents above 150 molecular weight and/or species that have an associated anionic or cation charge (valence) with higher charged species removed to a greater degree. Low molecular weight (below 100) MW and non-ionic or weakly charged species, low molecular weight organic compounds and dissolved gasses are generally removed to a lesser degree.

CONCEPTUAL COST ESTIMATES

Capital and Operation and Maintenance (O&M) cost estimates were developed for the two treatment alternatives.

CAPITAL COST ESTIMATES

Table 14 summarizes the estimated capital costs for both the Well and MWRF Treatment Alternative 2 - RO.

Table 14 - Estimated Construction Costs

Component	Capital Cost					
	Well 1B	Well 3B	Well 5	Well 7	Well 9B	MWRF
Feed Flow (gpm)	2,400	1,650	2,200	1,450	1,800	6,000
Permeate Flow (gpm)	1,920	1,320	1,760	1,160	1,440	4,800
Concentrate Flow (gpm)	480	330	440	290	360	1,200
Sodium Hypochlorite Chemical System	$28,000	$27,000	$28,000	$27,000	$27,000	$55,000
Sodium Bisulfite Chemical System	$28,000	$28,000	$28,000	$28,000	$28,000	$30,000
Antiscalant Chemical System	$30,000	$30,000	$30,000	$30,000	$30,000	$0
Cartridge Filters	$164,000	$82,000	$164,000	$82,000	$82,000	$0
RO System	$1,345,000	$841,000	$1,232,000	$811,000	$914,000	$2,823,000
RO CIP System	$208,000	$208,000	$208,000	$208,000	$208,000	$0
Carbon Dioxide Chemical System	$391,000	$378,000	$388,000	$374,000	$380,000	$734,000
Sodium Hydroxide Chemical System	$132,000	$99,000	$123,000	$90,000	$106,000	$224,000
Calcium Chloride Chemical System	$57,000	$47,000	$53,000	$47,000	$51,000	$63,000
High Lift Pump Station	$384,000	$217,000	$480,000	$139,000	$210,000	$0
Installation @ 20%	$553,000	$391,000	$547,000	$367,000	$407,000	$786,000
Mechanical Total	$3,320,000	$2,348,000	$3,281,000	$2,203,000	$2,443,000	$4,715,000
Facility Building	$2,314,000	$1,848,000	$2,314,000	$1,848,000	$1,848,000	$0
Subtotal	$5,634,000	$4,196,000	$5,595,000	$4,051,000	$4,291,000	$4,715,000
Piping, Valves, and Appurtenances @ 4%	$225,000	$168,000	$224,000	$162,000	$172,000	$189,000
Sitework @ 10%	$563,000	$420,000	$560,000	$405,000	$429,000	$472,000
Sewer Pipeline	$25,000	$20,000	$83,000	$267,000	$33,000	$0

Component	Capital Cost					
	Well 1B	Well 3B	Well 5	Well 7	Well 9B	MWRF
Sewer Connection Fee	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000
Plumbing and HVAC @ 5%	$282,000	$210,000	$280,000	$203,000	$215,000	$236,000
Electrical I&C @ 15%	$845,000	$629,000	$839,000	$608,000	$644,000	$707,000
Subtotal	$7,624,000	$5,693,000	$7,631,000	$5,746,000	$5,834,000	$6,369,000
Contingency @ 30%	$2,287,000	$1,708,000	$2,289,000	$1,724,000	$1,750,000	$1,911,000
Engineering @ 15%	$1,144,000	$854,000	$1,145,000	$862,000	$875,000	$955,000
Total Estimated Capital Cost	$11,055,000	$8,255,000	$11,065,000	$8,332,000	$8,459,000	$9,235,000

The total cost for all facilities involved is approximately 56 million dollars. The capital cost estimates were developed based on the design criteria for the two alternatives. The estimate is an AACE Class 4 estimate. Class 4 estimates are conceptual or planning level estimates and have an accuracy of +50%, -30% and typically include a 30% contingency. The capital costs were based on budgetary quotes and cost estimates for recent similar projects.

