Managed Aquifer Recharge (MAR) Project Financing

Presented By
Charles Job
April 24, 2023
San Antonio, TX

Managed Aquifer Recharge: Unleashing Resiliency, Protecting Groundwater Quality
Rationale for Focus on Financing MAR Projects

MAR projects have shown a **50 percent reduction in costs** compared to conventional water storage & supply alternatives.

- Investment to **minimize risk to community** health, business & environment by augmenting water supply
- Extreme climate effects can cause **drought** and result in **water storage depletion**.
- **Population growth** without conservation can increase water demand & groundwater depletion can cause **saltwater intrusion**.
- **Surface water reservoir** sites mostly **already developed** – underground space is available.
- MAR is an **economically attractive & scalable** water source alternative or supplemental source with **minimal land cost & water or habitat loss**.
- **Low interest** infrastructure loans & grants **save municipal funds** for other use.
Benefits of Managed Aquifer Recharge

Definition - Managed aquifer recharge (MAR) is the purposeful recharge of water to aquifers for later recovery or other benefits.

Direct Benefits

- Water supply security and resilience/maximize water storage (long-term and seasonal)
- Replenishment of depleted aquifers/restore groundwater levels/reduce water table decline
- Lower costs for permitting, construction and operation
- Restores groundwater-dependent ecosystems, including river flows
- Management of subsidence and saltwater intrusion
Benefits of MAR (cont.)

*Indirect Benefits*

- Sustainability of water supplies, particularly during periods of drought
- Avoided costs of alternative water supply during drought
- Avoided costs of having to procure additional water supplies and construct, operate and maintain the additional water systems
- Avoided impacts to communities during water shortages
Local and Societal Considerations

- Use of the transmission and treatment capacities of the subsurface environment
- Natural physical-chemical-biological degradation of contaminants
- Location where water needed
- Low-cost, low-energy water source with reduced costs for pumped storage
- Capability to generate electricity while injecting by well to offset other energy costs
- No or minimal evaporative loss
- No loss of land for farming or habitat for water storage
- Reduced greenhouse gas emissions reduces cost of emission control
Principal MAR Project Cost Components to Finance
(not exhaustive list)

• Water rights/permits for water source & storage
  o Surface water
  o Groundwater
  o Stormwater
  o Treated wastewater
• Pilot or feasibility-level investigations
• Design and construction of MAR project may include:
  o Collection, conveyance, pipes and pumps from water source to area of use
  o Recharge technique
    ❖ Injection well(s), pumps & motors
    ❖ Infiltration basin/canals including channels, pumps & motors
    ❖ Bank filtration including pumps & motors
Principal MAR Project Components to Finance (cont.)

- Treatment before injection/infiltration to be compatible with geologic & groundwater chemistry
  - Conventional treatment plant
  - Advanced treatment plant
  - Soil-Aquifer treatment through Green Infrastructure
- Treatment after aquifer storage to comply with drinking water standards
- Third-party Effects Mitigation through Construction For
  - Off-site water levels or quality changes
  - Downgradient/down stream water levels or quality changes
- Water Recovery Wells, Pumps, Motors and Distribution Lines
### Selected Examples of Levelized Cost & B/C Ratios for US and International Communities

<table>
<thead>
<tr>
<th>Location</th>
<th>Source</th>
<th>MAR Type</th>
<th>Annual Recharge Volume (000s m$^3$)</th>
<th>Levelized Cost per m$^3$</th>
<th>B/C Ratio (Basis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turku, Finland</td>
<td>Natural</td>
<td>Infiltration</td>
<td>22,800</td>
<td>Rechg $0.892</td>
<td>1.4 (alternative cost-treatment plant)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basin</td>
<td></td>
<td>Recov $0.912</td>
<td></td>
</tr>
<tr>
<td>Geneva, France-Switzerland</td>
<td>Natural</td>
<td>Infiltration</td>
<td>6,320</td>
<td>Rechg $0.754</td>
<td>5.8 (alternative cost-treatment plant)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basin</td>
<td></td>
<td>Recov $1.292</td>
<td>1.5 (alternative cost-desalination plant)</td>
</tr>
<tr>
<td>Perth, Australia</td>
<td>Recycled</td>
<td>Well</td>
<td>14,000</td>
<td>Recov $1.292</td>
<td></td>
</tr>
<tr>
<td>Salisbury, S. Australia</td>
<td>Recycled</td>
<td>Well</td>
<td>3,500</td>
<td>Recov $0.98</td>
<td>2.5 (alternative cost-strmwr vs main wtr)</td>
</tr>
<tr>
<td>Arizona Water Bank</td>
<td>Natural</td>
<td>Infiltration</td>
<td>342,000</td>
<td>Rechg $0.092</td>
<td>2.17 (alternative cost-stored vs purchased)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basin</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTES: (a) 1,000 cubic meters = 35,315 cubic feet; (b) Water rates: Joliet IL $1.37/m$^3$; Riverside CA $1.20/m$^3

