The U.S Army Corps of Engineers and The South Florida Water Management District

# Aquifer Storage and Recovery (ASR)

## Regional Study and Pilot Projects

NOVEMBER 2002

## Introduction

America's Everglades are widely recognized as a unique and imperiled national treasure. In the last century, more than half of the Everglades were drained and lost. South Florida's extensive drainage system still sends to sea an average of 1.7 billion gallons of freshwater a day. Some of that "wasted" freshwater could be captured and stored for use when needed.

For years, water flowed slowly through the southern Everglades in a shallow sheet in volumes reflecting seasonal rainfall. Today, the network of canals, gates and levees intercept, speed up and redistribute the flow. As a consequence, parts of the Everglades get too little water while other parts get too much and often at the wrong time of year. Worse, much of the water that stays in

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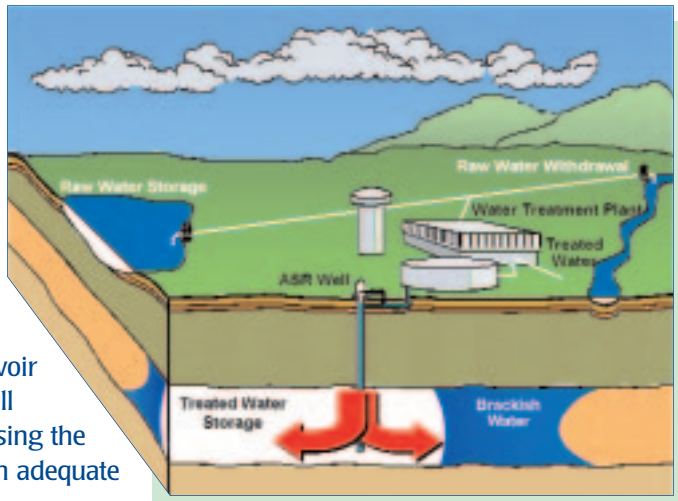
## What is aquifer storage and recovery?

ASR involves pumping freshwater, which has been treated to drinking water standards, approximately 1,000 feet underground where it is stored in a confined aquifer and can be recovered later. The pumped freshwater displaces, or pushes away, the brackish water of the Upper Floridan Aquifer, resulting in an underground reservoir of freshwater. On a relatively small scale, Florida utilities have been using the technology since 1983 to maintain adequate supplies of drinking water. The **Comprehensive Everglades Restoration Plan (CERP)** proposes to use up to 333 ASR wells to store as much as 1.6 billion gallons of freshwater per day to ensure water for the Everglades, improve conditions in **Lake Okeechobee** and prevent damaging releases of freshwater to coastal estuaries. Some water also would be available to support agriculture and to protect urban wells located near the coast from saltwater intrusion.




*Reservoirs and ASR wells will be operated in tandem, capturing water from rainfall, treating it, and then pumping it into adjacent ASR wells before the next rainfall*

There are significant advantages to ASR compared to traditional storage technologies such as reservoirs. Unlike surface reservoirs, little water is lost to evaporation. ASR systems allow for multi-year storage, whereas evaporation during severe droughts limits the ability of reservoirs to provide long-term storage. Usually, wells can be located where most needed and because wells require little land, the costs of large land acquisitions are avoided.

There are some uncertainties as well: How much freshwater can be recovered? How might water quality be changed? And, what impact might large-scale underground storage have on the aquifer itself? Operation and maintenance costs may also prove higher for ASR than for other means of water storage.

Three ASR Pilot Projects and the ASR Regional Study will help determine the feasibility of using ASR on a much larger scale as proposed in CERP. The Pilot Projects and Regional Study are being designed to collect data, review regulatory issues, and conduct scientific studies to address and reduce uncertainties about large-scale use of ASR.

# Description and goals of ASR Pilot Projects

ASR Pilot Projects will be located around **Lake Okeechobee,** adjacent to the **Hillsboro Canal** south of the **Arthur R. Marshall Loxahatchee National Wildlife Refuge,** and near the **Caloosahatchee River.** The number of five-million-gallon-a-day (mgd) ASR wells varies by project, but each site will include pumping and water-treatment facilities, monitoring wells and equipment needed for operational testing.

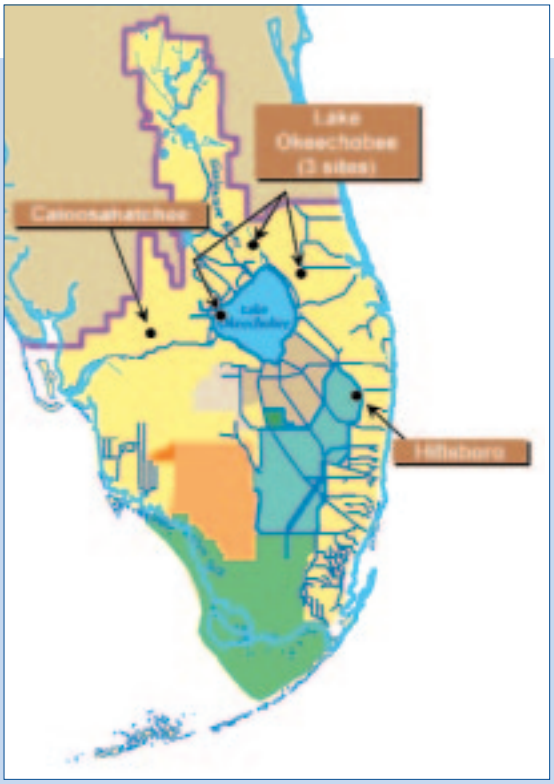
Design studies for the Pilot Projects are currently in progress. When these studies are complete, a **Draft Pilot Project Design Report (PPDR)** and **Draft Environmental Impact Statement (EIS)** will be prepared and distributed for public and agency comment in accordance with **National Environmental Policy Act (NEPA)** guidelines. After the Final PPDR/EIS has been approved, construction plans and specifications will be prepared and the ASR Pilot Project constructed.

