

6-15-2022

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Recommended Citation

Sarver, Bridget. 2022. "Why We Should Reuse Wastewater." *Certified Public Manager® Applied Research* 3, (1). <https://scholarworks.sfasu.edu/cpmar/vol3/iss1/3>

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Why We Should Reuse Wastewater

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Abstract

As population and industry grow, the need to reuse wastewater is growing. Aquifers are often the dominant water supplies to surrounding areas. The levels of those aquifers are declining each year. Water loss affects many things like water wells, lakes, and rivers. Lakes and rivers that are used as water sources are seeing a decline in levels. Low water levels and drought occur because of the changing water cycle. Heavy rain and runoff can help refill lakes and rivers; however precipitation does not always fall back on the area that it evaporated from. By reusing wastewater, we will be saving our fresh water sources from depletion. By reusing wastewater for things like cleaning, irrigation, and fire suppression, we will save our fresh water sources. Reused wastewater can be treated enough to be drinking water, but not everyone will be open to that idea. Reused wastewater can also recharge an aquifer when natural recharging cannot keep up with the amount being used.

Introduction

What is wastewater reuse? “Water reuse generally refers to the process of using treated wastewater (reclaimed water) for beneficial purposes such as agricultural and landscape irrigation, industrial processes, non-potable urban applications (such as toilet flushing, street washing, and fire protection), groundwater recharge, recreation, and direct or indirect water supply.”¹

Household water consumption adds up for lavatory uses, showering, dish washing, clothes washing, and outdoor use. “The average American family uses more than 300 gallons of water per day at home.”² With the growing population, this has put a strain on water sources in some areas. Forty states told the Government Accountability Office in a 2014 report that they expected to have water shortages over the next ten years that were not related to drought. The available water gets used faster than nature can recharge the source. There are many sources used and treated for drinking water.

If all cities with a wastewater facility were to reuse (reclaim) their effluent water, this would cut back on the amount of drinking water being used for things like irrigation, fire protection, and cleaning at the wastewater facility. Reused wastewater can be used at wood mills to keep logs from drying out while they are stockpiled before processing. This water can also be used to irrigate or fill ponds at golf courses, and the irrigation specialists at the golf course can add chemicals needed to adjust the pH of the water so that it is at the right level to help growth.

Earth's water is always in movement, and the natural water cycle, also known as the hydrologic cycle, describes the continuous movement of water on, above, and below the surface of the earth. Water is always changing states between liquid, vapor, and ice, with these processes happening in the blink of an eye and continuously over millions of years.³ This means that an area that once had plenty of water can be in danger of drought conditions. Droughts happen in the country every year and climate change has the potential to increase stress on water resources. To create a more sustainable water future, cities and states are coming together to encourage water conservation and efficiency to reduce demand. If these areas were to reuse their wastewater, it

could help mitigate the amount of drinking water used for things other than personal use. If treated correctly, reused wastewater could be used to recharge aquifers. Wastewater that is discharged to creeks and rivers is likely removed and treated for drinking water further down the river.

Depleting Water Sources

Growing population, industrial demand, and climate change are depleting water sources. We must make an effort to protect the depleting supply.

Texas Aquifers

The Texas Water Development Board (TWDB) recognizes 9 major aquifers that produce large amounts of water over large areas and 22 minor aquifers that produce minor amounts of water over large areas or large amounts of water over small areas.⁴ In the East Texas area the Carrizo-Wilcox outcrop and sub crop aquifers are dominant.

Water Loss

The aquifers have seen a decline in depth over the years. While some naturally replenish themselves, over pumping can cause groundwater depletion, which can cause wells to dry up. It can deteriorate the water quality and reduce water in the lakes. When groundwater depletion causes the water table to drop, well pumps may need to be lowered, and wells may decrease production. They may also have loss of production. Water evaporation also contributes to water loss. When water evaporates from one area, it may fall back down as rain in a different area, leaving the original area vulnerable to drought conditions which can cause water loss. When an area doesn't receive rain for a long period of time, but the same amount of water is being used to support the population, this also contributes to water loss.