## 16 Case Studies of MAR Financing

<table>
<thead>
<tr>
<th>Location</th>
<th>Reason</th>
<th>Project</th>
<th>Cost</th>
<th>Self-Financed</th>
<th>Donor Contribution</th>
<th>DW SRF</th>
<th>CW SRF</th>
<th>WIFIA</th>
<th>State Water Loan</th>
<th>Other Loans</th>
<th>Bond Issue</th>
<th>State Fund/Grant</th>
<th>Other Federal Grant</th>
<th>Taxation</th>
<th>Reven- nue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Othello, WA</td>
<td>GW decline</td>
<td>Water purchase, pipe, pumps using existing well</td>
<td>$900,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private Farm, OR</td>
<td>GW decline; irrigation; power generation from injection</td>
<td>Flood MAR, injection thru existing wells</td>
<td>$215,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hillsborough County Public Utilities, FL</td>
<td>Control saltwater intrusion, manage aquifer levels for water supply</td>
<td>Injection Wells</td>
<td>$150,000,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walla Walla Basin Watershed Council</td>
<td>Aquifer depletion from irrigation, streamflow maintenance</td>
<td>Flood MAR with injection wells</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dover, NH</td>
<td>Aquifer recharge</td>
<td>Injection wells</td>
<td>$9,100,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 16 Case Studies of MAR Financing (cont.)

<table>
<thead>
<tr>
<th>Location</th>
<th>Reason</th>
<th>Project</th>
<th>Cost</th>
<th>Self-Financed</th>
<th>Donor Contribution</th>
<th>DW SRF</th>
<th>CW SRF</th>
<th>WIFIA</th>
<th>State Water Loan</th>
<th>Other Loans</th>
<th>Bond Issue</th>
<th>State Fund/Grant</th>
<th>Other Federal Grant</th>
<th>Taxation</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Platte Natural Resources District, NE</td>
<td>Redistribuee water to irrigation, maintain streamflow, support drinking water &amp; endangered species</td>
<td>Irrigation canals</td>
<td>$7,213,056</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>El Mirage, AZ</td>
<td>Aquifer Depletion</td>
<td>Aquifer storage credits</td>
<td>$8,687,500</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orange Co Water District, CA</td>
<td>PFAS in Recharge Water</td>
<td>Treatment plant for recharge water</td>
<td>$267,000,000</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hampton Roads Sanitary District, VA</td>
<td>Chesapeake Bay protection, GW depletion, subsidence</td>
<td>Treatment plant, pipe, injection wells</td>
<td>$1,000,000,000</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bryan, TX</td>
<td>Water replenishment</td>
<td>ASR wells, pipe, pumping station</td>
<td>$18,000,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 16 Case Studies of MAR Financing (cont.)

<table>
<thead>
<tr>
<th>Location</th>
<th>Reason</th>
<th>Project</th>
<th>Cost</th>
<th>Self-Financed</th>
<th>Donor Contribution</th>
<th>DW SRF</th>
<th>CW SRF</th>
<th>WIFIA</th>
<th>State Water Loan</th>
<th>Other Loans</th>
<th>Bond Issue</th>
<th>State Fund/Grant</th>
<th>Other Federal Grant</th>
<th>Taxation</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inland Empire Utilities Agency, CA</td>
<td>Water replenishment</td>
<td>Pipe for recycled water recharge</td>
<td>$3,146,563</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inland Empire Utilities Agency, CA</td>
<td>Water replenishment</td>
<td>Pump station upgrade, pipe</td>
<td>$6,050,000</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orange County Water District, CA</td>
<td>GW Basin recharge</td>
<td>Infiltration basin construction</td>
<td>$8,101,219</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pure Water Monterey, CA</td>
<td>GW Basin recharge</td>
<td>Wastewater treatment, injection</td>
<td>$137,773,337</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East Valley Water District, CA</td>
<td>GW Basin recharge</td>
<td>Recycled water treatment plant, pipe</td>
<td>$176,493,764</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malibu, CA</td>
<td>GW recharge</td>
<td>Wastewater treatment plant, pipe, injection well</td>
<td>$58,947,782</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MAR Projects and Costs Financed (based on 16 case studies)

Project Types
- Wastewater treatment plants
- Water collection system
- Pipe
- Pumps
- Injection Wells
- Infiltration Basins
- Irrigation recharge canals
- Aquifer storage credits