Major assumptions for preparing this estimate include:

- RO system costs were based on quotations from equipment suppliers. Some ancillary equipment such as membrane cleaning chemical systems and process chemical feed systems were included in the quotes. Costs for other ancillary equipment not provided by the equipment suppliers were estimated.
- A building was assumed to enclose the major process equipment. However, for the MWRF Treatment Alternative 2 – RO, it was assumed that the major equipment associated would the RO system would fit in the building space occupied by the existing NF system. This assumption would need to be confirmed during preliminary design if the project moves forward.
- The estimate does not include costs for land acquisition per Mesa Water's request.
- The estimate only includes costs for new equipment for the PHG treatment.
- The sewer connection fee was estimated using a 10,000 square foot facility based on the rate table provided by Costa Mesa Sanitary District.
- For the Well Treatment Alternative 2 – RO, the existing storage for sodium hypochlorite would be sufficient for both the new Pre-Oxidation process and the existing Disinfection process.
- The site work line item includes general site preparation and finishing.

The percentages for Piping, Valves and Appurtenances, Site Work, HVAC, Plumbing, Electrical, and I&C were based on past projects recently bid in California, which are representative of the current water treatment industry construction pricing in the southwestern United States. Additionally, the costs for contingency, contractor overhead and profit and engineering were based on industry standards for a project of this nature.

O&M AND ANNUAL COST ESTIMATES

The estimated annual incremental O&M costs for the Wells using RO are presented in Table 15.

Table 15 – Wells: Estimated Incremental Annual O&M Costs

Component	Annual O&M Costs				
	Well 1B	Well 3B	Well 5	Well 7	Well 9B
Feed Flow (gpm)	2,400	1,650	2,200	1,450	1,800
Permeate Flow (gpm)	1,920	1,320	1,760	1,160	1,440
Concentrate Flow (gpm)	480	330	440	290	360
Equipment Power	$327,400	$233,100	$290,500	$208,200	$256,700
Chemical Costs	$464,800	$314,000	$428,500	$277,800	$341,300
Concentrate and RO Cleaning Waste Disposal	$369,000	$253,900	$338,500	$223,300	$276,800
Operating and Maintenance Labor	$28,500	$14,300	$24,700	$10,500	$17,100
Parts and Materials	$120,400	$82,600	$115,400	$78,900	$88,100
Support Services	$13,700	$5,100	$11,400	$2,900	$6,900
Miscellaneous @ 5% of Annual Costs	$66,200	$45,200	$60,500	$40,100	$49,300
Incremental Total	$1,390,000	$948,200	$1,269,500	$841,700	$1,036, 200

The total incremental annual cost for wells is provided in Table 16. Costs derived for the existing system were taken from 2019 data that operated at 64 percent utilization. The current basin replenishment assessment is $487/AF. The incremental and total annual cost/AF were calculated using the new permeate flow amount.

Table 16 - Wells: Estimated Total Annual Costs

Component	Annual Cost		
	Existing	Incremental	Total
Feed Flow (gpm)	9,500	9,500	9,500
Permeate Flow (gpm)	--	7,600	7,600
Concentrate Flow (gpm)	--	1,900	1,900
Equipment Power	$826,000	$1,315,900	$2,141,900
Chemical Costs	$158,000	$1,826,400	$1,984,400
Concentrate and RO Cleaning Waste Disposal	--	$1,461,500	$1,461,500
Operating and Maintenance Labor	$85,500	$95,100	$180,600
Parts and Materials	$117,700	$485,400	$585,200
Support Services	$68,500	$40,000	$108,500

Component	Annual Cost		
	Existing	Incremental	Total
Basin Replenishment Assessment	$7,313,300	--	$4,512,500
Miscellaneous @ 5% of Annual Costs	--	$261,300	$261,300
Subtotal	$8,551,100	$5,485,600	$14,036,700
Annual Capital Recovery (30 yrs @ 4%)	--	$2,727,600	$2,727,600
Amortized $/AF	$569	$684	$1,396
Amortized $/Kgal	$1.75	$2.10	$4.28

Table 17 provides the total amortized cost for the addition of treatment for the proposed MWRF system under the assumptions provided with a 2019 MWRF utilization of 24.5%. Capital Costs were amortized over a 30-year period using an interest rate of 4 percent. The incremental and total annual cost/AF were calculated using the new permeate flow amount.

