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SOUTH ATLANTIC DIVISION, CORPS OF ENGINEERS
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ATLANTA, GEORGIA 30303-8801

REPLY TO
ATTENTION OF

RECORD OF DECISION

**CENTRAL AND SOUTHERN FLORIDA PROJECT
LAKE OKEECHOBEE, HILLSBORO, AND CALOOSAHATCHEE (C-43) RIVER
AQUIFER STORAGE AND RECOVERY (ASR) PILOT PROJECTS**

DECISION

We have reviewed the Final Pilot Project Design Report (PPDR) and Environmental Impact Statement (EIS) for the Central and Southern Florida Project, Lake Okeechobee, Hillsboro and Caloosahatchee (C-43) River Aquifer Storage and Recovery (ASR) Pilot Projects, in Palm Beach, Okeechobee, Hendry, Glades and Martin Counties, Florida. We have also reviewed all correspondence, including comments on the Draft and Final PPDR/EIS, and all pertinent documents for this project. Based upon this review and after review of the views of other agencies, Native American Tribes, non-governmental organizations, and the general public, I concur with the District Engineer's recommendations to implement the plan to construct, test, and operate the Lake Okeechobee (2 sites), Hillsboro, and Caloosahatchee (C-43) River ASR Pilot Projects. These small-scale ASR projects will help reduce uncertainties associated with ASR technology and provide detailed technical information necessary to determine the feasibility of the 333 wells proposed in the Comprehensive Everglades Restoration Plan (CERP).

RECOMMENDED PLAN

The Recommended Plan consists of four ASR well systems and associated features, with specific water quality treatment technologies, operational cycle testing plans, and locations of broad geographic range. Working together, each would aid in reducing technical uncertainties of the ASR technology through demonstration of its application in support of Everglades Restoration. Specifically, the ASR pilot projects will further define: cycle testing protocols; relationships between recovery efficiency and ecological effects; treatment technologies' ability to treat water to desirable ecological and regulatory standards prior to storage and discharge to surface waters; differences in aquifer storage capabilities, aquifer water quality, and water movement at spatially different sites in South Florida, and critical pressure to prevent rock fracturing. All of these are essential evaluation features of the Recommended Plan. The specific details of features, design and operations of the project are presented in detail in the Final EIS

Under the Lake Okeechobee ASR Pilot Study a fifth well system had been proposed and evaluated through the draft PPDR and Draft EIS. This fifth well system was known as the Moore Haven site, and the evaluation is presented in the Final EIS. However, it is not included in the Recommended Plan due to financial limitations. In order to meet monetary constraints of the pilot projects, resources were directed to the other pilot project well systems to ensure adequate

testing and monitoring. In addition, the treatment process selected for this system included disinfection with chloramines, of which by-products can be toxic to wildlife and humans. This was an unacceptable risk and was not necessary to achieve the objectives of the pilot project. Further, the additional treatment to remove chloramine by-products would be costly. Thus, it was determined that the remaining pilot project well systems recommended would meet the project intent without the Moore Haven system.

ALTERNATIVES AND CONSIDERATIONS BALANCED IN MAKING THE DECISION

An interagency, multidisciplinary Project Delivery Team (PDT) participated in formulating, evaluating, refining and selecting alternatives, which resulted in the Recommended Plan. In addition to the no-action alternative, five other alternatives with multiple components were carried through the final plan evaluation and selection process. The alternative plans were formulated and evaluated beginning with the development of five multi-purpose alternatives to test ASR technology, efficiency, and feasibility at a pilot facility to provide answers to questions and uncertainty raised on the proposed regional CERP ASR program. The team optimized the alternatives and a Recommended Plan was determined.

During development of the Recommended Plan, the interagency team considered alternatives related to pilot well siting, raw water intake, treatment and disinfection methods, and discharge of recovered water. Sites were chosen based on location, stratigraphy and available raw water characteristics, as well as lack of sensitive species or critical natural resources likely to be affected by pilot project operations. Water treatment options were selected based on lack of toxic by-products generated and on effectiveness in destroying enteric bacteria and pathogens. Intake and discharge structures were adjusted according to each specific site.

A siting analysis was conducted for all well sites based on such factors as availability of water, property constraints, impacts to people, wetlands, threatened and endangered species, cultural resources and aesthetics. Sites selected for recommendation were all similar in that they were restricted to publicly owned properties and had been previously disturbed, thus minimizing impacts by pilot project construction. Next, the PDT evaluated ASR component options, such as intake and discharge features, treatment technologies, and cycle testing plans. The placement of a multi-well system was also evaluated. Each ASR system had several components to evaluate. The main components that were evaluated and screened with considerations of site characteristics for raw water intake, distribution/collection piping, water treatment facilities, recovered water discharge. For each of these groups, various options were examined. The following paragraphs provide a brief description of each group.

Raw Water Intake

For raw water intake, four main options were considered for inclusion as part of the final detailed design. The four options considered were intake channels with trash racks or rotating bar screens, direct intake pipe with appropriate pipe screen, in-bank sump/engineered bank filter, and natural bank filter.