Following construction, operational tests will be conducted for two years under the guidance of the Pilot Projects. The Lake Okeechobee and Hillsboro ASR Pilot Projects were authorized in the Water Resources Development Act (WRDA) of 1999; the Caloosahatchee (C-43) River ASR Pilot Project was authorized in the Water Resources Development Act (WRDA) of 2000.

**Lake Okeechobee ASR Pilot Project:** This project will locate ASR wells at three sites around Lake Okeechobee. In this way, a geographic understanding of ASR system performance around Lake Okeechobee can be established. One site is expected to have a cluster of three ASR wells to demonstrate how multiple wells perform; the other sites will have one well each. Operational testing and data collection, which follow construction, are to be completed in the fall of 2009.

**Hillsboro ASR Pilot Project:** This project is located in southern Palm Beach County just south of the Arthur R. Marshall Loxahatchee National Wildlife Refuge and north of the Hillsboro Canal on land owned by the **South Florida Water Management District.** The project consists of a cluster of three ASR wells. Operational testing and data collection, which follow construction, are to be completed in the summer of 2009.

**Caloosahatchee (C-43) River ASR Pilot Project:** This project is located just west of LaBelle, near the Caloosahatchee River on land owned by the **South Florida Water Management District** in Hendry County. One ASR well is planned. Construction and testing are to be completed in the spring of 2010.




| ASR Pilot Projects | Wells |
|---|---|
| Lake Okeechobee | 5 |
| Hillsboro | 3 |
| Caloosahatchee | 1 |
| **Total** | **9** |

***ASR systems allow for multi-year storage, whereas evaporation during severe droughts limits the ability of reservoirs to provide long-term storage. Usually, wells can be located where most needed and because wells require little land, the costs of large land acquisitions are avoided.***

# Aquifer Storage and Recovery (ASR) Regional Study

The scope of the ASR Regional Study was established by a multi-agency team and was based on recommendations of the **South Florida Ecosystem Restoration Working Group** and the **National Academy of Science.** The study goes well beyond what can be learned from the Pilot Projects to address the potential effects of large-scale ASR on water levels, on water quality within the aquifer, on surface waters, such as Lake Okeechobee, and on plants and animals. The study also will develop a regional computer model of the Floridan Aquifer system to be used in evaluating impacts in specific areas.

## Study goals include:

- Characterizing sources, quantity and quality of water to be stored.
- Studying potential geo-chemical reactions that may occur when storing surface water in a brackish aquifer.
- Describing hydro-geologic characteristics of the regional Upper Floridan Aquifer, and assessing potential pressure-induced changes and water-flow patterns due to the proposed CERP ASR system.
- Understanding the relationship between recovery rates, recharge volumes, and length of time water is stored.
- Developing and verifying a conceptual framework for modeling the regional Floridan Aquifer system.
- Assessing ecological impacts of releasing aquifer-stored water on Everglades receiving waters, plant communities, fish and wildlife, including investigating the potential for mercury bioaccumulation.

| CERP ASR Projects | Wells |
|---|---|
| Lake Okeechobee | 200 |
| Caloosahatchee | 44 |
| L-8 Basin | 10 |
| C-51 Basin | 34 |
| Central PBC | 15 |
| Hillsboro | 30 |
| **Total** | **333** |

## Introduction

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the system is suburban and agricultural runoff laden with elevated levels of nutrients that trigger changes in the Everglades food web.

As a result, losses of habitat have put 69 species of Everglades plants, fish, birds and other wildlife on the Fish and Wildlife Service's list of species endangered or threatened with extinction. The number of wading birds counted in Everglades National Park alone may have declined by 90 percent since the 1930s.

Recognizing the scope and severity of the threats, Congress authorized the **U.S. Army Corps of Engineers** to re-study the drainage system to determine how to correct the water quantity, quality, timing and distribution problems. Eight years later, it approved the resulting $7.8 billion, 30-year **Comprehensive Everglades Restoration Plan** in the Water Resources Development Act (WRDA) of 2000. That act also authorized the Corps to work cooperatively with the state of Florida to implement the Plan, which is often referred to as CERP. Two caveats were placed on implementation of the Plan: Existing flood protection in South Florida must be maintained, and water supplies for current users must not be disrupted.

Successful implementation of CERP requires finding ways to store water during South Florida's rainy season to protect the environment during the dry season and droughts. Aquifer storage and recovery, also known as ASR, is a key technology that may be used.

## Costs and Benefits

Costs of the ASR Regional Study and the three ASR Pilot Projects will be shared equally by the federal government and the State of Florida. The local sponsor is the **South Florida Water Management District.**

This Study and the three Pilot Projects are vital to determining the feasibility of ASR for successful ecosystem restoration.

Benefits of environmental restoration cannot be expressed in monetary terms. However, ASR will store large quantities of freshwater, which can be used to meet ecological and other water resource needs during Florida's dry seasons.

## Implementation Process

Project Management Plans (PMPs) have been approved for each of the ASR Pilot Projects. A Project Management Plan for the ASR Regional Study is still being developed. These plans and drafts, monthly progress reports, a calendar of public meetings, and additional documents are available on the Internet at: **www.evergladesplan.org.** Public input is welcome and public workshops are being conducted.

## The project managers are:

US Army Corps of Engineers

sfwmd.gov

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