Table 17 - MWRF: Estimated Total Annual Costs

Component	Annual Cost		
	Existing	Incremental	Total
Feed Flow (gpm)	6,000	6,000	6,000
Permeate Flow (gpm)	--	4,800	4,800
Concentrate Flow (gpm)	--	1,200	1,200
Equipment Power	$1,536,100	$779,700	$2,315,800
Chemical Costs	$917,200	$1,132,700	$2,049,900
Concentrate and RO Cleaning Waste Disposal	--	$920,100	$920,100
Operating and Maintenance Labor	$20,600	$10,300	$30,900
Parts and Materials	$142,900	$193,900	$336,800
Support Services	$180,500	$9,000	$189,500
Basin Replenishment Assessment	$4,616,900	--	$4,618,900
Miscellaneous @ 5% of Annual Costs	--	$152,300	$152,300
Subtotal	$7,416,200	$3,198,000	$10,614,200
Annual Capital Recovery (30 yrs @ 4%)	--	$535,000	$535,000
Amortized $/AF	$782	$492	$1,469
Amortized $/Kgal	$2.40	$1.51	$4.51

The O&M cost estimates were also developed based on the design criteria for the two alternatives. Annual costs were based on a 98 percent plant online factor per year.

Other major assumptions for preparing this estimate include:

- Electrical Power costs were based on a rate of $0.15/kWhr.
- Current natural gas for the Well 5 pump engine are $0.59 per CCF.
- For the wells, estimated costs for the existing well pump and disinfection system were included.
- For the MWRF, estimated costs for the existing well pumps, methane/hydrogen sulfide removal, disinfection, and distribution were included.
- Equipment replacement was assumed to be 20 years and was only included for new equipment.
- Labor costs for O&M and maintenance are included in the estimate based on rates provided by Mesa Water.
- RO membrane replacement costs and frequency were determined from experience with numerous membrane projects.
- Chemical costs were estimated from recent projects.
- Disposal costs were based on Orange County Sanitation District 2019 Class I discharge permit rates.

MesaWater DISTRICT®

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MEMORANDUM

TO: Engineering and Operations Committee
FROM: Paul E. Shoenberger, P.E., General Manager
DATE: January 21, 2020
SUBJECT: OCWD PFAS Program

RECOMMENDATION

This item is provided for discussion.

STRATEGIC PLAN

Goal #1: Provide a safe, abundant, and reliable water supply.
Goal #2: Practice perpetual infrastructure renewal and improvement.

PRIOR BOAD ACTION/DISCUSSION

At its December 17, 2019 meeting, the Engineering and Operations Committee received an update on polyfluoroalkyl substances (PFAS) regulatory issues and was provided a modeling presentation on impacts to the Orange County Groundwater Basin from Orange County Water District (OCWD) Executive Director of Water Quality and Technical Resources Jason Dadakis.

DISCUSSION

Staff would like to discuss with the Mesa Water District (Mesa Water®) Board of Directors the proposed modification to OCWD's PFAS Policy as outlined in Attachments A, B and C.

FINANCIAL IMPACT

None.

ATTACHMENTS

Attachment A: OCWD Staff Report, Dated 1/15/2020
Attachment B: OCWD PFAS Response Program Policy, Redline
Attachment C: OCWD PFAS Final Policy, Redline

AGENDA ITEM SUBMITTAL

Meeting Date: January 15, 2020

To: Water Issues Committee

From: Mike Markus

Staff Contact: J. Kennedy/ J. Dadakis

Budgeted: N/A
Proposed Budget: N/A
Cost Estimate: N/A
Funding Source: N/A
Program/Line Item No.: N/A
General Counsel Approval: N/A
Engineers/Feasibility Report: N/A
CEQA Compliance: N/A

Subject: MODIFICATION TO PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) PROGRAM

SUMMARY

On November 18, 2019 the District established a per- and polyfluoroalkyl substances (PFAS) policy to assist the Producers with treating groundwater that exceeds a 10 part-per-trillion (ppt) Perfluorooctanic acid (PFOA) Response Level that is expected to be set by the State Division of Drinking Water. Staff was directed at that time to develop an amendment to the policy regarding how the District and Producers would coordinate in any litigation efforts to recover PFAS expenses against potential responsible parties. A modified PFAS policy has been prepared and is provided for the Boards consideration.