All four of these options have drawbacks. Intake channels require additional real estate to be included in the overall project footprint. Direct intake pipes may pose a hazard to navigation and are subject to encrustation by invertebrates (e.g., mussels). In-bank sumps require installation of sheet pile and import of sand or gravel with the proper gradation. In addition, natural bank filters or in-bank sumps may have limited hydraulic loading capabilities. However, both limit entrainment of aquatic organisms and fish. Each of these options may be suitable depending on the ASR pilot project location.

Water Treatment Facilities

Water treatment systems for potable water are regulated under Chapters 62-555 and 62-560 Florida Administrative Code (FAC). Though these ASR facilities are not potable water systems, they are required to treat water to primary drinking water standards prior to well recharge. Drinking water standards specify primary and secondary standards that relate to threshold limits of approximately 109 chemicals (73 primary and 36 secondary) with which the system must comply.

Site-specific source water characterizations were used to guide the final selection of the treatment system and determine if the water at the site contains any toxic chemicals or other constituents that require special treatment. The existing source waters contain coliform counts well in excess of the EPA standard. Therefore, a primary goal of any treatment system is to remove or inactivate the coliforms prior to ASR recharge activities. Removal may be accomplished through the use of micro- or nano-filtration. Inactivation of coliforms and other pathogens can be accomplished through the use of various types of disinfection processes including ozonation, chlorination, and ultraviolet radiation. However, ultraviolet radiation disinfection was selected for the Pilot Projects because the other treatments generated undesirable by-products.

For the ASR Pilot Projects, compliance with the coliform standard is the primary goal, but it is not the only pathogen indicator to consider. Although more treatment-resistant pathogens such as giardia lamblia or cryptosporidium have not been detected during water quality sampling events, monitoring for these pathogens will occur during the pilot well operations to ensure the selected disinfection processes are effective.

The presence of algae and associated algal toxins in the source waters was considered during the design process. Removal of these toxins will be accomplished using conventional filtration technologies.

Another design issue for any ASR facility would be the ability to meet the iron standard (0.3 mg/l) and remove sufficient suspended solids to prevent nuisance plugging of the aquifer. Other potential problems may arise from the sulfate concentration of the source water. The sulfate molecule is an energy source for sulfate-reducing bacteria present in the aquifer that can cause well plugging. It is anticipated that a regular well back-flushing program will be implemented at all of the ASR Pilot Projects in order to minimize any plugging related problems. It is anticipated that the nutrient concentrations in the recovered ASR water will actually have lower concentrations than those already in the respective surface water bodies due to hydrodynamic

dispersion and mixing that will occur within the Floridan Aquifer System; therefore, water quality problems should be minimized.

Recovered Water Discharge

Water recovered from the ASR wells may be at a different temperature or contain undesirable constituents such as heavy metals or radioactive decay byproducts. Prior to pilot testing, it is not possible to predict the need for or the type of ancillary treatment that recovered water may require prior to discharge. The water treatment facilities would be designed so that the recovered water can be run back through the existing treatment trains or through treatment trains specifically added to remove the problem constituents. If temperature differences are problematic, some attenuation can be achieved by routing the recovered water through the on-site storage ponds prior to discharge. These are important considerations for the effects discharged water could have on fish and wildlife.

Cycle Tests

The cycle testing plan went through several reiterations of screening. Ideally, the plan would mimic operations of the actual ASR system envisioned in the future should ASR be recommended for full-scale implementation. However, cycle testing plans were limited by the duration of the pilot project, a two-year testing program. In addition, the cycle testing plans were designed to test variable storage times and recovery cycles for the efficiency of recovery and stored-water migration, changes in water quality with storage time, and the pressure changes of multiple storage and recovery events. The final cycle testing plan took into consideration the deferment of the Moore Haven site and the information the testing plan would gain at that site. Data collection will be performed during the cycle testing to evaluate the operation and efficiency of the system. Data to be collected during the testing includes discharge and recovery flow rates and volumes, volume of water stored, water quality of the injected and recovered water, bioassays and ecotoxicological analysis of recovered water, and pressures (water levels) during recharge and recovery of the ASR and monitor wells.

Several levels of screening took place to develop the final recommended alternative, taking into consideration the site-specific conditions with the selected intake and treatment facilities proposed. Finally, a monitoring plan was developed to monitor water quality and ecological conditions to determine compliance with regulations, potential effects to the ecosystem, and adaptive management protocols for the ASR pilot projects.

MEANS TO AVOID OR MINIMIZE ADVERSE EFFECTS

All practicable means to avoid or minimize adverse environmental effects have been incorporated into the Recommended Plan. The removal or destruction of ecologically valuable habitat has been minimized by siting all structures on existing levees or levee right-of-ways, spoil disposal sites, or previously altered terrain by agricultural uses.

