

CAGRD Agenda Number 2

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MEETING DATE: February 15, 2018

AGENDA ITEM: Update on TDRP Test Well Project

LINKAGE TO STRATEGIC PLAN, POLICY, STATUTE OR GUIDING PRINCIPLE:

CAWCD 2016 Board of Directors Strategic Plan

- *Water Supply: Implement Recovery Plan*

PREVIOUS BOARD ACTION/ACTIVITY:

- April 7, 2016 - Report and Discussion of Firming and Recovery Planning
- September 1, 2016 - Information Brief – CAP’s Role in Recovery
- March 2, 2017- Report on Recovery Implementation Activities
- June 8, 2017- Board approved a Construction Contract for the Drilling and Installation of a Hydrologic Test Well at Tonopah Desert Recharge Project
- January 4, 2018 - Status Report and Update on Recovery Planning/Implementation Activities

ISSUE SUMMARY/DESCRIPTION:

At the January Board meeting, staff presented preliminary results of the 2017 hydrologic test well project conducted at Tonopah Desert Recharge Project (TDRP). Results from the project indicate that permeability of the aquifer below a depth of 300 feet (current groundwater level) is substantially lower than previously estimated and concentrations of arsenic and fluoride are larger than previously estimated. These findings have significant implications on a number of factors related to the recovery of water stored at the site such as design and location of recovery wells, chemical quality of recovered water and the potential cost of recovery.

As Chair of CAGRD and Underground Storage Committee, Director Megdal requested a more detailed briefing on the project and findings. Mark Cross, chief hydrogeologist and project manager with Montgomery and Associates, has prepared a presentation on the subject for the Committee.

