GIS-Based Delineation of Prime Groundwater Recharge Areas in the East Salt River Sub-basin

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A Guide for Recharge

This project is simply intended to be a guide for areas of prime recharge in the sub-basin. There are two items central to recharge that were explored in this project: criteria and geographic location.

1. **What criteria are important to determining prime recharge areas?**
2. **Where are those areas within the East Salt River Valley (ESRV) Sub-basin?**

This project is crucial because no GIS-based sub-basin wide study on suitable recharge areas had been carried out. However CAP conducted a similar study along the CAP canal that this project is modeled after.[1]

Important Factors of Recharge

Criteria and parameter selection was based on a combination of a review of literature and recommendations from experts. A list of about 25 criteria that was deemed relevant was created. Taking into account the scope and time allotted for the project, the list was split into 4 criteria themes. Indicator criteria was selected from each section and split into parameters.

Technical
- **Depth to Groundwater**

Political/Social
- **Land Use**
- **Land Ownership**

Environmental
- **UST/VRS/Superfund sites***
- **Vicinity to waterways**

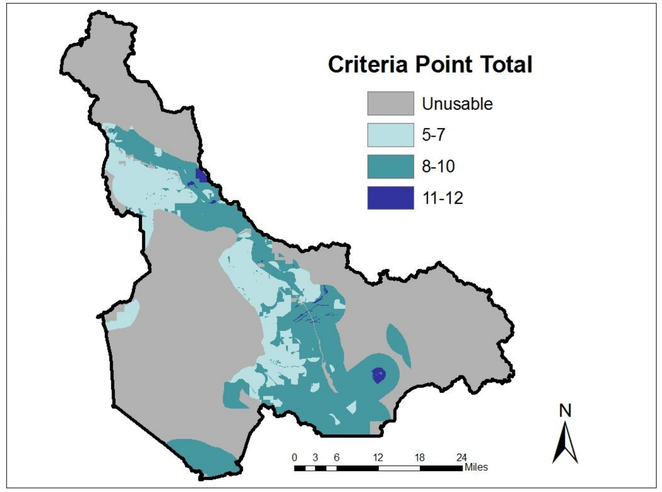
Economic
- **Vicinity to canals**

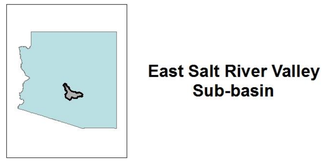
*UST=Underground storage tanks VRS=Voluntary Remediation Sites

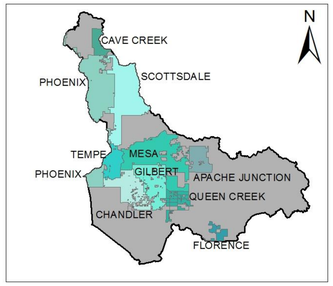
Parameters of Criteria

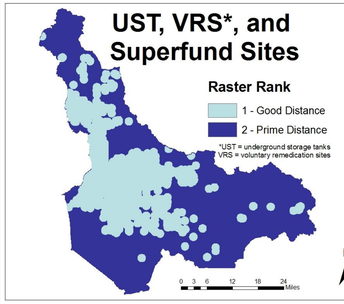
	Criteria	0	1	2
Technical				
Depth to Groundwater	ft to water	ft < 100, ft > 500	100 - 300	300 - 500
Environmental				
UST/VRS/Superfund sites	miles to site	N/A	I mile	m> I
Vicinity to waterways	miles to stream	N/A	I mile	m>1
Cultural/Political				
Land Ownership	types	Other	Private	BLM, State, City Owned, Forest
Land Use	types	Urban, All other	Agriculture	Open Space
Economic				
Vicinity to Canal	miles to canal	m > 3	1 - 3	m<1

