COLLEGE OF AGRICULTURE & LIFE SCIENCES
Soil, Water and Environmental Science

Arizona's Effluent Recharge and Recovery: a Beyond the State Model

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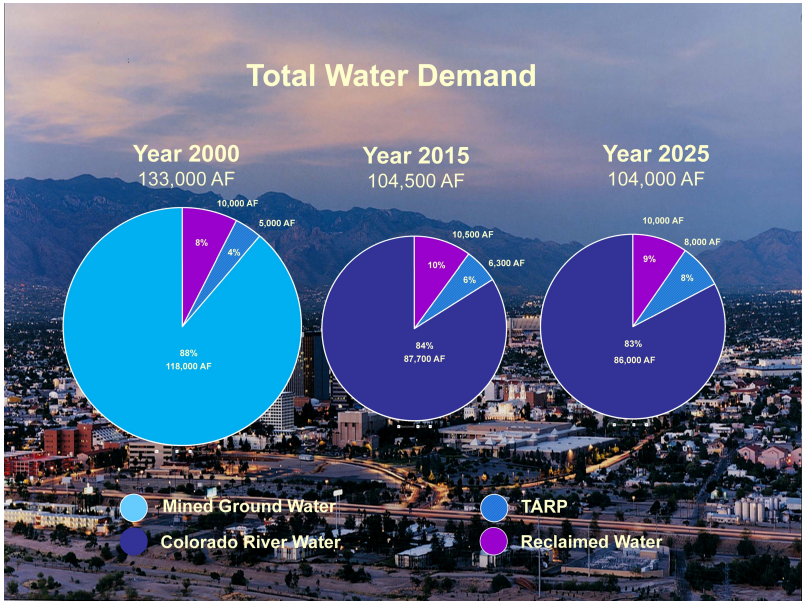
Tucson's New Water Bucket

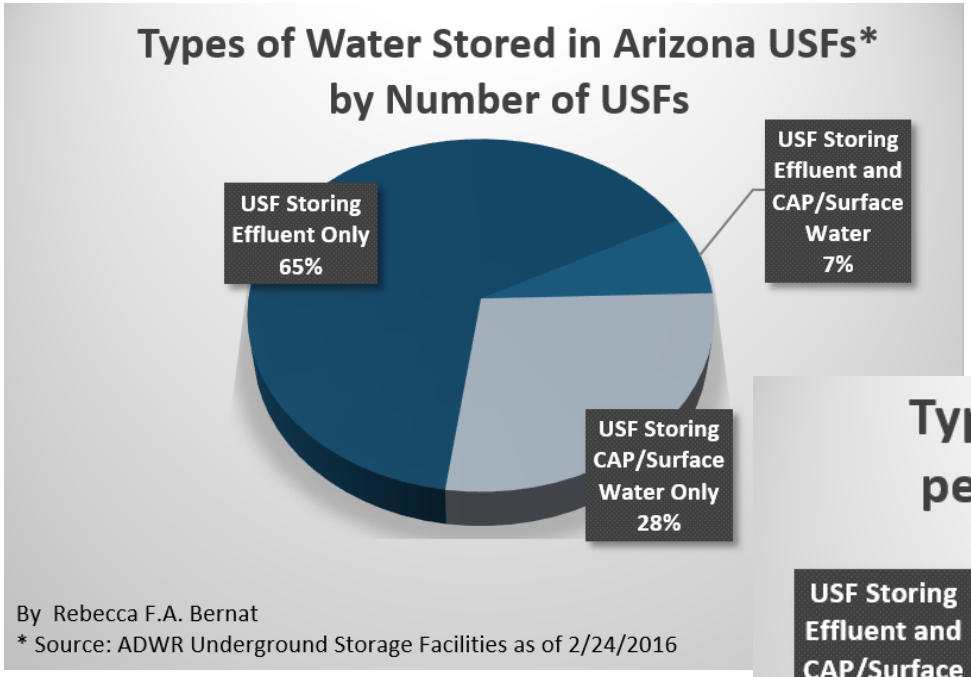
- Shift from groundwater to surface water use through aquifer storage and recovery:
  - 88% of total water demand was from groundwater pumping in 2000
  - In 2015, use of groundwater was largely replaced by use of CAP water



