Managed Aquifer Recharge (MAR) Project Financing

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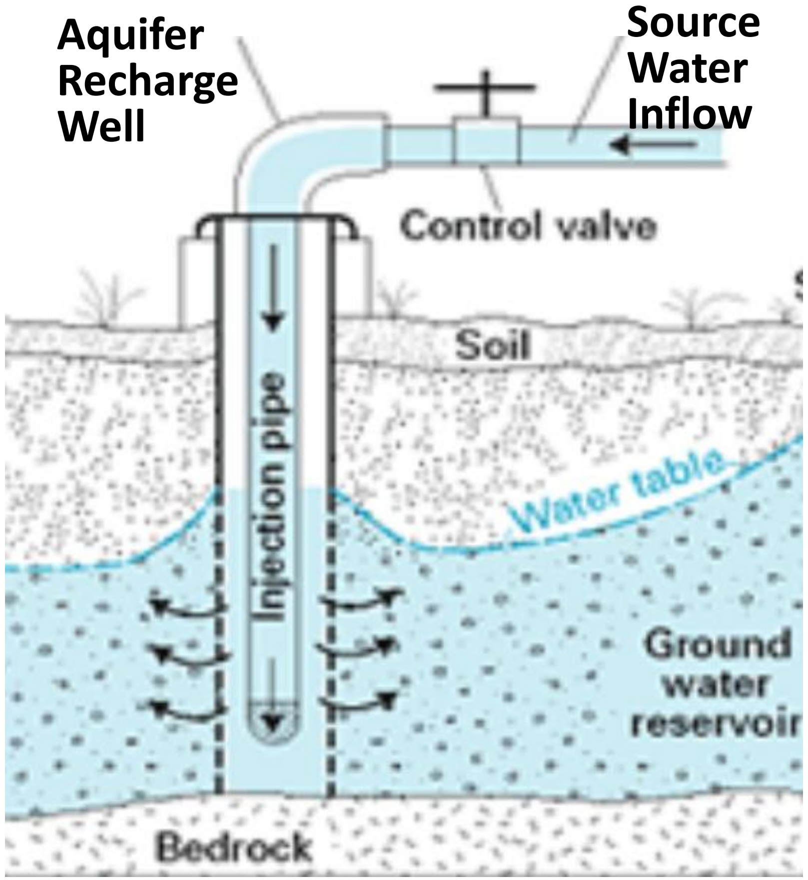
April 24, 2023
San Antonio, TX

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
  - Surface water
  - Groundwater
  - Stormwater
  - Treated wastewater
- Pilot or feasibility-level investigations
- Design and construction of MAR project may include:
  - Collection, conveyance, pipes and pumps from water source to area of use
  - 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

Location	Source Water	MAR Type	Annual Recharge Volume (000s m3)	Levelized Cost per m3	B/C Ratio (Basis)
Turku, Finland	Natural	Infiltration Basin	22,800	Rechg $0.892 Recov $0.912	1.4 (alternative cost- treatment plant)
Geneva, France-Switzerland	Natural	Infiltration Basin	6,320	Rechg $0.754	5.8 (alternative cost- treatment plant)
Perth, Australia	Recycled	Well	14,000	Recov $1.292	1.5 (alternative cost- desalination plant)
Salisbury, S. Australia	Recycled	Well	3,500	Recov $0.98	2.5 (alternative cost- strmwtr vs main wtr)
Arizona Water Bank	Natural	Infiltration Basin	342,000	Rechg $0.092	2.17 (alternative cost- stored vs purchased)

NOTES: (a) 1,000 cubic meters = 35,315 cubic feet; (b) Water rates: Joliet IL $1.37/m3; Riverside CA $1.20/m3

Source: Zheng, Y., A. Ross, K.G. Villholth, and P. Dillon (Eds.). 2021a. Managing Aquifer Recharge: A Showcase for Resilience and Sustainability. Paris. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000379962 (accessed August 4, 2022).