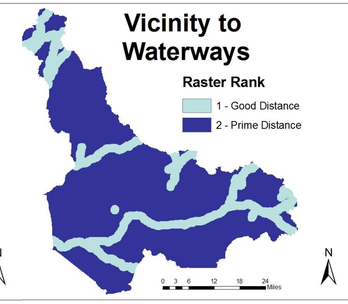
Prime Recharge Areas in the ESRV Sub-basin

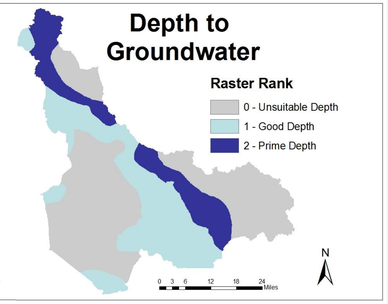


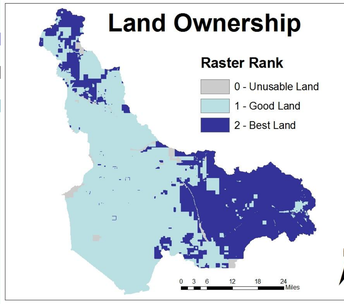


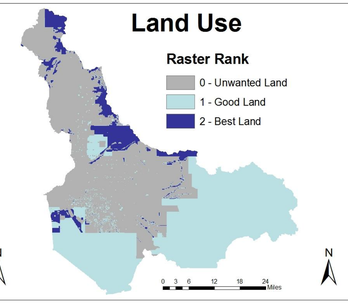


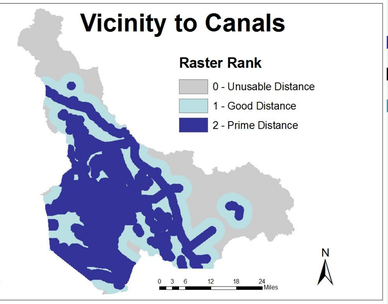












GIS Delineation of Recharge

To determine the prime areas of recharge geographically a raster overlay analyzation technique was used. Parameters were determined for each criteria and each criteria was converted to a raster layer. The resulting raster cells were given a point value for each criteria based on the parameters they fell into.

- **0 -Unable to be used for recharge**
- **1 -Good parameter for recharge**
- **2 -Optimal parameter for recharge**

Any 0 value in any criteria eliminated that raster cell (except the Land Use layer). The point values for each criteria were totaled for each raster cell and ranked based on total points.

Results

Values ranged from 5 to 12 with 12 being the highest possible point total. The area with most activity was through the central part of the sub-basin. This is because the corridor has the prime water depth criteria and is within prime vicinity of canals. Both of these are limiting factors because they eliminate large potions of the sub-basin where there cannot feasibly be recharge.

Moving Forward

Relevance
- Reports similar to this have been completed, but not to the extent of the entire ESRV sub-basin before this project
- This project will be included in a report delivered to the City of Mesa that is intended to provide Mesa and stakeholders in the East Valley Water Forum (EVWF) valuable information to make informed decisions about recharge in the sub-basin.

Collaboration
- Part of the report delivered to Mesa includes a study on collaboration between members of the EVWF by Emily Allen, which is very important when dealing with recharge
- Human interaction is very hard to quantify and but is still important, and therefore should betaken into consideration when looking at recharge. [2]

Next Steps
- A comprehensive 3D groundwater model would be a beneficial addition to the project in order to provide subsurface criteria such as infiltration rates
- Addition of other basin-wide criteria and refinement of current criteria would improve the identification and accuracy of prime recharge sites.

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[1] Plato and Brooks, *Data Report and Report of Initial Weighting of Sites: East Salt River Valley Siting Study,* (Tempe, Arizona: GeoTrans, 2002)
[2]See *"Uncovering Barriers and Motivations in Groundwater Management Collaboration"* by Emily Allen

Data for this project was acquired form the ASU GIS repository, The City of Mesa, and the Maricopa Association of Governments.