

Managed Aquifer Recharge for Resilient Water Management at the U.S. Army Corps of Engineers:

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Summary: The U.S. Army Corps of Engineers (Corps) is well known for its surface infrastructure, including locks and dams, levees and harbor channels. However, in recent years, managed aquifer recharge (MAR) has received increased consideration by the Corps and its partners. This presentation surveys the current and potential role of MAR in Corps water resources projects throughout the U.S.

As the U.S.'s water needs become more diverse, and its climate future more uncertain, requests for reallocation of water stored in Corps reservoirs are increasing, and tensions among water users are growing. Opportunities to solve such challenges using new surface infrastructure are scarce and existing infrastructure is aging. However, among these challenges lie opportunities for using MAR as a water management measure to enhance the effectiveness and robustness of existing infrastructure.

This review shows that the Corps or its partners are, or have considered, using MAR in 17 of the 50 states—to support flood risk management and aquatic ecosystem restoration missions, and contribute to drought resilience, saltwater intrusion mitigation, and water availability. The costs may be borne by the Corps and/or its non-federal partners, depending on the project's purpose(s).

MAR's increasing acceptance as a water management measure, and the need for additional storage options for an uncertain future, suggest that MAR will play an ever greater role in Corps projects. By providing seasonal and inter-annual storage for droughts, helping "flatten" flood hydrographs, contributing to environmental flows, and improving water supply reliability, MAR can help the Corps deliver sustainable and robust solutions under a variety of climatic, environmental and demographic conditions.



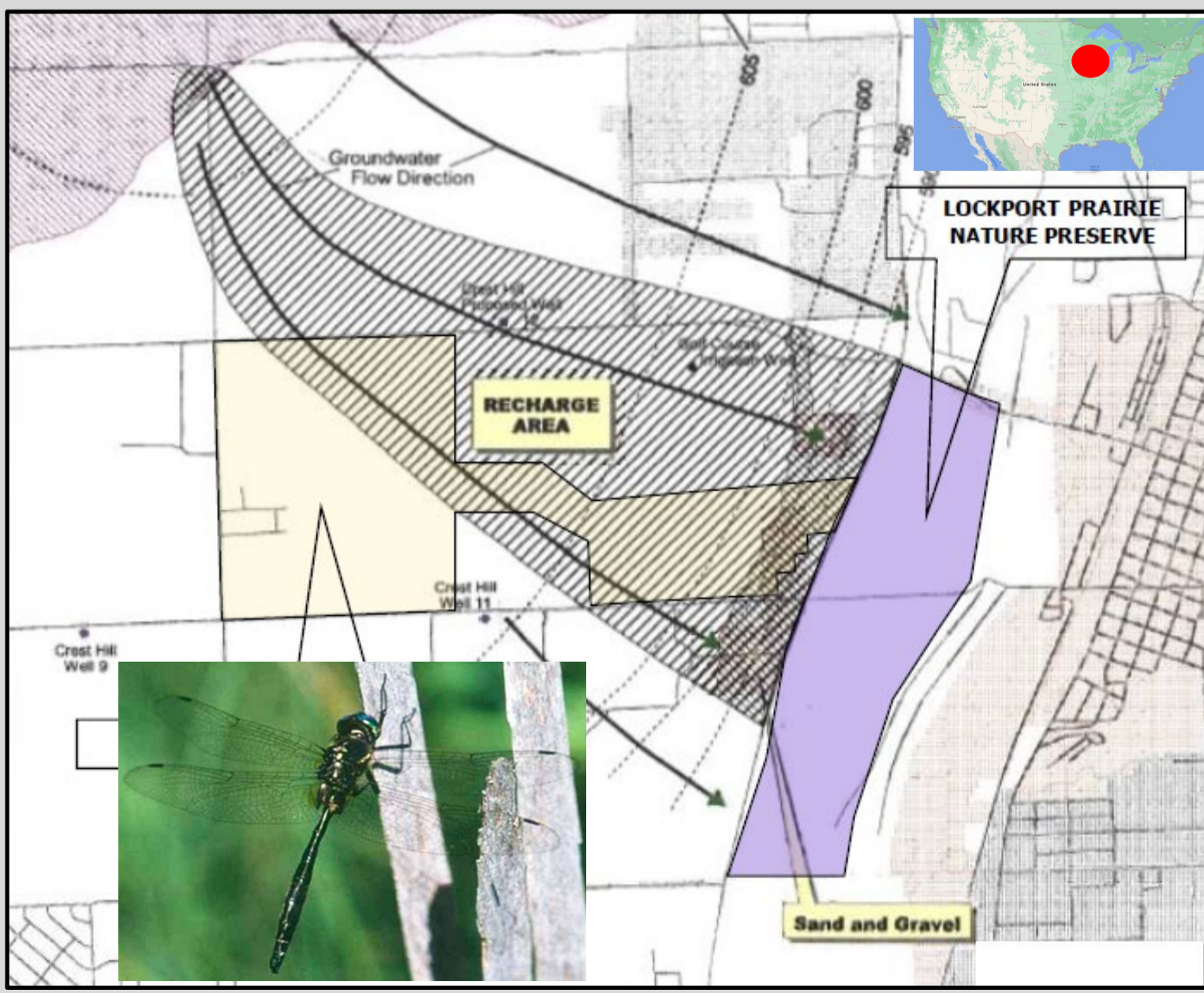
Harbor dredging, coastal shore protection, and construction of reservoirs, locks and dams, and levees are traditional strengths of the U.S. Army Corps of Engineers—not groundwater projects. This is changing.