16 Case Studies of MAR Financing

Location	Reason	Project	Cost	Self-Financ-ed	Donor Contri-bution	DW SRF	CW SRF	WIFIA	State Water Loan	Other Loans	Bond Issue	State Fund/ Grant	Other Fed-eral Grant	Taxa-tion	Reve-nue
Othello, WA	GW decline	Water purchase, pipe, pumps using existing well	$900,000									X			
Private Farm, OR	GW decline; irrigation; power generation from injection	Flood MAR, injection thru existing wells	$215,000	X											
Hillsborough County Public Utilities, FL	Control saltwater intrusion, manage aquifer levels for water supply	Injection Wells	$150,000,000							X	X	X			X
Walla Walla Basin Watershed Council	Aquifer depletion from irrigation, streamflow maintenance	Flood MAR with injection wells	NA		X							X	X		
Dover, NH	Aquifer recharge	Injection wells	$9,100,000			X									

16 Case Studies of MAR Financing (cont.)

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

16 Case Studies of MAR Financing (cont.)

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

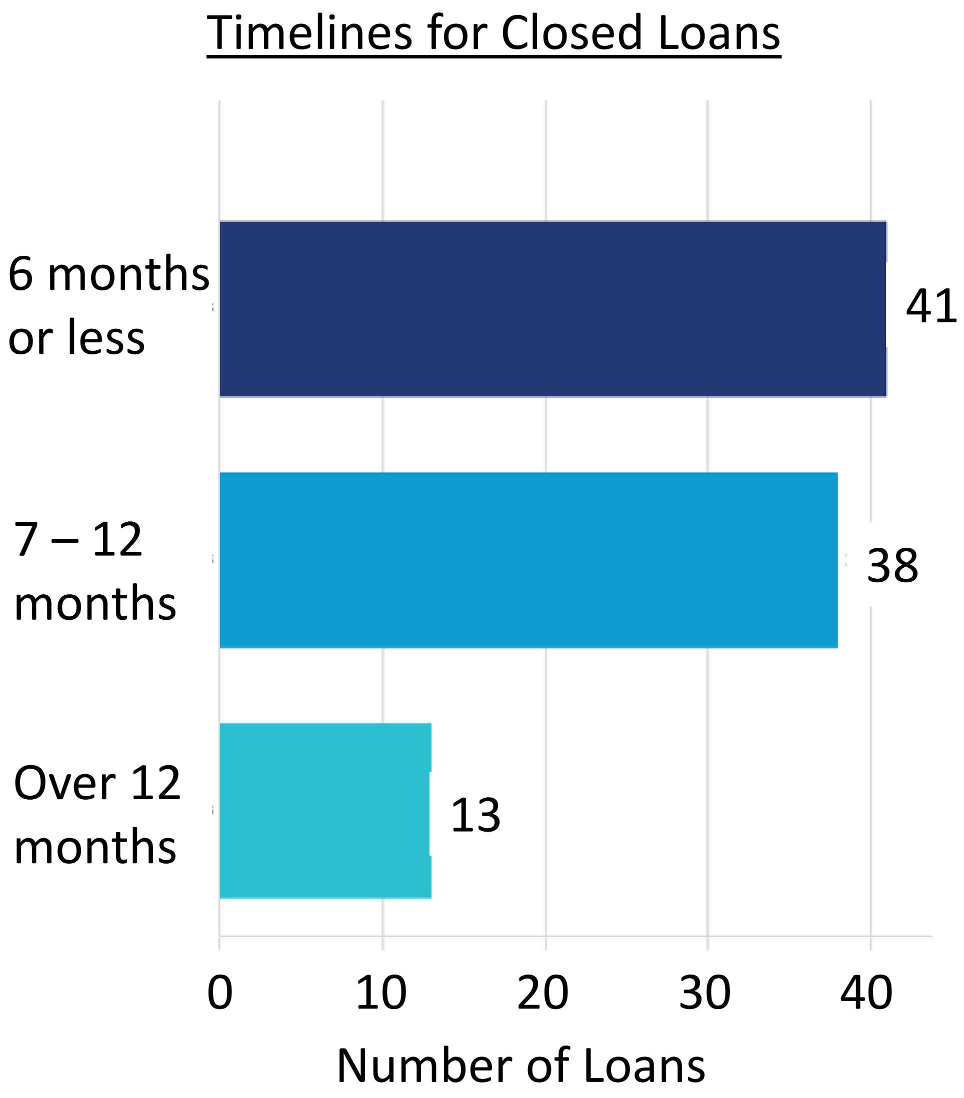
MAR Projects and Costs Financed
(based on 16 case studies)

Project Types	Cost Range
Wastewater treatment plants Water collection system Pipe Pumps Injection Wells Infiltration Basins Irrigation recharge canals Aquifer storage credits	\$215,000 To \$1 Billion