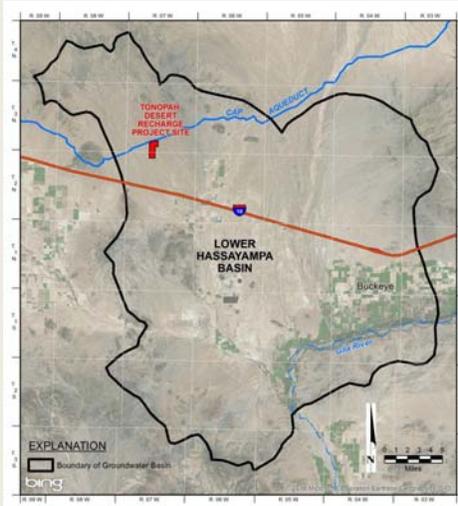
TONOPAH DESERT RECHARGE PROJECT

Recovery Planning Update

February 15, 2018



PROJECT LOCATION

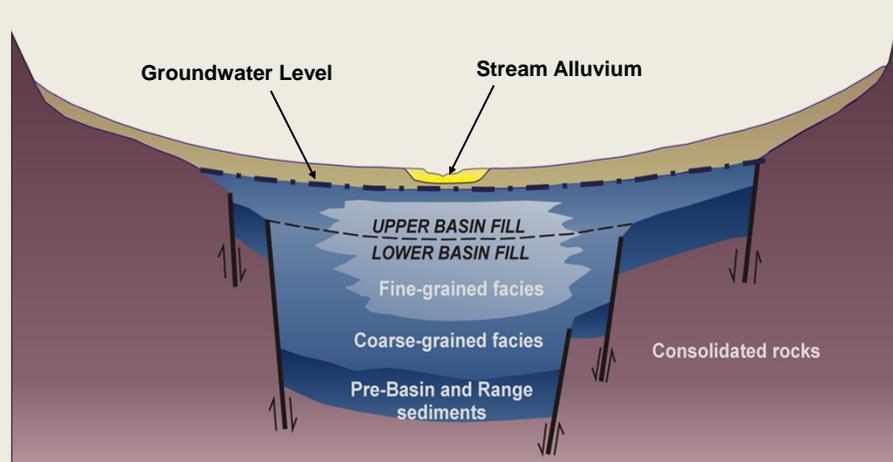


PROJECT HISTORY

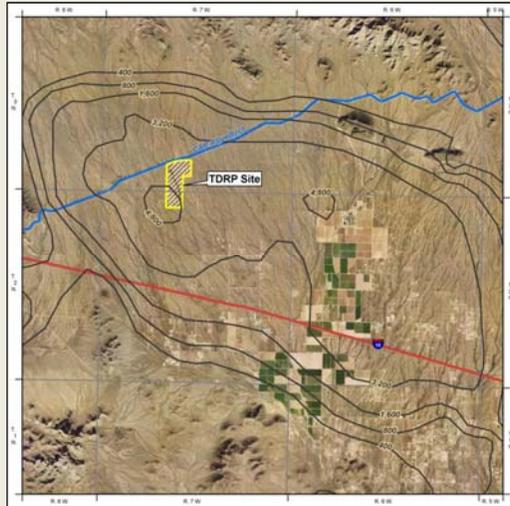
- Recharge facility siting (2000-2001)
- Feasibility studies (2000-2003)
- Permits/construction (2003-2005)
- Recharge operations (2006-2014)
- Preliminary recovery plan (2009)
- Recovery plan update (2015)
- Investigation of deeper part of aquifer (2016-2017)



REGIONAL AQUIFER SYSTEM



DEPTH TO BEDROCK LOWER HASSAYAMPA BASIN



ALLUVIAL FAN DEPOSITS AT MOUNTAIN FRONT



ALLUVIAL FAN DEPOSITS 3 MILES FROM MOUNTAIN FRONT

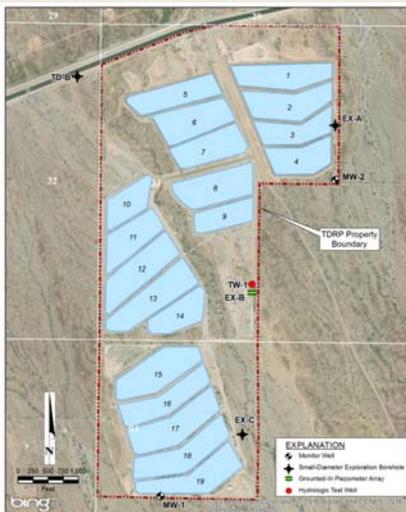


RECHARGE FEASIBILITY INVESTIGATIONS

- Preliminary investigations near TDRP site (2001)
 - Four boreholes along CAP canal to depths of 600 to 780 feet
 - Depth to groundwater level 470 to 494 feet
 - Arsenic concentrations ranged from < 0.003 to 0.018 mg/L
 - Fluoride concentrations ranged from 0.9 to 9.4 mg/L
 - Results favorable for proceeding with on-site investigations
- Recharge feasibility investigations at TDRP site (2002)
 - Nine boreholes at site to depths of 99 to 319 feet
 - Twelve exploration trenches
 - Seven small-basin infiltration tests
 - Thirteen shallow borehole infiltration tests
 - Results favorable; data used to support facility design and permitting



TDRP RECHARGE FACILITIES

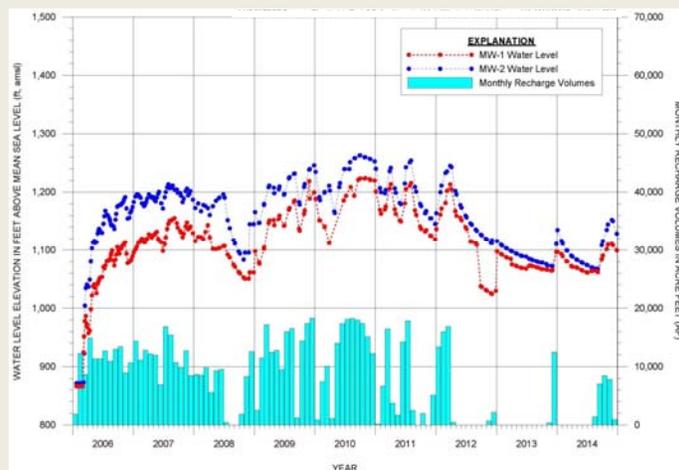


RECHARGE RESULTS

- Initial depth to water 450-475 feet
- Operated from 2006 through 2014
- Maximum annual storage 150,000 AF (in 2009 and 2010)
- Maximum water level rise 360-390 feet
- Stored total of 806,000 AF