Water Wells

The Texas Ground Water Committee's definition of a water well is a hole drilled into an aquifer with a pipe, screen, and pump to pull water out of the ground.⁵ There are several different kinds of water wells. Public wells are the wells used to supply the public with drinking water in some cities. They are tested monthly, and those test results are sent to the Texas Commission on Environmental Quality (TCEQ). If any sample result shows contamination, then the city that owns the well must report it to TCEQ and send out a public notice to its citizens.

Private water wells supply domestic needs, as well as irrigation and watering livestock. These wells are not regulated. There are no water quality testing and reports required on privately owned wells. The users are not required to treat the well water before use.

Abandoned wells are of most concern due to the possibility of contamination to the water attached to the well. If an abandoned well is not plugged, then someone could use it to dispose of potentially contaminating material. There is also risk of an animal or person falling in the well and getting injured or dying.

Natural Recharging

Groundwater is recharged naturally by rain and snow melt and, to a smaller extent, by surface water (rivers and lakes).⁶ The slower it rains, the more the water will soak into the ground and filter into the aquifer recharging it. When rain falls hard and fast it tends to run off into drains, lakes, and rivers. Snow melt is a good source of groundwater recharge due to the snow melt being slow and allowing the water to penetrate the ground. Natural recharging usually does not keep up with the pace of water being removed from an aquifer.

Artificial Recharging

One way of artificial recharging an aquifer is the direct-surface technique when surface flooding of land allows the water to seep through the soil, which in turn is a form of filtration. There are also ditch and furrow systems used to recharge. There is also the indirect recharge method which is water being injected into the ground. This is used when there is not enough land available to do surface flooding. Although these methods are studied, we still do not know the full effect of artificial recharging.

Lakes

Many lakes in Texas currently supply drinking water, with many more considered as a backup in case groundwater wells run dry. Lake water must be treated in a surface water treatment plant before it can be sent out to customers. Lake water is more costly to treat than groundwater because lake water has solids and sludge from organics that have to be removed from the water before it can be disinfected and distributed to the public, however the treatment plants are set up very similarly to wastewater treatment plants.

Lake Sources

Several lakes serve as water sources for surrounding areas. Lake Nacogdoches is used for a water source in Nacogdoches, Texas and has the production capacity of 25 million gallons per day.⁷ Lake Palestine is a source of water for the Lake Palestine water treatment plant and has the treatment capacity of 30 million gallons per day.⁸ Lake Tyler and Lake Tyler East are the source of water for the Golden Road Water Treatment Plant and have a treatment capacity of 34 million gallons per day.⁹ Lake Conroe is a water source for one of Harris county's surface water plants. Lake Houston and Lake Livingston are also sources for Harris County.

Water Loss

The majority of Texas lakes used for water supply are below the conservation pool, meaning they are below the full level. During droughts the lakes that are being used for public water supply start drying out. This can lead to a lake drying up completely if nothing is done to slow water use. Lake water can also soak into the ground and help recharge aquifers.

Rain and Runoff

Heavy rain can help fill the lakes back up. The heavier the rain is, the more runoff occurs. The runoff goes to ditches, creeks, rivers, and area lakes. A light and steady rain usually soaks into the ground. Although it can produce some runoff, it does not help fill the lakes like the heavy rain does. Cities install storm sewer intakes to help move the runoff in the direction of a creek. They also install curbs along roadways to direct the runoff in the direction needed. This helps to prevent street flooding during a heavy rain event while helping add water to rivers and lakes by sending the directed water to creeks that feed into rivers and lakes.

The Water Cycle

The water cycle describes how water evaporates from the surface of the earth, rises into the atmosphere, cools and condenses into rain or snow in clouds, and falls again to the earth's surface as precipitation.¹⁰ The water falling on land collects in rivers, lakes, soil, and porous layers of rock, and much of it flows into the oceans, where it will once again evaporate.¹¹ Once the water evaporates, it can remain in the clouds for a long period of time and travel many miles before it falls back to earth as precipitation. An area that was once abundant with water can become dry and experience drought conditions because of the way the evaporated water travels.

