SPECIAL PUBLICATION SJ2012-SP6

EXPANDED EXECUTIVE SUMMARY
CITY OF SANFORD
AUXILIARY (NO. 2) WATER TREATMENT PLANT
AQUIFER STORAGE AND RECOVERY SYSTEM

Expanded Executive Summary
City of Sanford
Auxiliary (No. 2) Water Treatment Plant
Aquifer Storage and Recovery System

Prepared for:

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September 2011

Contents

Appendices

Items on DVD:

DVD 1

Reports

Desktop Assessment of Aquifer Storage and Recovery for City of Sanford, Florida. Report dated October 2003.

Exploratory Well Project Report for City of Sanford, Florida. Report dated December 2005.

Bench Scale Geochemical Assessment of Water-Rock Interactions: City of Sanford Aquifer Storage and Recovery Facility. Report submitted by Florida Geologic Survey, dated August 2007.

Cycle Testing and Monitoring Program, City of Sanford Auxiliary WTP ASR Project. Report dated February 2009.

Aquifer Storage and Recovery System Operation and Maintenance Manual for City of Sanford, Florida. Report dated February 2009.

Aquifer Storage and Recovery System Project Completion Report for the City of Sanford, Florida. Report dated September 2008.

City of Sanford ASR Construction and Testing at Auxiliary WTP Site Cycle Testing Evaluation. Memo dated November 2009.

Aquifer Storage and Recovery Pretreatment System Project Report for the City of Sanford, Florida. Report Dated October 2010.

City of Sanford ASR Construction and Testing at Auxiliary WTP Site Cycle Test 1 through 3 Evaluation. Memo dated September 2010.

City of Sanford ASR Construction and Testing at Auxiliary WTP Site Cycle Test 1 through 4 Evaluation. Memo dated September 2011.

Aquifer Storage and Recovery Pretreatment System Operations and Maintenance Manual for City of Sanford, Florida. Report Dated December 2010.

Expanded Executive Summary City of Sanford Auxiliary No. 2 Water Treatment Plant Aquifer Storage and Recovery System. Report Dated September 2011.

Plans and Specs

City of Sanford ASR Specifications. Dated June 2006.

City of Sanford ASR Plans. Dated June 2006.

City of Sanford ASR Dechlorination/Degasification System Specifications. Dated April 2009.

City of Sanford ASR Dechlorination/Degasification System Plans. Dated April 2009.

DVD 1 (cont.)

Permits

Permit Applications

Application to Construct a Class V Injection Well System, City of Sanford ASR Project. Dated December 2005.

Response to Request for Additional Information No. 1: Application to Construct a Class V Injection Well System, City of Sanford ASR Project. Dated March 2006.

Response to Request for Additional Information No. 2: Application to Construct a Class V Injection Well System, City of Sanford ASR Project. Dated April 2006.

Application for a Specific Permit to Construct PWS Components, Sanford Auxiliary WTP ASR Project. Dated June 2006.

Consumptive Use Permit Application for City of Sanford ASR Project. Dated May 2011

Issued Permits

Building Permit Number 07864

SJRWMD Consumptive Use Permit 162

Generic Permit for Discharge of Uncontaminated Groundwater to Surface Waters

FDEP PWS Permits: 59-0080856-257, 59-0080856-299, and PWS permit clearances.

FDEP UIC Permit 59-0259876-001-UC, Minor Permit Modifications 1 and 2, Major Permit Modification 3, Administrative Order AO-08-0015

Well Construction Permits 108689-1, 108688-1, and 108686-1

DVD 2

Exploratory Well (SZMW-1) Video Log from Exploratory Well Project Report for City of Sanford, Florida. Dated December 2005.

DVD 3

ASR-1 Video Log from Aquifer Storage and Recovery System Project Completion Report for City of Sanford, Florida. Report dated February 2009.

DVD 4

SZMW-2 Video Log from Aquifer Storage and Recovery System Project Completion Report for City of Sanford, Florida. Report dated February 2009.

DVD 5

CZMW-1 Video Log from Aquifer Storage and Recovery System Project Completion Report for City of Sanford, Florida. Report dated February 2009.

List of Figures

List of Tables

Section 1
Introduction

1.1 Purpose of Expanded Executive Summary

This Expanded Executive Summary summarizes the work accomplished by CDM for the City of Sanford Aquifer Storage and Recovery (ASR) Project at the City of Sanford Auxiliary (Aux) (No. 2) Water Treatment Plant (WTP). The ASR system consists of an ASR well, two storage zone monitoring wells, and one confining zone monitoring well, as well as a pretreatment system. Digital copies of previous reports, memorandums, permits, and other associated documents are also included on a DVD in **Appendix F**.