Source: Tucson Water

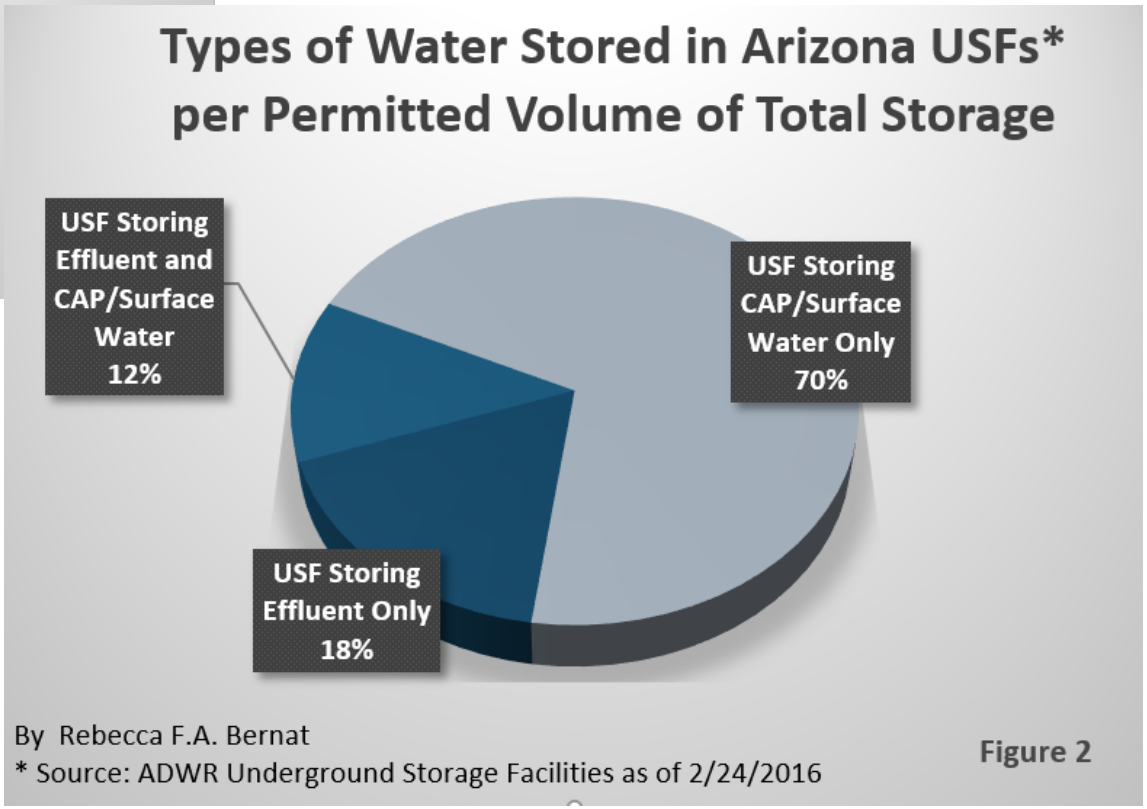
- Shift from surface water use to reclaimed water reuse through aquifer storage and recovery:
  - Climate change and drought
  - The Arizona Department of Administration projected an increase of 60% of the state population by 2050

Effluent Recharge



60/83 USFs store effluent

Almost 1/3 of the USF volume is effluent



APP Regulations

Almost all APP numeric groundwater quality standards meet the SDWA maximum contaminant levels

ADEQ: Arsenic Concentration = 0.05 mg/L

ADEQ: Ethylene dibromide Concentration = 0.0001 mg/L

ADEQ: Lead Concentration = 0.05 mg/L

National Primary Drinking Water Regulations

Contaminant		MCL or TT[1] (mg/L)[2]	Potential health effects from long-term[3] exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L)[2]
OC	Acrylamide	TT[4]	Nervous system or blood problems; increased risk of cancer	Added to water during sewage/ wastewater treatment	zero
OC	Alachlor	0.002	Eye, liver, kidney or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops	zero
R	Alpha/photon emitters	15 picocuries per Liter (pCi/L)	Increased risk of cancer	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation	zero
IOC	Antimony	0.006	Increase in blood cholesterol; decrease in blood sugar	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder	0.006
IOC	Arsenic	0.010	Skin damage or problems with circulatory systems, and may have increased risk of getting cancer	Erosion of natural deposits; runoff from orchards; runoff from glass & electronics production wastes	0
OC	Ethylbenzene	0.7	Liver or kidney problems	Discharge from petroleum refineries	0.7
OC	Ethylene dibromide	0.00005	Problems with liver, stomach, reproductive system, or kidneys; increased risk of cancer	Discharge from petroleum refineries	zero
OC	Hexachlorobenzene	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer	Discharge from metal refineries and agricultural chemical factories	zero
OC	Hexachlorocyclopentadiene	0.05	Kidney or stomach problems	Discharge from chemical factories	0.05
IOC	Lead	TT5; Action Level=0.015	Infants and children: Delays in physical or or mental development; children could show slight deficits in attention span and learning abilities; Adults: Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits	zero