First *general authorization* explicitly addressing MAR in Corps of Engineers projects was in 2016, "Leveraging Federal infrastructure for increased water supply" included increasing the storage capacity or diverting water from the project to recharge groundwater, including ASR.



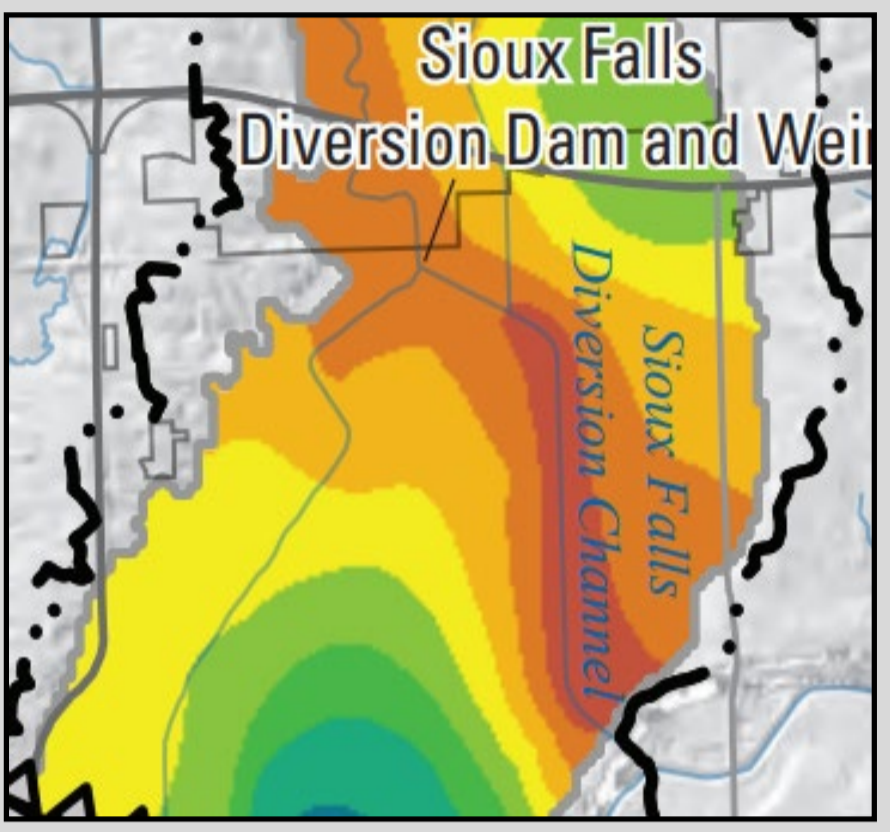
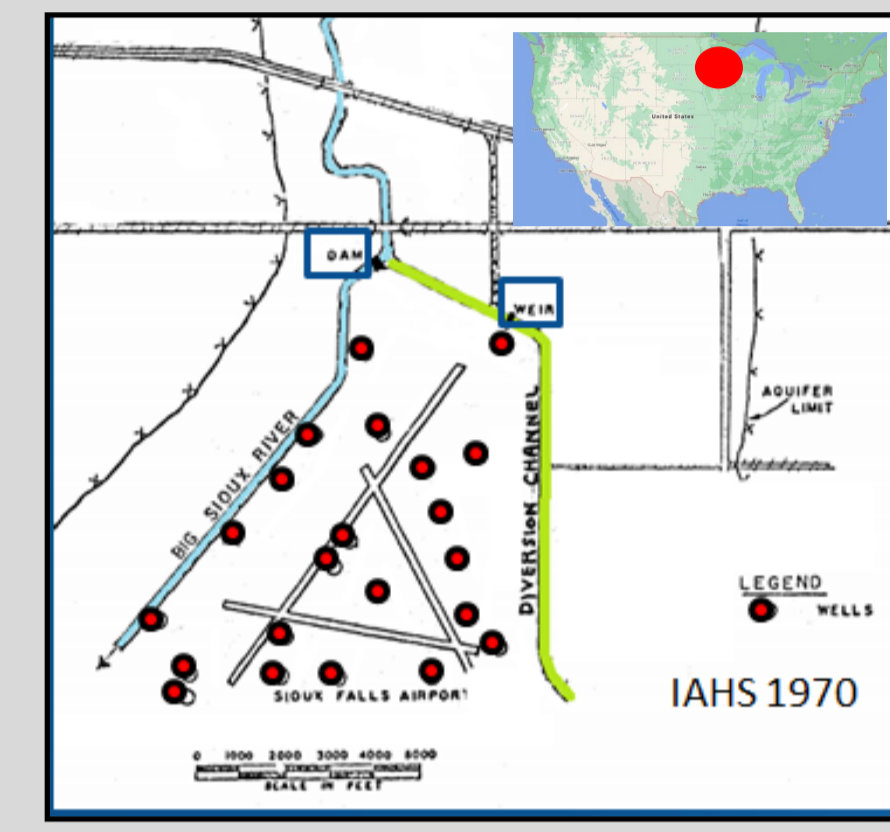
First large-scale, *project-specific* authorization from U.S. Congress for MAR (ASR) was in 2000, for Everglades Restoration. Seven of the 68 original projects involved MAR—a watershed moment. ~80 ASR wells planned for Lake Okeechobee area.

But not all Corps projects involving MAR are large scale.