1.2 Overview of St. Johns River Water Management District ASR Program

The St. Johns River Water Management District (SJRWMD) is investigating several alternative water supply strategies to be used in conjunction with fresh groundwater to meet future potable water demands. ASR has been identified as being an important component in the development of alternative water supplies, as it can potentially provide very large volumes of seasonal water storage, such as excess wet-season surface water flows. The SJRWMD sponsored an ASR feasibility and testing program for higher demand areas within the priority water resource caution areas of the District to evaluate if ASR can be successfully used as a tool for helping to meet future potable water demands. Five cities and counties partnered with SJRWMD as cooperators in the program. The cooperator ASR sites are shown on **Figure 1-1**.

1.3 Project Timeline and Overall Cost

The SJRWMD identified the need for alternative water supplies to meet projected future demands in its 2000 District Water Supply Plan (DWSP) and in 2002 the SJRWMD prepared the ASR Construction and Testing Program Plan. The following project milestones with dates are detailed below:

- In October 2003, CDM completed the Desktop Assessment of ASR for the City of Sanford, Florida.
- In October 2004, CDM completed drilling and construction of an exploratory well at the Sanford Aux No. 2 WTP site.
- In December 2005, upon completion of the exploratory well testing and evaluation program, CDM submitted the final Exploratory Well Project Report for the City of Sanford, Florida detailing the well construction, testing and evaluation program, the results of the evaluation, and recommendations for moving forward.
- The final ASR system design was completed in June 2006.