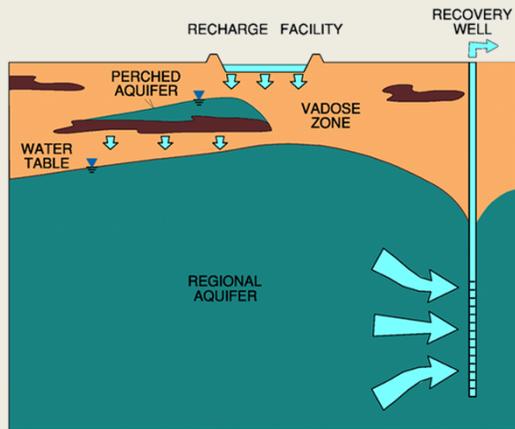


MONTHLY RECHARGE VOLUMES AND GROUNDWATER LEVELS

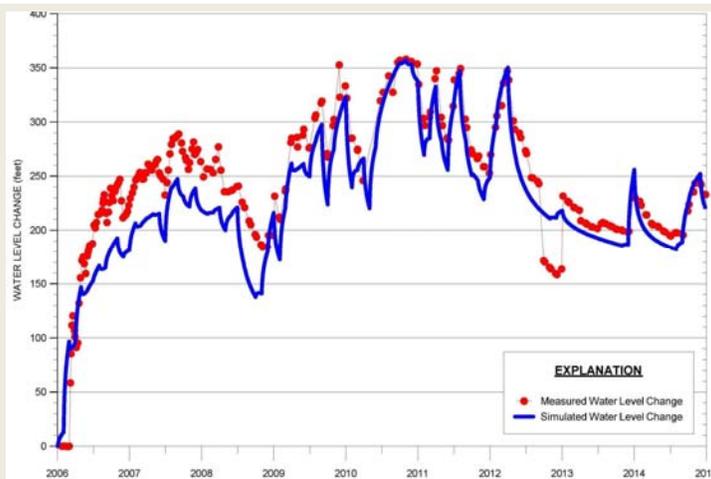


RECOVERY GOALS FOR TDRP SITE (2015)

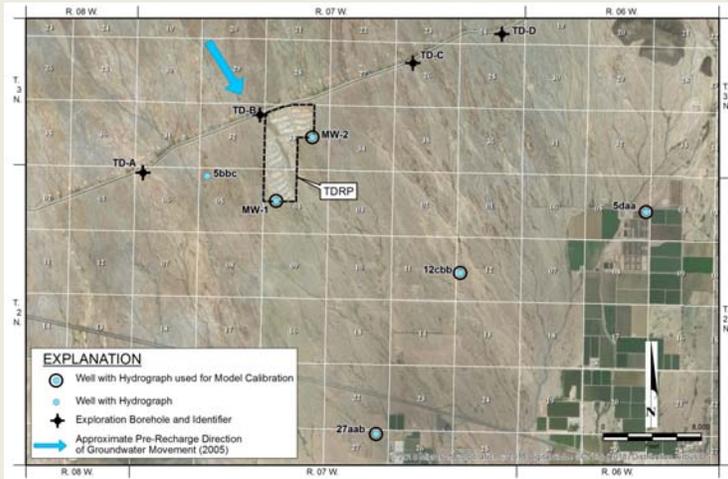
- Phase I
 - 2020-2029
 - 100,000 AF
- Phase II
 - 2030-2039
 - 200,000 AF
- Phase III
 - 2040-2045
 - 180,000 AF
- Total over 26 years: 480,000 AF
- Chemical quality of recovered water must meet primary drinking water standards