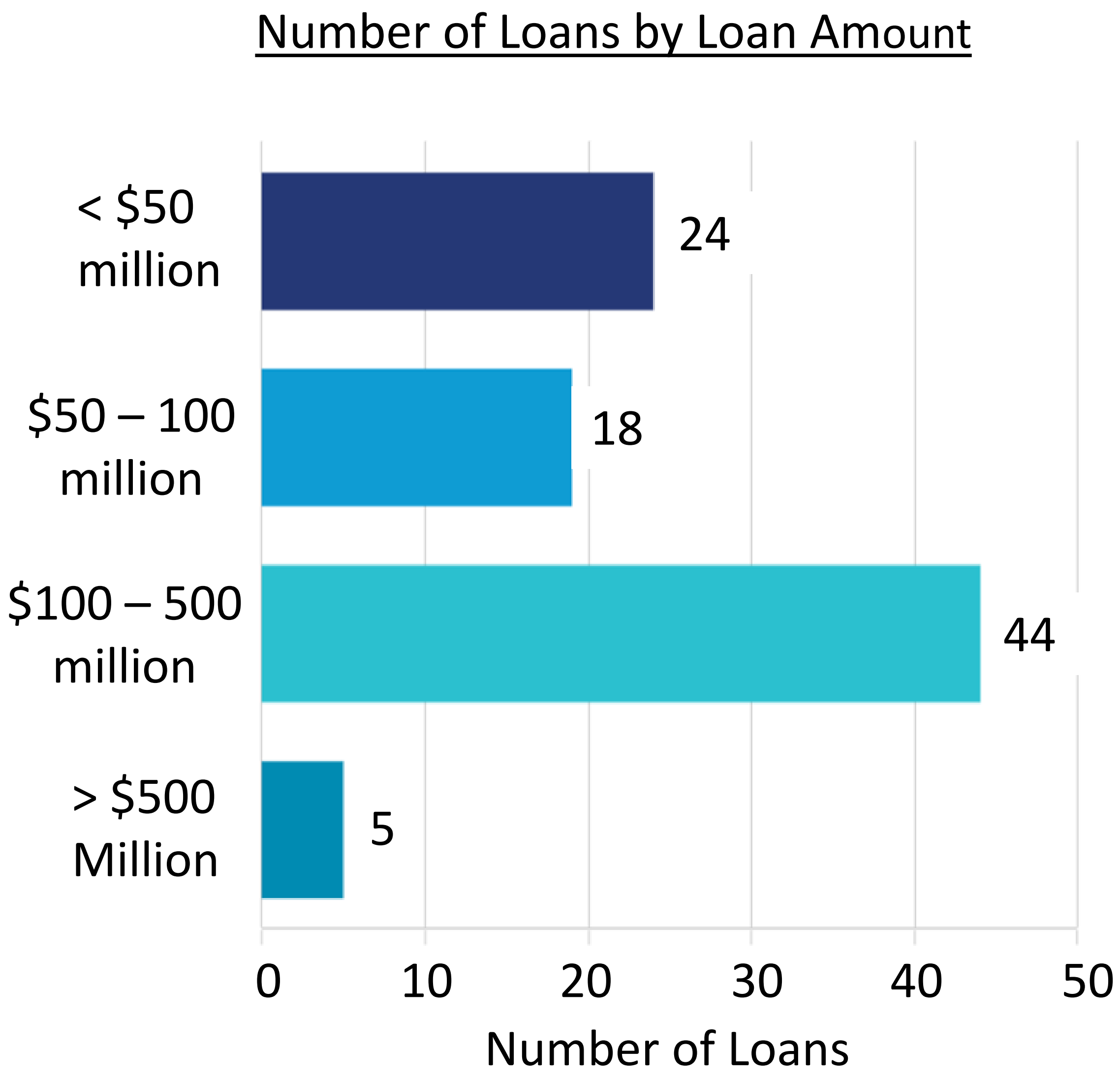
Potential Financing Sources for MAR
(based on 16 case studies & other information)