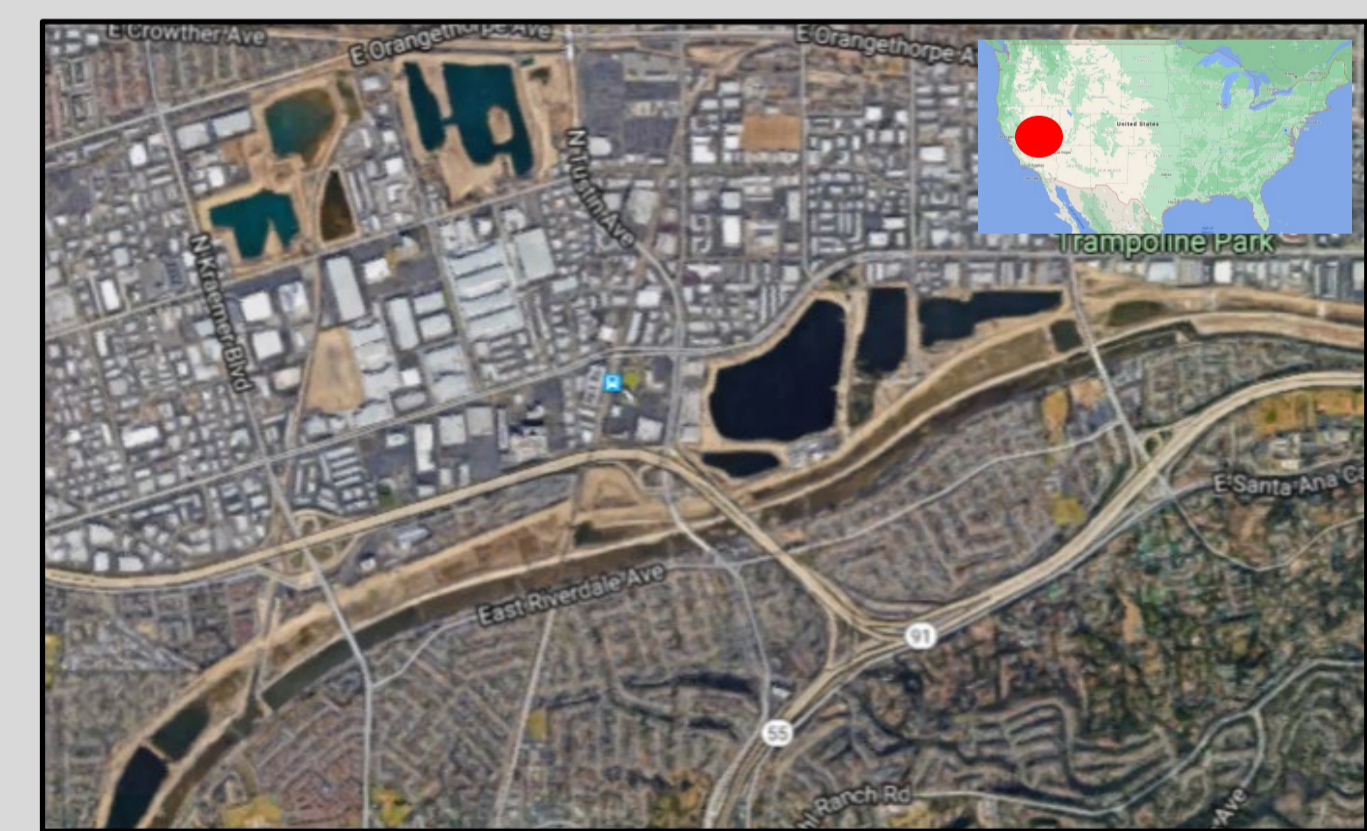
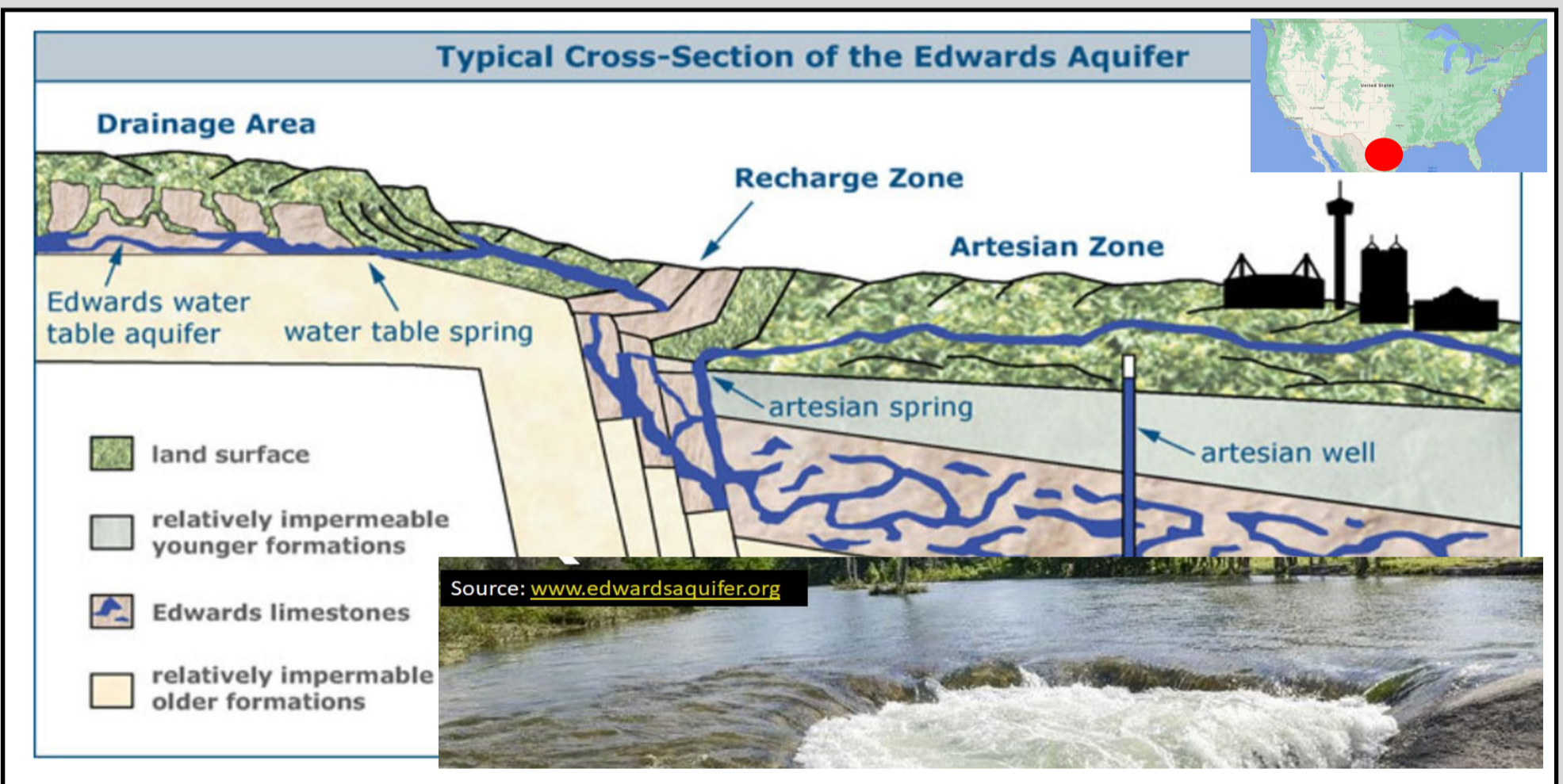
Small-scale project – restoring natural recharge for 130 ha. wetland near Chicago with endangered species.

Some MAR projects began as something else.



1961 diversion channel for flood control, Sioux Falls, South Dakota turned out to be a good recharge basin to replenish the local aquifer. Regular dredging of channel plus dam and weir operations combine to enhance recharge under normal conditions. Red zone in map on right shows high recharge zone (USGS 2019).

Dams built in Central Texas, near San Antonio, for irrigation in early 20th Century failed during droughts due to unplanned aquifer recharge along fault zone (figure; cross-section and inset). Later Corps dams were built for flood risk management *and* managed aquifer recharge.



The Corps cooperates with Orange County Water District (Southern California) to release water from the Prado Dam, when safe, at a rate less than or equal to the maximum recharge capacity of the county's downstream recharge basins.

Nationally, the Corps is, or was, engaged in MAR in 17 states and most of its divisions. This includes projects where MAR was considered but not chosen, and projects where state or local partners would build and operate the MAR system. The Corps is still learning about MAR and can benefit from additional training, internal communications and collaboration with other agencies.