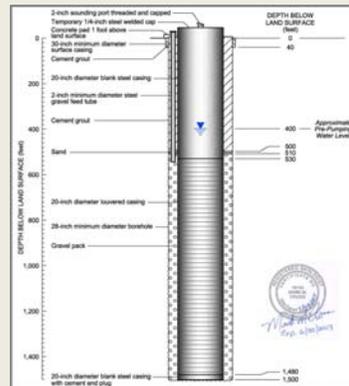
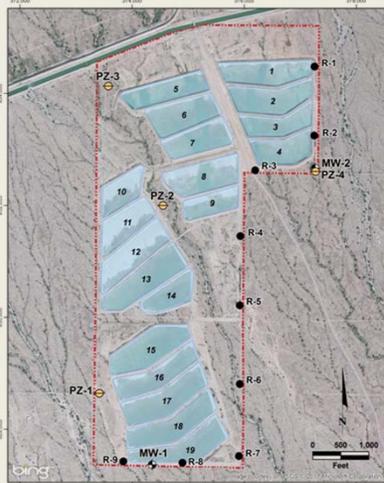
GROUNDWATER MODEL CALIBRATION TO ESTIMATE AQUIFER PERMEABILITY



WELLS WITH HYDROGRAPHS USED FOR MODEL CALIBRATION



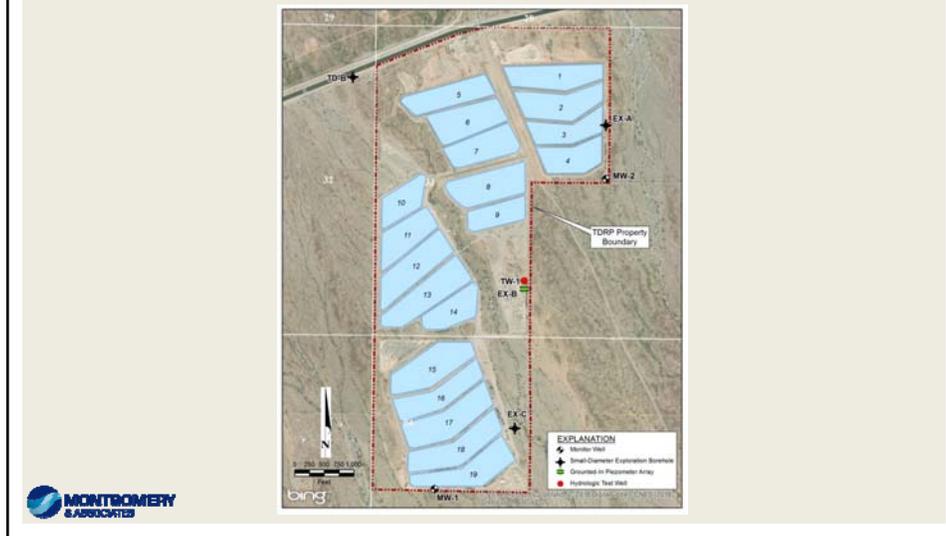
2015 RECOVERY PLAN UPDATE



Central Arizona Project
 Tonopah Desert Recharge Project
**SCHEMATIC DIAGRAM
 OF CONSTRUCTION
 FOR PROPOSED RECOVERY WELLS**
 MONTGOMERY & ASSOCIATES
 FIGURE 16



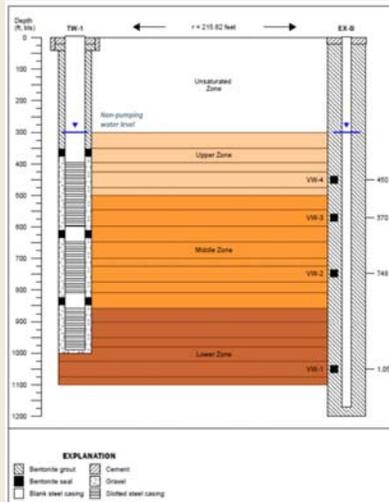
DEEP EXPLORATION BOREHOLES (2016) AND HYDROLOGIC TEST WELL (2017)



