

Water reclamation for reuse and groundwater recharge

Orange County, Florida, USA

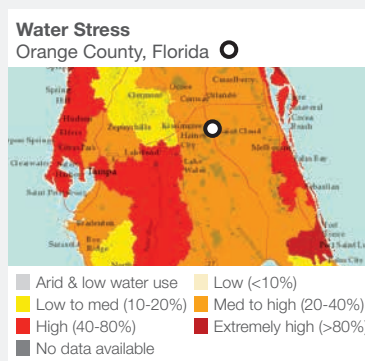
water scarcity impact

Reduced withdrawal	●
Reduced consumption	●
Improved water quality	
Increased productivity	●
Net basin benefit	●

volumetric impact
58 000 000 m³/yr

capital cost
\$344 000 000

estimated unit cost of water
45 ¢/m³



Water Stress Map:
Gassert, F., M. Landis, M. Luck, P. Reig, and T. Shiao. 2013. "Aqueduct Global Maps 2.0."

Confidence level
● Low ● Medium ● High

Water Scarcity Impact Key
● Main ● Minor

Credits
We wish to acknowledge the input of Mike Infurmar of the Water Reuse Association in the preparation of this case study.

Project Overview

The Conserv II project was developed in partnership by City of Orlando and Orange County to upgrade the wastewater treatment systems in order to comply with a court decision and cease discharge of treated municipal wastewater into watercourses draining into Lake Tohopekaliga. The objective of the court decision was to improve water quality of Shingle Creek, Lake Tohopekaliga and its adjacent nature reserves that were being affected by municipal wastewater discharges.

The \$344m project was designed in collaboration with the US Environmental Protection Agency (EPA). It included upgrades to the municipal wastewater treatment plant, construction of a new reclaimed water distribution network and construction of Rapid Infiltration Basins for groundwater recharge.

Almost 60% of the reclaimed water is used for irrigating landscapes in golf courses and local parks, and for irrigating 1 300ha of citrus orchards that previously used groundwater sources. Around 40% of the reclaimed water is used to recharge the surficial aquifers via 81ha of Rapid Infiltration Basins (RIBs).

To encourage use by citrus farmers, an agreement was forged with early entrants to the project to provide the reclaimed water free of charge for a 20year period. This reduced the groundwater demand of citrus orchards and increased recharge of the Floridian Aquifer System which is the sole source of potable water in central Florida.

Key Elements

- Wastewater reclamation for irrigation and ground water recharge.
- \$344 000 000 project cost financed through municipal bonds and a grant from the US EPA.
- The capital and operating expense is serviced by charges for treating municipal wastewater and from sale of reclaimed water.
- Construction of Rapid Infiltration Basins to enhance the recharge of the Floridian Aquifer System.
- Treatment and re-use of waste water flows that would have otherwise discharged to Shingle Creek, and hence Tohopekaliga.
- Principal source of water supply is groundwater.

Key Outcomes

- Eliminated discharges to Lake Tohopekaliga improving its water quality.
- Total volume of reclaimed water 58 million m³ per year utilised as follows:
 - 23 million m³ of aquifer recharge through rapid infiltration basins.
 - 25 million m³ of reclaimed water used by citrus farmers instead of abstracted groundwater.
 - 10 million m³ of water used to supply golf courses, amusement parks, and residential and commercial users.
- Storage in the aquifer reduces the evaporative losses (consumptive use) from water that would have otherwise remained as surface water.
- For each unit of water abstracted from the original source a greater productive output is achieved.



Florida, USA

Intervention Features

- Groundwater recharge
- Wastewater reuse for agriculture
- Non-potable water distribution system
- Reduced water rates for reclaimed water

Project Levers

The project was primarily funded by the City of Orlando and Orange County administrations, with 36% of the project cost covered by a US EPA grant.

(1) Advanced wastewater treatment:

The treatment measures employed at the plant include equalisation basins, biological nutrient removal, clarification, filtration and ultraviolet disinfection. The reclaimed water is consistently within drinking water standards for all chemical constituents, including heavy metals.

(2) Reclaimed water supply network:

An extensive pipe network was constructed to convey the reclaimed water from the Conserv II Distribution Center to various users. Although the system has a peak conveyance capacity of 284 000m³/day to cater for future growth in demand, the incoming wastewater flows limit the current reclaimed water supply to 159 000m³/day.

(3) Multiple users for reclaimed water:

The reclaimed water is supplied to residential and commercial users for landscape irrigation, evaporative cooling, and to citrus farmers for irrigating the orchards. The volume not consumed by these users is discharged to rapid infiltration basins for aquifer recharge.

(4) Free supply to citrus farmers:

Reclaimed water was supplied for free to citrus farmers for a period of 20 years, provided they became early participants and applied reclaimed water to the orchards in large volumes to aid groundwater recharge. This incentive helped to save the initial capital expense of additional rapid infiltration basins and provided a productive use for the treated wastewater. The agreement was extended in 2010 for a further five years, following which reclaimed water will be charged at \$5/m³ to all the citrus farmers.

(5) Monetary incentives for users:

Reclaimed water rates for residential and commercial users are lower than the charges for municipal potable water supply. The primary incentive for citrus farmers was in the reduced cost of maintaining and operating their own groundwater abstraction systems. The rates are set lower for the citrus farmers than other commercial users, as the orchards help with infiltration of reclaimed water. The comparison of water rates in 2012 is shown in the adjacent table.

Outcomes and Challenges

The direct discharges of treated municipal wastewater into Lake Tohopekaliga stopped following completion of the project, thereby complying with the court decision. Studies comparing the environmental conditions have also shown improved water quality in Lake Tohopekaliga.

Reclaimed water provides a reliable and secure supply to the local citrus farmers and has helped them avoid crop failure due to recent droughts. Its use in citrus orchards has helped to reduce direct agricultural groundwater abstraction in the Orange County from 59 412 000m³ in 1985 to 33 057 000m³ in 2005.

Significant outreach was necessary to convince citrus farmers to accept reclaimed water for crop irrigation. They only accepted on the basis of research supporting the efficiency of the nutrient rich reclaimed water and having been offered reclaimed water at no cost for a twenty year period.

The use of reclaimed water helped increase tree growth and deliver higher fruit crop. The application of large amounts of reclaimed water has helped to increase fruit weight and juice content by 5% in comparison to orchards irrigated with groundwater.

The use of reclaimed water by orchard farmers and discharge into infiltration basins has helped increase groundwater levels by up to 1 200mm in parts of the aquifer. However, overall groundwater levels continue to fall as a result of increased abstraction to meet the water demand of a growing population.

	Water Use (in m ³)	Potable Water (\$ per m ³)	Reclaimed Water (\$ per m ³)
Residential	Up to 11.3	0.28	0.20
	11.3 to 37.8	0.38	
	37.8 to 75.7	0.75	
	75.7 to 113.5	1.50	
	Above 113.5	3.00	
Commercial	Up to 37.8	0.38	0.12
	37.8 to 75.7	0.75	
	75.7 to 113.5	1.50	
	Above 113.5	3.00	
Citrus Farmers	-	-	0.05