Attachment:
Modified PFAS Response Program Policy
Presentation Material

RECOMMENDATION

Agendize for the January 22 Board meeting: Adopt the modified Per- and Polyfluoroalkyl Substances Response Program Policy dated January 2020

BACKGROUND/ANALYSIS

The District and Groundwater Producers are contemplating litigation to recover PFAS costs from potential responsible parties. How this coordination would occur was not adequately addressed in the PFAS policy approved by the District in November 2019. The proposed changes to the PFAS policy are summarized below:

- Either the District or the Producer could initiate litigation for the PFAS costs incurred by both agencies. The District would have the first option to initiate litigation. If the District decides not to do such, then the Producer could initiate the litigation.
- If the District decides to initiate litigation, the Producer would be required to support this effort and be a co-plaintiff.
- Cost recovery funds received by OCWD, or by a Producer that accepts OCWD funding for PFAS treatment systems, would be used to reimburse the following cost in the order listed:

1. OCWD treatment system capital cost,
2. OCWD and the Producers operation and maintenance cost in equal proportion, and
3. Producers cost of purchasing imported water to replace groundwater that exceeds a Response Level or Maximum Contaminant Level.

Ultimately the District will need to enter into an agreement with Producers who want to participate in the District's PFAS program. Staff expects to have a draft of the agreement out for review in late January or early February.

Groundwater Producers

Staff met with the Groundwater Producers at a special PFAS meeting on January 8th to discuss the policy changes. Staff will provide a summary of that meeting. Staff will again discuss the proposed changes with the Producers at their regular monthly meeting on January 15th after the Water Issues Committee to continue the discussions.

PRIOR RELEVANT BOARD ACTION(S)

6/19/19, M19-98 – Approved issuing RFP to hire a consultant to conduct PFAS treatment pilot study

7/17/19, M19-105 – Approved issuing RFP to hire a consultant to prepare a PFAS planning study for the impacted Producers

8/7/19, R19-8-111 - Approved professional services agreement with Jacobs Engineering for PFAS pilot study

11/18/19, Approved PFAS Policy

Per- and Polyfluoroalkyl Substances (PFAS) Response Program Policy
~~November 20, 2019~~ January 2020

Consistent with the Orange County Water District's mission and authority granted under the District Act and other provisions of law, it is the objective of this policy to provide guidance to the District in taking actions to protect the groundwater basin from PFAS compounds.

Orange County Water District policy principles are provided below:

- PFAS compounds create a unique groundwater contamination issue that impacts a large percentage of the Groundwater Producers. Without any action, PFAS impacted groundwater will continue to migrate affecting more wells and larger portions of the groundwater basin.
- OCWD desires to maintain a groundwater supply of suitable quality for all existing and potential beneficial uses. Quick and effective actions are needed to remove PFAS compounds down to established regulatory limits. Until treatment systems are constructed, the impacted Groundwater Producers will be purchasing greater amounts of more expensive imported water.
- OCWD will fund the lowest reasonable and efficient treatment system design and construction cost to remove PFAS compounds down to existing and anticipated new Response Levels and anticipated future Maximum Contaminant Levels.
- OCWD will provide a 50 percent subsidy for operation and maintenance expenses up to $75/acre-foot. The exact amount of the O&M subsidy will be determined by OCWD with input from the Groundwater Producer after accounting for the specific circumstances of the treatment system constructed. It is fair and reasonable that the Producer should have some cost in addressing this potential problem. The $75/acre-foot maximum is based upon current estimates and knowledge of expected O&M cost. If unforeseen conditions are encountered or new information becomes available significantly increasing the overall expected O&M cost, staff will consider recommending a higher maximum amount to the Board.
- Spreading a large portion of the PFAS treatment cost over the entire basin conforms to OCWD policies of wanting Producers to have similar water supply cost.
- OCWD will not pay for temporary PFAS treatment facilities or for alternative imported water supplies.
- OCWD will review with the impacted Producers if the existing Basin Equity Assessment Exemption Program can be used to address their situation.
- OCWD will pursue grants and other funding opportunities that may be available to offset PFAS costs. ~~and seek cost recovery from responsible parties.~~
- OCWD may seek cost recovery via litigation from responsible parties by hiring special litigation counsel and/or participating in cost recovery efforts by the California Attorney General. Producers will be required to support and assist such efforts, to include, where requested by OCWD, joining OCWD as co-plaintiffs.