Source: https://www.epa.gov/sites/production/files/2016-06/documents/npwdr_complete_table.pdf

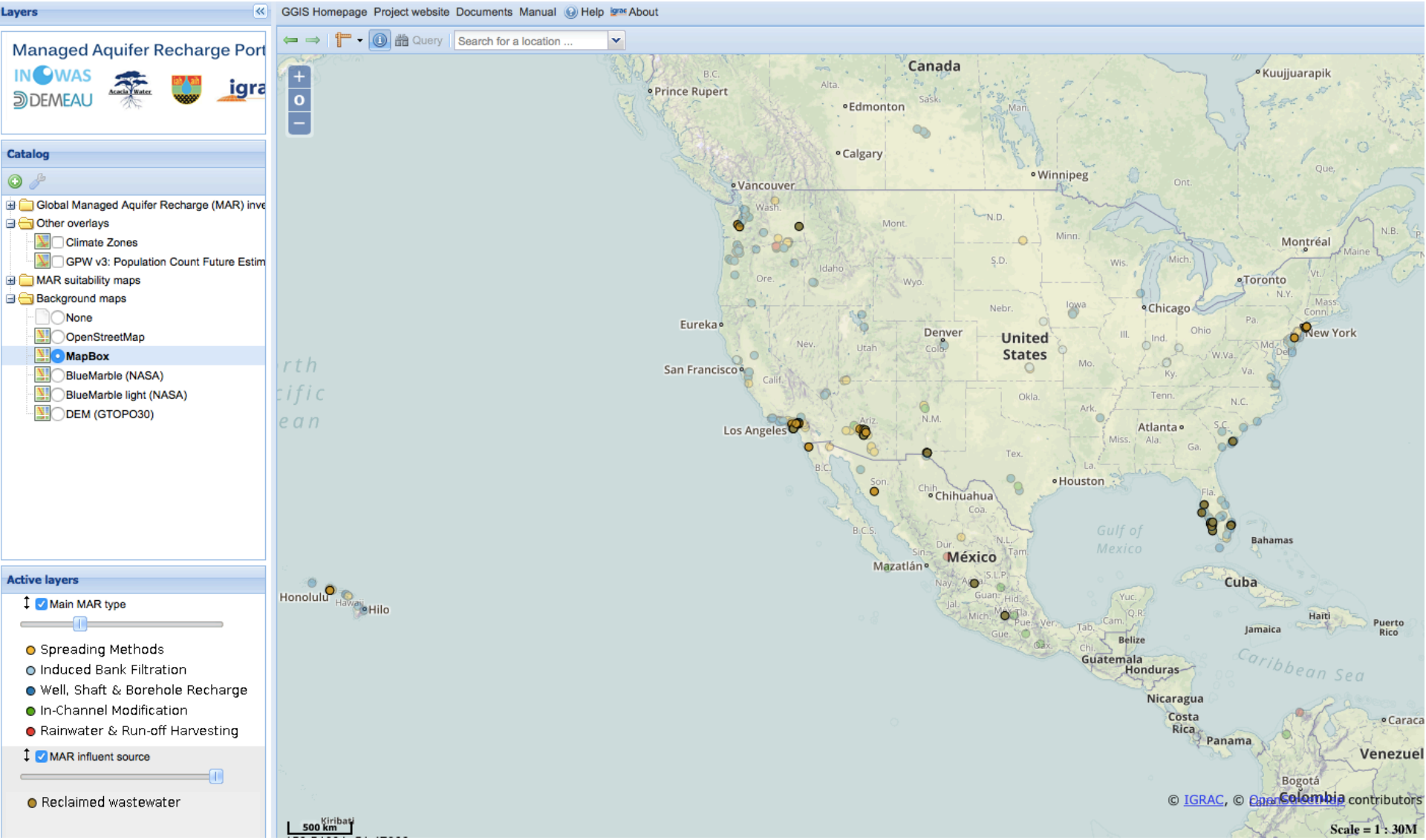
Moving forward with IPR

- Disconnect Policy between the area of recharge and the area of recovery:
  - Flexibility between WWTP/recharge and recovery/DWP → transmission cost limitation
  - *De facto* potable use → It is already happening