Prior to construction, detailed surveys will be conducted to determine the presence of listed species, specifically bald eagle, caracara, burrowing owl, gopher tortoise, mastiff bat, terns,

skimmers and limpkins, where appropriate. Gopher tortoises may need to be relocated. If listed species are found, the Corps and the U.S. Fish and Wildlife Service will determine if additional consultation under the Endangered Species Act is necessary. During the construction phase for all components of the project, standard construction precautions or management plans will be implemented for the bald eagle, eastern indigo snake, kestrel, and West Indian manatee to avoid any adverse effects on those listed species. Construction personnel will also be made aware of the possible presence of the Okeechobee gourd, an endangered plant species. Wading bird rookeries will be protected by maintaining a construction set back distance or consulting with the Florida Fish and Wildlife Conservation Commission (FFWCC). The Corps has committed to providing manatee barriers where appropriate to ensure that ASR project facilities will pose no additional threat of structure-caused mortality or injury, entrapment in culverts or canals, or any other form of take as defined in the Endangered Species Act.

Structural considerations and operational conditions have been added to the designs of the ASR facilities and management during cycle testing. The intake structures will have screens and intake velocities will be minimized to reduce/eliminate impingement/entrainment of fish and fish larvae; In addition, a metered shunt pipe for sampling of entrained aquatic life will be installed at all the pilot sites for sampling, as this is a condition to cease operations and modify the plan or design. Water quality prior to discharge will meet applicable water standards, be aerated to increase dissolved oxygen, and monitored for pH, temperature, DO and salinity. There are operational stop conditions if any of these parameters start to demonstrate a negative impact to fish and wildlife in the receiving waters. Conditions that would require the immediate cessation of recovered water discharge include: detection of dead or stressed fish in the vicinity of the outfall, large entrainment events, or temperature, dissolved oxygen, salinity or pH extremes that result in ecological harm

All land has previously been acquired for the project. A cultural resources analysis has been conducted and concluded that due to past uses of each site, cultural resources are highly unlikely to be discovered at any of the sites. The State Historic Preservation Officer has concurred with our determination of no effect to cultural or historic resources in accordance with Section 106 of the National Historic Preservation Act (36CFR800).

PUBLIC /AGENCY COMMENTS IN THE FINAL PPDR/EIS

Public comments include many concerns about the safety, efficacy and sustainability of ASR technology to provide the required storage. Some comments relate to substituting aboveground storage (which would require large areas for multiple reservoirs) and abandoning ASR technology. Many of these concerns are more focused on the proposal, contained in the 1999 Central and Southern Florida Restudy, of locating banks of ASR wells, rather than the potential impact of the currently proposed pilot tests. There is a general concern about the potential adverse short- and long-term effects of what is publicly a little understood technology. Many public comments criticized the Final PPDR and EIS because they did not consider the costs, alternatives to, and cumulative impacts of a full-scale, 333 well CERP ASR program. The data and results from the pilot project are expected to address the technical and ecological uncertainties and criticisms associated with the ASR technology. The pilot projects will provide information needed for the formulation and evaluation of a full-scale program, and the results

from the pilot projects will be fully disclosed to the scientific community and public. Until the data is obtained from the pilot studies, a scientifically based evaluation of the proposed CERP ASR Program is constrained. Future recommendations for additional wells, alternatives, and their impacts would be considered under separate decision documents and fully coordinated in accordance with the provisions of the National Environmental Policy Act.

COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

The Recommended Plan is in compliance with all applicable environmental laws and requirements including but not limited to the National Environmental Policy Act, the Endangered Species Act (ESA), the Fish and Wildlife Coordination Act, the National Historic Preservation Act, the Clean Water Act, the Clean Air Act, the Coastal Zone Management Act, and Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Population and Low Income Populations." Recommendations in the Fish and Wildlife Coordination Act Report (FWCAR) have been incorporated into the Recommended Plan. Both the draft and final documents were distributed for public comment; public comment was incorporated and considered. The draft EIS, serving as the endangered and threatened species Biological Assessment, determined that the project would not likely adversely affect any listed species. The US Fish and Wildlife Service (FWS) concurred with the no-effect determination. Construction of the structural features and their operations will incorporate FWS recommendations made to ensure that threatened or endangered species are not adversely impacted and disturbance to residents is minimized.

CONCLUSION

In view of the above, I find that any adverse affects of the recommended action, described in the Final Pilot Project Design Report and Final Environmental Impact Statement, with addition of the extensive monitoring throughout the operations of the pilot facilities and the specific ecological design criteria and operational criteria incorporated, have been avoided and/or minimized to the extent practicable, and am confident that the Recommended Plan best meets the overall Federal and State objectives. The recommended action is consistent with all applicable laws, regulations, national policy, and administrative directives. The total public interest will be best served by implementing, as expeditiously as possible, the Recommended Plan as described in the Final PPDR and EIS.

21 Oct 2005
Date

Benjamin H. Butler
BENJAMIN H. BUTLER
Acting Commander, South Atlantic Division