- Cost recovery funds received by OCWD, or by a Producer that accepts OCWD funding for PFAS treatment systems, will be used to reimburse the following cost in the order listed:
    1. OCWD treatment system capital cost
    2. OCWD and the Producers operation and maintenance cost in equal proportion
    3. Producers cost of purchasing imported water to replace groundwater that exceeds a Response Level or a Maximum Contaminant Level.
    4. Other appropriate cost
- ~~Producers seeking cost recovery for additional PFAS related expenses will be required to closely coordinate with the District and other impacted Groundwater Producers.~~
- This policy only applies to the nineteen Groundwater Producers.

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Per- and Polyfluoroalkyl Substances (PFAS) Response Program Policy
~~January 2020~~January 22, 2020

Consistent with the Orange County Water District's mission and authority granted under the District Act and other provisions of law, it is the objective of this policy to provide guidance to the District in taking actions to protect the groundwater basin from PFAS compounds.

Orange County Water District policy principles are provided below:

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- OCWD desires to maintain a groundwater supply of suitable quality for all existing and potential beneficial uses. Quick and effective actions are needed to remove PFAS compounds down to established regulatory limits. Until treatment systems are constructed, the impacted Groundwater Producers will be purchasing greater amounts of more expensive imported water.
- OCWD will fund the lowest reasonable and efficient treatment system design and construction cost to remove PFAS compounds down to existing and anticipated new Response Levels and anticipated future Maximum Contaminant Levels.
- OCWD will provide a 50 percent subsidy for operation and maintenance expenses up to $75/acre-foot. The exact amount of the O&M subsidy will be determined by OCWD with input from the Groundwater Producer after accounting for the specific circumstances of the treatment system constructed. It is fair and reasonable that the Producer should have some cost in addressing this potential problem. The $75/acre-foot maximum is based upon current estimates and knowledge of expected O&M cost. If unforeseen conditions are encountered or new information becomes available significantly increasing the overall expected O&M cost, staff will consider recommending a higher maximum amount to the Board.
- Spreading a large portion of the PFAS treatment cost over the entire basin conforms to OCWD policies of wanting Producers to have similar water supply cost.
- OCWD will not pay for temporary PFAS treatment facilities or for alternative imported water supplies.
- OCWD will review with the impacted Producers if the existing Basin Equity Assessment Exemption Program can be used to address their situation.
- OCWD will pursue grants and other funding opportunities that may be available to offset PFAS costs.
- OCWD may seek cost recovery via litigation from responsible parties by hiring special litigation counsel and/or participating in cost recovery efforts by the California Attorney General. Producers will be required to coordinate, support and assist such efforts. ~~, to include, where requested by OCWD, joining OCWD as co-plaintiffs.~~
- Cost recovery funds received by OCWD, or by a Producer that accepts OCWD funding for PFAS treatment systems, will be proportionally distributed to OCWD

and the impacted Producers based upon actual cost incurred.~~used to reimburse the following cost in the order listed:~~:

1. ~~OCWD treatment system capital cost~~
2. ~~OCWD and the Producers operation and maintenance cost in equal proportion~~
3. ~~Producers cost of purchasing imported water to replace groundwater that exceeds a Response Level or a Maximum Contaminant Level.~~
4. ~~Other appropriate cost~~

- This policy only applies to the nineteen Groundwater Producers.

REPORTS:

9. REPORT OF THE GENERAL MANAGER

REPORTS:

10. DIRECTORS' REPORTS AND COMMENTS

Mesa Water DISTRICT®

Dedicated to Satisfying our Community's Water Needs

MEMORANDUM

TO: Engineering and Operations Committee
FROM: Justin Finch, Water Use Efficiency Analyst
DATE: January 21, 2020
SUBJECT: Smart Timer Distribution Workshop

RECOMMENDATION

This item is provided for information.

STRATEGIC PLAN

Goal #1: Provide a safe, abundant, and reliable water supply.
Goal #4: Increase public awareness about Mesa Water® and about water.
Goal #6: Provide outstanding customer service.

PRIOR BOARD ACTION/DISCUSSION

None.