*" The recovered water may be hydrologically distinct from the recharge activity, but **it retains the legal characteristic** of the source water that was stored."* *Megdal, 2014*

- Environmental buffer: No need for environmental buffer assessment, because the APP already regulates the discharge of effluent → saving costs

Effluent Recharge in North America



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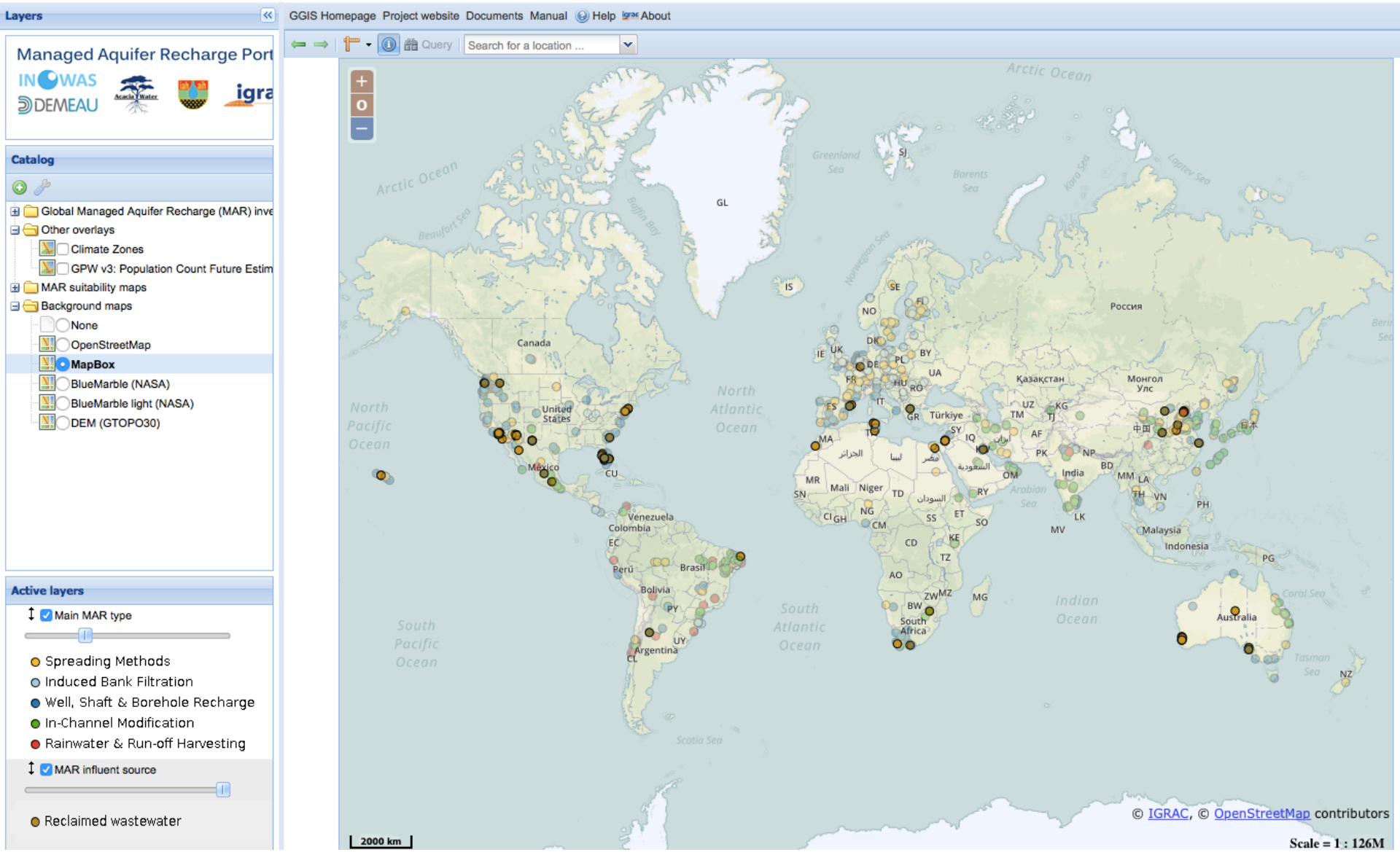
Effluent Recharge in the World



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Conclusion

- Recharge and recovery in Arizona is **relevant**, **safe** and economically **feasible**.
- There are **other semi-arid regions** where recharge and recovery of effluent coupled with **IPR** could be implemented.
- Is it **legitimate** to recharge and recover effluent in other regions? Would it be an answer to **water security**?

Thank you