Wastewater Reuse Water

Municipal wastewater and industrial wastewater can be reused. There are different levels of treatment which determine what the reused water can be used for. In areas that have limited access to a water supply, this could alleviate some of the concerns of overuse of the water wells or lake sources. There is planned and unplanned reuse of water.¹² When a wastewater plant discharges into a river and then a municipality pulls from that same river for their drinking water source, unplanned reuse occurs. Intentionally sending the wastewater to a place to be reused is considered planned reuse.

Ways to Reuse Wastewater

Some of the ways to reuse wastewater are grounds irrigation systems, industrial uses, non-potable cleaning, fire suppression, and drinking water.

Grounds Irrigation

Reused water can irrigate fields, lawns, or flower beds, though less treated water should only irrigate places that are not open to the public due to the likelihood of less treated water carrying health risks.

Filling Ponds

Not all cities have a local golf course, but if they do then the treated wastewater can be used to fill the ponds on the golf course. Some of these ponds are used as irrigation for the grass, while others are there for the visual affect and a refuge for local wildlife.¹³ Certain grass species grow better when the soil pH is slightly alkaline (6.5-7.0), therefore the water used to irrigate the grass should have a pH level in the preferred range to allow for optimal growth.

Depending on the level of treatment, reused water can fill crop irrigation and livestock ponds. There is no limit to where it can go so long as it meets the disinfection level needed.

Cleaning at Wastewater Plant

Almost all equipment used at a wastewater plant must be cleaned. The clarifiers, contact chambers, aerators, bar screens, and lagoons all need to be cleaned regularly. A wastewater plant can be set up with a pump and holding tank that feed non-potable water faucets for cleaning at the plant. By using the reused water from the wastewater plant for cleaning purposes, it saves the city's fresh water supply for the citizens. This can save thousands of gallons of potable water per month.

Industrial Fire Suppression

All major industrial buildings are required to have a fire suppression system. These systems can use large amounts of water if triggered, however if the system is triggered in a small city, it could limit the water supply to that city. If the system is large enough it could possibly drain the city's total supply. The City of Diboll has several large industrial buildings that could potentially drain the water supply such as GP Wood Products and Hexion Chemical Plant. By using reused wastewater for the fire suppression system, the fresh water supply would remain untouched in the event of their use. For example, the City of Diboll used to send all its effluent water to Temple Inland for them to use for fire suppression and to spray their logs.

Industrial Wood Spraying

When logs must be stored for long periods of time at a temperature above freezing, it is best to keep the logs soaking wet. This protects the logs from things like insects and fungus.¹⁴ These logs can be stored under a sprinkler system for long periods of time. These wood mills could use reused wastewater to keep the logs wet instead of using city furnished potable water, which would not only save potable water but also save the company money. When the City of Diboll was sending its effluent reuse water to Temple Inland Wood Products they were not charged for the reused water. The water was used to spray on the stored logs. When Temple Inland sold out to GP, they did not want to use the reused water and had it removed from their permit with TCEQ.

Drinking Water

Turning reuse wastewater into potable water can be expensive. Not only does it have to be treated at a higher level, it also must be purified or filtered. It is important to note that turning reused water into potable water is not always right for all areas. When the effluent water that was once sent to a creek or river is diverted, this can interrupt the return of water to the natural environment.¹⁵ If a creek or river is dependent on the water being returned to it then reuse would not be the right choice for that area. The biggest hurdle lies in gaining public acceptance.¹⁶ When citizens hear that treated wastewater is to be used as drinking water, they often get concerned about the safety of the water and get disgusted. It may take some time to educate the public to get them on board, however it is a necessary undertaking in order to preserve fresh water for their personal use.

Conclusion

The reuse of wastewater would allow for personal water use reserves to remain full while still having enough water for industrial uses such as fire suppressors, irrigation systems, and industrial wood spraying. Reusing wastewater can help ease concerns in areas with naturally low water levels by ensuring all industrial watering needs are met while keeping enough water clean for personal uses such as drinking and cooking. With the various levels of cleaning available depending on the location of the plant, reusing wastewater is not as unsanitary as it seems. It is a matter of properly educating the public on where their water comes from and exactly how it is cleaned enough for reuse.

Notes

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⁴ Visit

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