DISCUSSION

Mesa Water District (Mesa Water®) is launching a Pilot Program (Program) to distribute approximately 125 Weather-Based Irrigation Controllers, also known as Smart Timers, to residential customers. The distribution method will be through an educational workshop hosted by Mesa Water and taught by a representative from the selected manufacturer. The workshop will last approximately 60 minutes, with 45 minutes of educational material related to water-wise irrigation methods, how to install a smart timer and any related components such as flow sensors and/or weather stations, and how to program a smart timer. Following instruction will be 10-15 minutes of question-and-answer. After the workshop is completed, customers will turn in their application for the program and pick up their new smart timer free of additional charges. 2-3 weeks after the workshop, staff will contact customers to schedule inspections to verify installation in order to satisfy inspection and funding requirements of Metropolitan Water District of Southern California (MWD) and Municipal Water District of Orange County (MWDOC).

Mesa Water applied for supplemental funding through MWDOC to MWD's Member Agency Administered Program (MAAP) and was successful in securing $10,000 towards this Program. MAAP allows member agencies to use rebate funding from MWD's regional water efficiency program in order to simplify the reimbursement process and run programs locally. Additionally, Mesa Water was successful in securing additional funds for the Program through a MWDOC administered grant that was recently awarded. Total outside funding will be $150 per timer, leaving Mesa Water's share to be up to $60 per timer.

Mesa Water solicited proposals from six qualified manufacturers. Five firms submitted a response and participated in selection interviews. The proposals were reviewed by a Selection Panel comprised of two Mesa Water staff. Each firm was evaluated based on overall presentation, smart timer capabilities, company's support structure, and firm experience providing similar educational and outreach methodology. The results were as follows:

Rank	Firm	Final Score
1	Rachio	4.6
2	Hydrorain	4.3
3	Rainbird	3.8
4	Weathermatic	3.8
5	Hunter	3.5

Rachio was the top scorer and has significantly more experience in conducting customer workshops and working with water districts. The other proposers provided good proposals but had less experience and overall higher costs.

Mesa Water has selected Rachio to conduct the customer workshop on March 14, 2020 and to provide 125 smart timers to residential customers. The total cost for the workshop, 125 smart timers and related components, will be $28,475. However, MAAP and grant funding will total $18,750, therefore Mesa Water's net expense for the program will be approximately $9,725.

<u>FINANCIAL IMPACT</u>

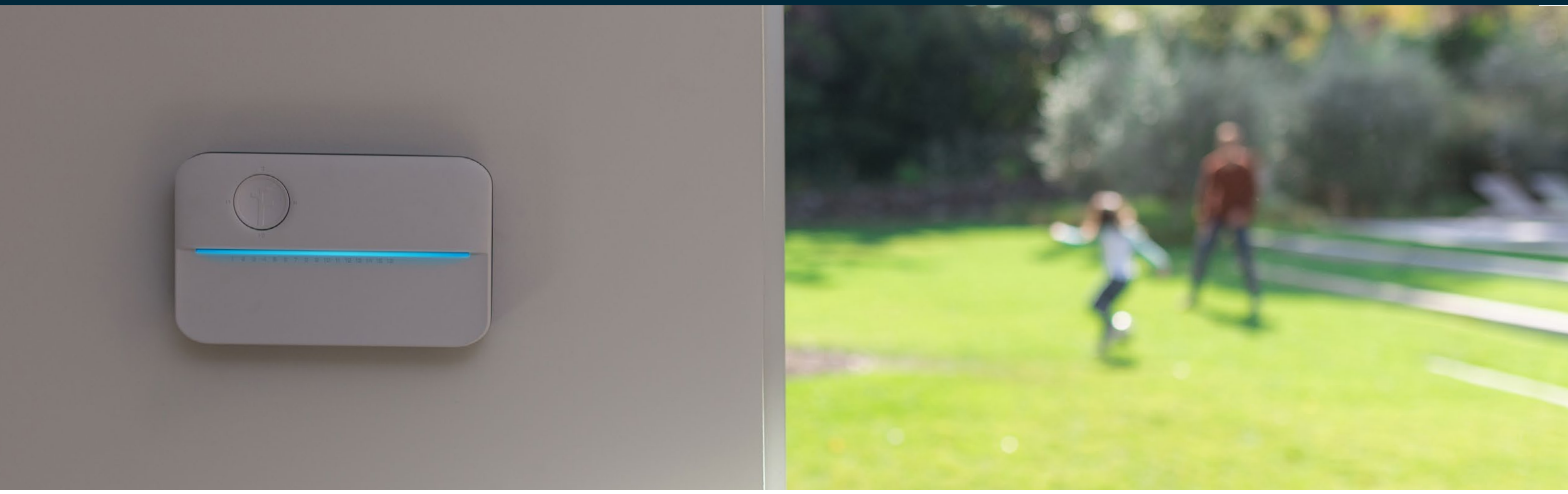
In Fiscal Year 2020, $22,750 is budgeted for Water Use Efficiency Rebate Programs; $940 has been spent to date.

