Water for the Future: Strategies on Conservation

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Objective

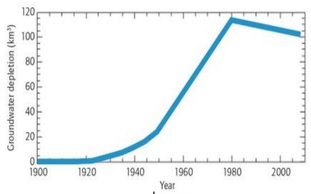
Create a viable framework for comparing different water resource strategies, specifically water conservation in retrofitted cooling towers versus development of new groundwater wells.

Background

As Arizona is facing a drought, it is essential to conserve water with systems that operate with high amounts of water such as cooling towers and Aquifer Storage Recovery wells.

The idea of conserving water came from the realization of the amount of water that is being depleted from Arizona's water sources. The two graphs below show the depletion of water in Arizona's aquifers and Lake Mean's water levels. If these actions continue the states will most likely face a drought. To avoid a devastating drought, it is essential that states start to take action in conserving water for the future of their residents.

Arizona Alluvial aquifer



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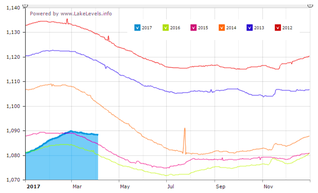
Lake Mead Water Levels



LakesOnline.com

Method

- Gathered data from City of Phoenix records for the cooling tower and aquifer storage recovery well.
- Utilized Microsoft Excel to create a framework to display the comparisons between the cooling tower and Aquifer Storage Recovery ASR well (see table in center top)
- Presented it to the city to see the comparisons

Definitions

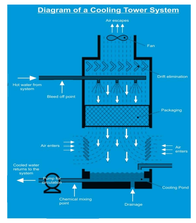
- **Cycles of Concentration:** The term used in calculating and determining the amount of bleed.
- **Bleed:** Water loss from a pump seal, leaks in the system, overflow down the tower drain, or windage.

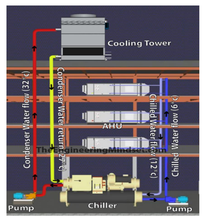
Framework

	Cooling Tower	ASR Well
Reason	Increase cycles of concentration to reduce water consumption.	Help replenish the water table by reduce the dropping rate of the water table and store water for future use.
Action	Upgrade cooling tower	Install ASR well
Location	Phoenix International Airport Terminal 4	City of Phoenix Well No. 299
Capital Cost	$1,000,000.00	$2,521,677.47
Maintenance Cost	$40,000	$186,999.00
Per Unit (Gallons)	Before upgrade: 57,816,000 gallons After upgrade: 42,924,000 gallons	Pumping: 1870 gpm (4 months) Recharging: 2100 gpm (8 months)
Net Savings	14,892,000 gallons saved per year	402,624,000 gallons pumped back into the ground through the year
Risks	Bacteria Scaling Corrosion	Bacteria (Iron bacteria, TCE, Coliform) Air entrainment in the aquifer
Implication for Drought	Less water consumed means that there is more water for to be conserved.	Conserving water by pumping more water into the ground.

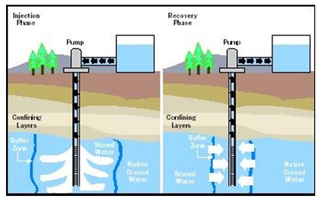
Cooling Tower

A cooling tower is a device that expels heat to the atmosphere through air passing through a mist of water to lower the temperature.





ASR Well



Aquifer Storage Recovery (ASR) is a well that pumps water into the ground when the demand is down and pumps water out when the demand is high.

Conclusion

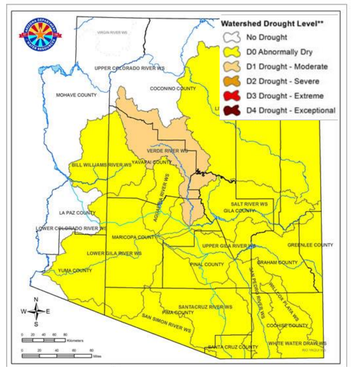
In the end, the comparison framework shows the two main topics that people are interested in when it comes to conserving water. How much water are we going to create for future use and how much will it all cost in the end?

An issue with developing this framework was creating a framework to compare water resources strategies based on a variety of factors. This caused and issue due to the fact that a cooling tower is a demand system and an ASR well is a supply system. This issue was resolved by comparing the volume of water that is conserved through the actions of the two systems. Cooling towers get an upgrade and a new ASR well gets installed. For this to happen cost, risks, drought adaptation and other factor have to be involved when considering a decision in conserving water.

At the end the objective was reached by creating a comparison framework for conservation in retrofitting cooling towers versus development of new groundwater wells. These topics can help the decision makers when it comes to conserving water.

Future Results

This framework is not complete because it is a foundation for future water systems. This is only an outline for others to follow and add to compare strategies that depend on water. The two big topics of water conservation and cost will still be the main focus of any decision making. With great success, this framework will create more clarifications on issues regarding water conservation methods.



droughtmonitor.unl.edu

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