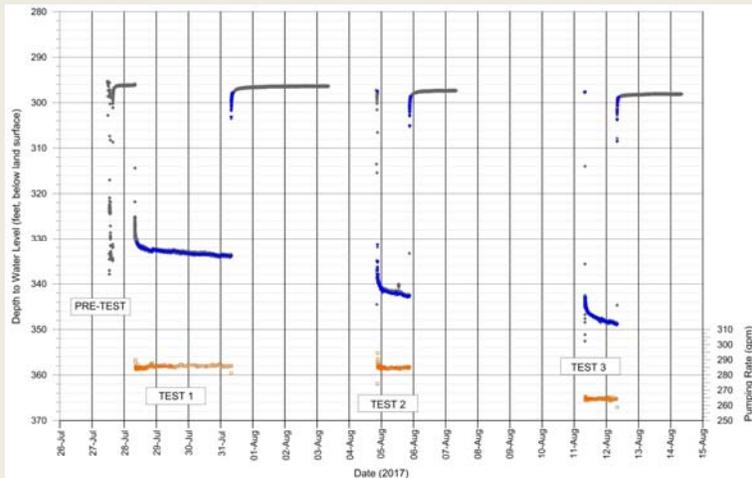
RESULTS OF AQUIFER CHARACTERIZATION

- Three boreholes to 1,200 - 1,440 feet
 - Lithification of sediments, and arsenic & fluoride concentrations, increase with depth
- Hydrologic test well to 1,000 feet (2017)
 - Hydraulic conductivity 10 ft/day to < 1 ft/day
 - Arsenic concentrations 0.007 to 0.335 mg/L (primary standard = 0.010 mg/L)
 - Fluoride concentrations 2.1 to 23.5 mg/L (primary standard = 4.0 mg/L)

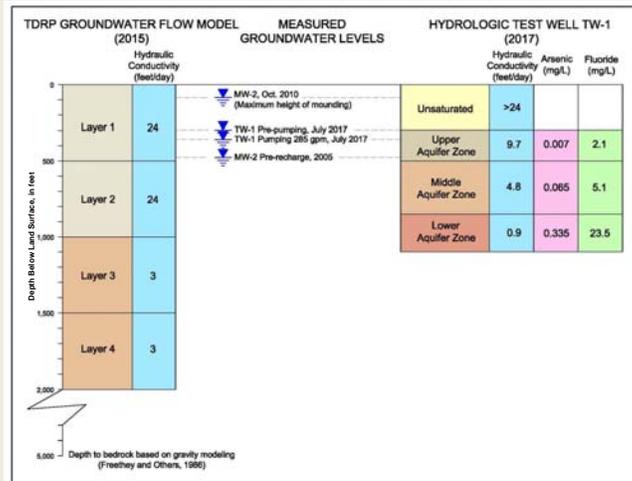
PUMPED WELL TW-1, PIEZOMETER ARRAY, AND AQUIFER ZONES



HYDROGRAPH FOR PUMPED WELL TW-1 DURING THREE PUMPING TESTS



RESULTS OF 2015 MODEL CALIBRATION AND 2017 HYDROLOGIC TESTING



IMPLICATIONS FOR RECOVERY

- Recovery well depths 850 feet maximum
- Individual well yields 10 x smaller
- Number of wells required 10 x larger
- To meet recovery goal of 480,000 AF, wellfield would extend outside TDRP site



IMPLICATIONS FOR TREATMENT

- Arsenic concentrations 2.3 times higher
- Fluoride concentrations 1.6 times higher
- Treatment by coagulation-assisted microfiltration (Option 1)
 - Capital and O&M costs only slightly sensitive to arsenic concentrations
- Treatment by media filters (Option 2)
 - Capital and O&M costs close to proportional to increases in arsenic concentration



COST IMPLICATIONS FOR 3-PHASE 480,000 AF PLAN

- Additional well capital and maintenance costs
- Additional pipeline costs
- Additional capital and O&M costs for water treatment (small increase for Option 1; large increase for Option 2)
- Increase in total cost (2015 dollars) from \$300/AF to more than \$500/AF



RECOMMENDATIONS

- Consider wellfield in north part of site
 - Arsenic and fluoride concentrations smaller
 - Closer to CAP canal–reduced pipeline costs
 - Pilot recovery well installation & testing
 - Groundwater modeling for wellfield design and projection of recovery capacity
 - Estimate capital and O&M costs
 - Pilot treatment project to assess feasibility of treatment Option 1



RECOMMENDATIONS (CONTINUED)

- Consider options outside of TDRP site
 - On CAP easement along aqueduct
 - Other locations south of aqueduct
 - Review existing information on hydrogeology, groundwater quality, land ownership/uses, existing wells
 - Select options for further investigation





THANK YOU

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