- 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

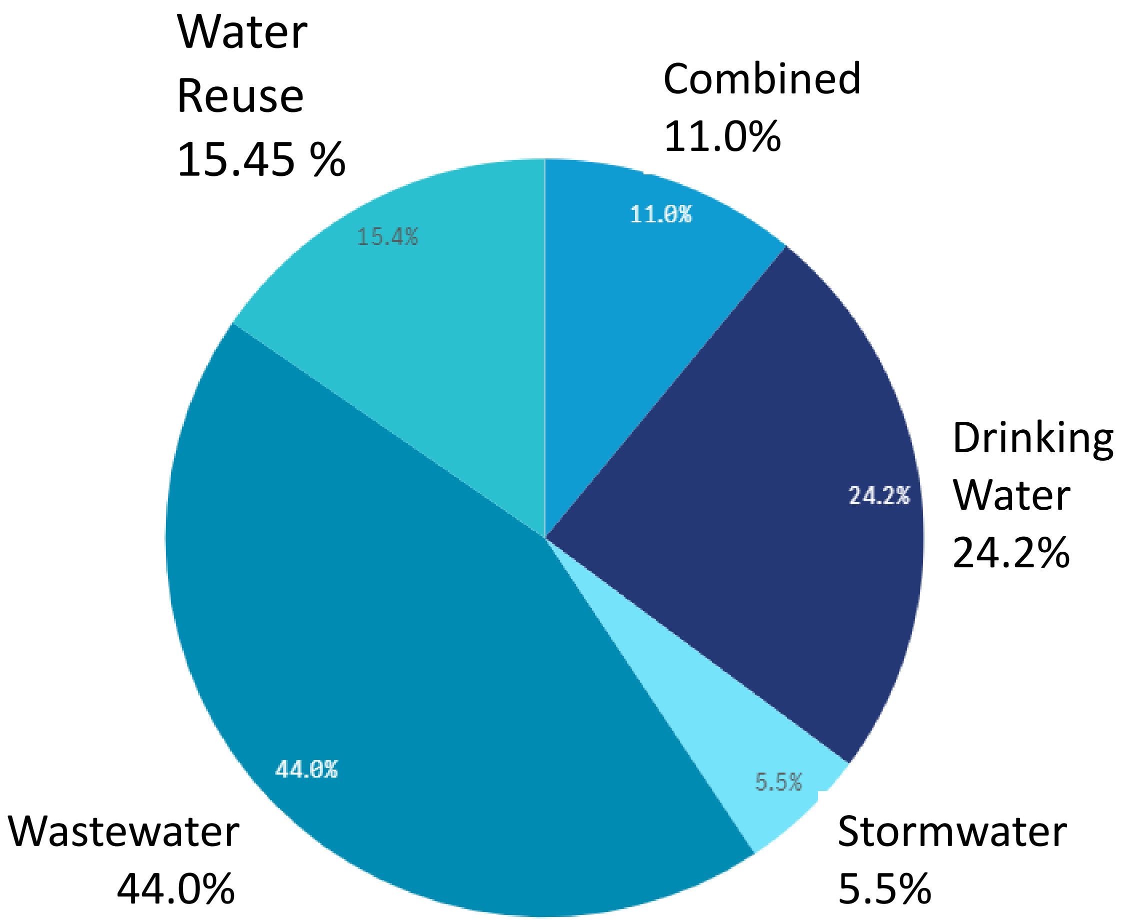


Timelines for Closed Loans
6 months or less
7 – 12 months
Over 12 months
41
38
13
0
10
20
30
40
Number of Loans



Number of Loans by Loan Amount
< $50 million
$50 – 100 million
$100 – 500 million
> $500 Million
24
18
44
5
0
10
20
30
40
50
Number of Loans

WIFIA Loans – Project Types Financed & Loan Features



<u>LOAN FEATURES</u>

- $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

Source: USEPA. 2022. WIFIA Dashboard. https://www.epa.gov/wifia/wifia-fund-facts-dashboard

Drinking Water State Revolving Fund

<u>Program Features</u>

- 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/**<u>Managed Aquifer Recharge</u>**
- 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
https://www.epa.gov/sites/default/files/2019-10/documents/dwsrf_eligibility_handbook_june_13_2017_updated_508_versioni.pdf

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

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References

Rationale for Focus on Financing MAR Projects

Zheng, Y , A. Ross, K.G. Villholth, P. Dillon [editors]. 2021. “Managing aquifer recharge: a showcase for resilience and sustainability.” United Nations Educational, Scientific and Cultural Organization. 379p. https://unesdoc.unesco.org/ark:/48223/pf0000379962

Benefits of MAR

Commonwealth Scientific and Industrial Research Organisation (CSIRO). 2019. Managed Aquifer Recharge. URL: https://research.csiro.au/mar/

Sharma, S.K. Undated. Strategies and Policies for Artificial Recharge of Ground Water. URL: https://www.indiawaterportal.org/sites/indiawaterportal.org/files/S.K.Sharma_GWE.pdf ((Accessed April 15, 2020).

Halihan, Todd. 2016. *The Future of Water: Will Our Data Beat Our Instincts.* Published October 20, 2016, by the National Ground Water Association.

Stanford Woods Institute for the Environment (SWIE). Undated. Understanding California’s Groundwater. URL: http://waterinthewest.stanford.edu/groundwater/recharge/ (Accessed May 7, 2020).