Cost Range
- $215,000 to $1 Billion
Potential Financing Sources for MAR  
(based on 16 case studies & other information)

- Drinking Water State Revolving Fund – loans at/below market rates, submit nomination to state w/prelim engr’g
- Clean Water State Revolving Fund – loans at/below market rates, submit nomination to state w/prelim engr’g
- Municipal Bonds – depends on bond rating, market rates apply
- State Grants/Principal Forgiveness – may depend on state and disadvantaged community status
- Water Infrastructure Financing & Innovation Act Loan – 49% of project cost; minimum $20 M; solicits letters of interest
- U.S. Department of Agriculture Water and Wastewater Loans/Grants – Applications year-round; rural communities
- U.S. Housing and Urban Development Grant – Community Development Block Grant/New water sources
- Federal Emergency Management Agency – supports community resilience to drought or other natural hazards
- U.S. Bureau of Reclamation - WaterSMART Water & Energy Efficiency Grants for water supply reliability; 50% cost share
- Donations – private sources may contribute
- Self-financing – Capital required; more likely done by water-dependent business and irrigated farm
- Revenue stream – customer water payments to utility
- Water district taxing authority – provides a stream of revenue to support construction and maintenance
- Other options may be available including other state and federal agencies
WIFIA Loans

Timelines for Closed Loans

- 6 months or less: 41
- 7 – 12 months: 38
- Over 12 months: 13

Number of Loans by Loan Amount

- < $50 million: 24
- $50 – 100 million: 18
- $100 – 500 million: 44
- > $500 Million: 5
WIFIA Loans – Project Types Financed & Loan Features

**LOAN FEATURES**

- $20 million: Minimum project size for large communities
- $5 million: Minimum project size for small communities (population ≤ 25,000)
- 49%: Maximum portion of eligible project costs fundable under WIFIA
- Total federal assistance may not exceed 80% of project eligible costs
- 35 years: Maximum final maturity date from substantial completion

How to Apply - [https://www.epa.gov/wifia/how-apply-wifia-assistance-1](https://www.epa.gov/wifia/how-apply-wifia-assistance-1)

Drinking Water State Revolving Fund

Program Features
• 50 State + Puerto Rico Revolving Fund Programs (capitalized by federal grants)
• Loan Terms:
  • At or below market rates for up to 30 years
  • For disadvantaged communities: 40 years or design life of project, whichever is less
    • May include principal forgiveness and negative interest rate loans
  • Repayments begin up to 18 months after project completion
• Eligible Entities
  • Publicly or privately owned community water systems – small and large systems
  • Non-profit non-community water systems
• Types of Projects
  • Drinking Water Treatment/Pipe Installation/Replacement/Source Water Protection/Well
    Construction/Rehabilitation/Storage/Managed Aquifer Recharge
• From 1997-2019, state DWSRFs provided $41.1 billion to water systems in 15,425 financial agreements
• Smallest Loan $825 – Largest Loan $217 million

STATE CONTACTS - https://www.epa.gov/dwsrf/state-dwsrf-website-and-contacts
Clean Water State Revolving Fund

Program Features
• 50 State + Puerto Rico Revolving Fund Programs (capitalized by federal grants)
• Loan Terms
  • The terms of the loan may not exceed 30 years or the useful life of the project.
  • Interest rates must be at or below market rate, including interest-free.
  • Some states fund planning and design work - decisions made by each state.
• For disadvantaged communities, states may provide grants, principal forgiveness, and negative interest rate loans

From 1988 to 2021, state CWSRFs have provided $153 billion to communities through over 44,500 low-interest loans

• Eligible projects include Treatment, Distribution, Water Reuse/Recycling, Managed Aquifer Recharge

STATE CONTACTS — https://www.epa.gov/cwsrf/state-cwsrf-program-contacts

In addition to federal and state resources, nonprofit foundations have provided funding for water infrastructure:
  • Johnson Foundation
  • Rockefeller Foundation
  • Ford Foundation
  • Walton Family Foundation
  • Pisces Foundation
Project Financing Eligibilities Information

**DWSRF**
2017 Drinking Water State Revolving Fund Eligibility Handbook

**CWSRF**
Financing Options for Nontraditional Eligibilities in the Clean Water State Revolving Fund Programs.
https://www.epa.gov/sites/default/files/2017-05/documents/financing_options_for_nontraditional_eligibilities_final.pdf

**WIFIA**
Follows DWSRF and CWSRF project eligibilities

**Other Program Eligibilities – Key Words Search for Webpage**

Questions/ Follow Up
Chuck Job, Regulatory Affairs Manager
National Ground Water Association
202-660-0060 or cjob@ngwa.org
References

Rationale for Focus on Financing MAR Projects


Benefits of MAR