<u>ATTACHMENTS</u>

Attachment A: Rachio 3 Product Details

rachio 3

Smart Sprinkler Controller



Extend the smart home outdoors.

The Rachio 3 Smart Sprinkler Controller knows exactly how much water your landscape needs. Sit back and manage the changing needs of your landscape with easy-to-use smartphone watering control and tailored schedules that automatically adapt to weather.

Easy to Install.
Set up in less than 30 minutes, with or without Wi-Fi.

Set it and forget it.
Self-adjusting schedules from install to move in. Ensure plants get the right amount of water without worry.

Access from anywhere, anytime.
Homeowners can monitor and adjust sprinkler system from their phone, tablet or laptop.

Cutting-edge integrations.
Rachio works with most connected home platforms, including Amazon Alexa and Samsung Smartthings.

Don't water in the rain.
Rachio Weather Intelligence uses predictive technology to automatically skip watering before the first drop of rain hits, saving water and money.

Water only when needed.
Rachio uses customized yard details, watering science and technology to determine exactly how much to water and when.

On average, single-family homes in the United States use 50% of their water outdoors. Rachio users report saving up to 50% on outdoor watering while keeping plants healthy.

EPA WaterSense Certified
Tap into smart water savings and efficiency you can trust with WaterSense Certified Rachio technology.

Amazon Alexa Certified
Control watering with the power of your voice. Use more than 100 different voice commands to run zones, set rain skips and more with Amazon Alexa.

rachio 3

Technical Specifications

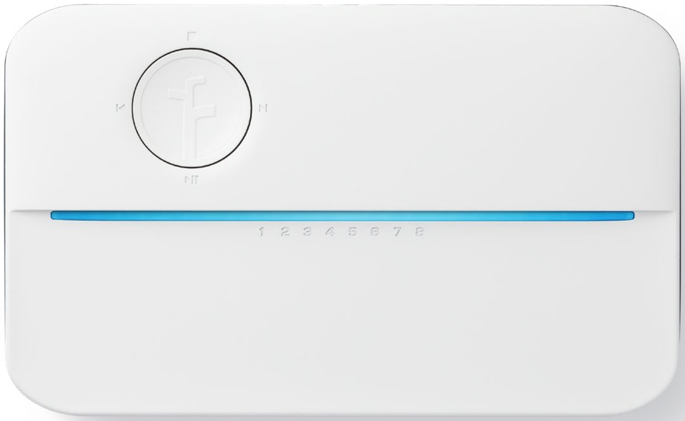
Models
- 8-Zone Model
- 16-Zone Model

Compatibility
- Wireless Rachio accessories
- Master valve / pump relay
- 3rd party sensors
- Normally closed (NC) rain sensors, freeze sensors, soil sensors
- Wired flow sensors (visit rachio.com/flow for details)

Wire Terminals
- Zones (8 or 16)
- C (Common)
- M (Master Valve)
- S1 (Sensor 1)
- S2 (Sensor 2)
- ACC - (Sensor Power)
- ACC + (Sensor Power)

Electrical Specifications
- Transformer input: 120 VAC ~60Hz 300mA
- Transformer output: 24 VAC 1000mA
- Zone output (24 VAC): Compatible with 24VAC solenoids
- Pump/master valve (24 VAC)
- Operating temperature: -13°F to 140°F

Connectivity & Security
- IEEE 802.11 a/b/g/n 2.4 GHz and 5 GHz
- WPA and WPA2 (Personal) encryption
- DHCP (dynamic) or static IP addressing
- Transport Layer Security (TLS)
- 915MHz



8-zone	16-zone
$229.99	$279.99

Certifications
- UL, FCC, RoHS compliant, EPA WaterSense & SWAT approved

Installation Requirements
- iOS or Android compatible device
- 2.4 or 5 GHz wireless network signal available at the installation location

Warranty
- 2-year warranty

Product Dimensions
- Dimensions of unit: 9.1" x 5.6" x 1.4"
- Weight: 1.05 lbs

Get it on Google play

Download on the App Store