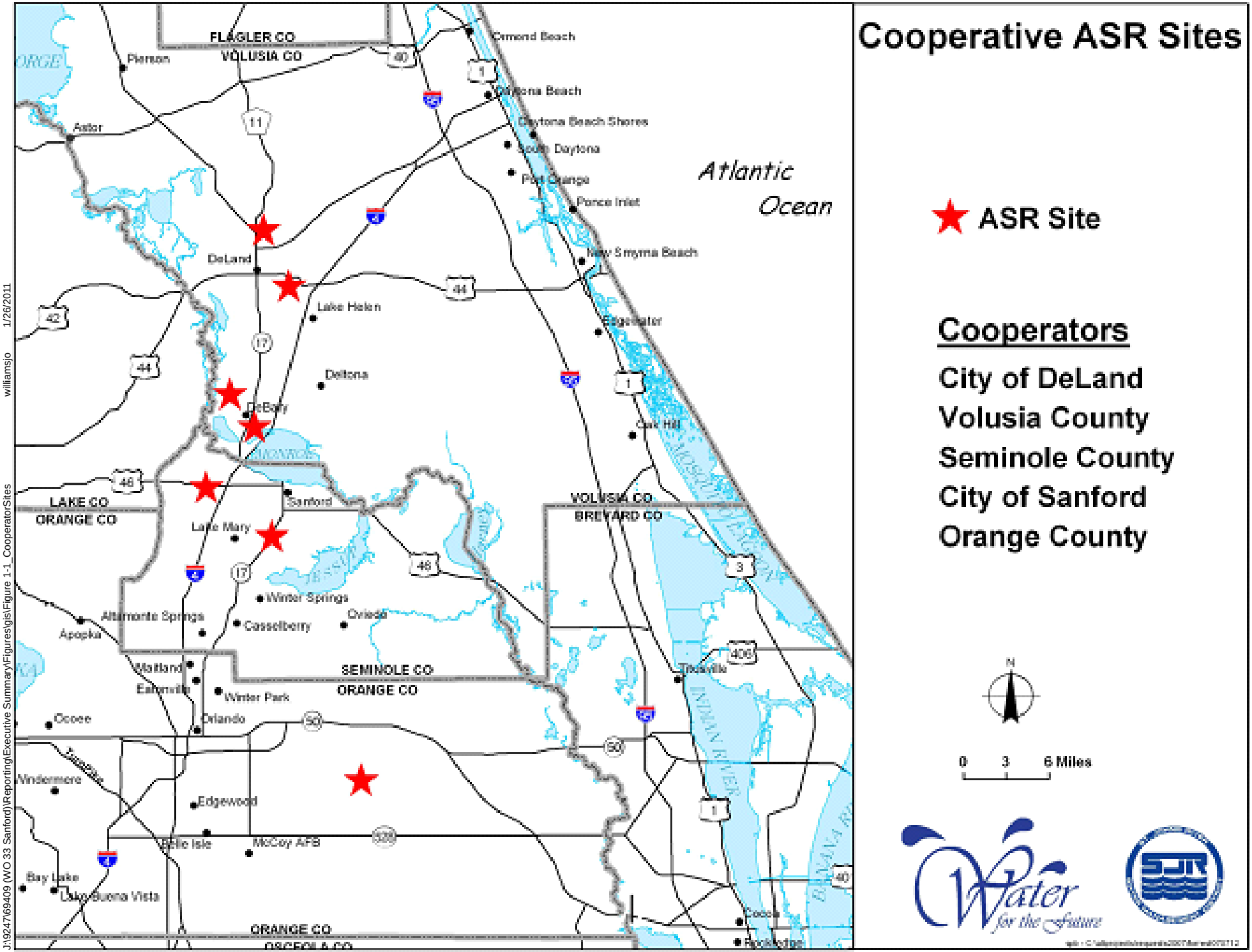


Figure 1-1
Cooperator ASR Sites

- Construction of the ASR system was completed in September 2008.
- In February 2009, upon completion of construction of the ASR system, including the ASR well, storage zone monitoring wells, confining zone monitoring well, and associated piping, CDM submitted the ASR Project Completion Report for the City of Sanford, Florida detailing the construction, testing and evaluations, startup activities, and results.
- The final ASR pretreatment system design was completed in April 2009.
- Construction of the pretreatment system was completed in November 2009.
- In October 2010, upon completion of the pretreatment system, CDM submitted the final ASR Pretreatment System Project Report for the City of Sanford, Florida detailing the construction, testing, and startup activities for the system.

The total capital cost of the project including, the desktop assessment, exploratory well construction and testing, design and construction of the ASR system and pretreatment system, permitting, cycle testing, analyses, and reporting was approximately $4 million, detailed in **Table 1-1.**

Table 1-1
City of Sanford Aux WTP ASR Project Cost Summary

W.O. NUMBER	DESCRIPTION	PROJECT COST
SF409F3	Desktop Assessment for City of Sanford	$ 75,390
SF409F9	Exploratory Well for City of Sanford	$391,185
SF409F12	Leaching Analysis for Sanford Well	$ 28,200
SF409F14	Preliminary ASR System Design and Initial Permitting	$108,991
SF409F17	Final ASR System Design and Permitting	$ 81,971
SF409F22	Sanford ASR Test Well Construction & Testing	$1,186,439
SF409F23	Sanford ASR Test Well Construction & Testing	$ 747,890
SF409F25	Sanford ASR Expandability Plan	$8,479
SF409F31	Sanford ASR Test Well Construction & Testing	$ 149,232
SF409F33	Sanford ASR Pre-Treatment System Construction	$ 951,802
SF409F36	Sanford ASR Pre-Treatment System Construction	$222,458
SF409F39	Sanford ASR Cycle Testing Assistance	$73,094
Total:		**$ 4,025,130**

1.4 Section Summaries

The following details the sections included in this report:

- **Program Plan:** Includes a summary of the ASR Construction and Testing Program Plan prepared by the SJRWMD in 2002.

- **Desktop Assessment of ASR:** Details the initial ASR feasibility study for the City of Sanford.
- **Cooperator Agreement:** Summary of the Memorandum of Understanding (MOU) between SJRWMD and the City of Sanford.
- **Preliminary Basis of Design:** Details the design, testing, and construction of the exploratory well, and presents the preliminary basis of design for the ASR system.
- **Project Design:** Details the design of the ASR system and the pretreatment system.
- **Regulatory Permitting:** Summarizes the permits obtained for the construction and testing activities at the site.
- **ASR Facilities Construction, Start-up, Monitoring, and Training:** Summarizes the construction, testing, and startup activities of the ASR system and pretreatment system.
- **Cycle Testing Operational Monitoring and Evaluations (Ongoing):** Details the cycle testing program and current status of the system.
- **Preliminary Feasibility Determination and Conclusion:** Details ASR feasibility, next steps and future considerations.

Section 2
Program Plan

2.1 Program Plan

In 2002 the SJRWMD prepared an ASR Construction and Testing Program Plan to be used as guide by all cooperators. A copy of the Program Plan is included in **Appendix A.** The goal of the ASR Construction and Testing Program is to examine the appropriateness of integrating ASR technology into regional water resource and water supply development projects. To achieve the goal the SJRWMD identified several objectives that would need to be met:

- Determining the extent to which ASR could be applied to meet local or regional water supply needs through use of alternative water supplies (i.e., surface waters, reclaimed waters) in addition to limited groundwater supplies.
- Establishing the fundamental criteria for successful application of ASR in the SJRWMD.
- Providing test sites for a variety of applications in order to identify and address the different issues (e.g., permitting/regulatory, technical, logistics, political) unique to each application.
- Identifying and securing Cooperators, through executed agreements, to participate in ASR construction and testing which would result in development of a functional ASR facility to be used by the Cooperator at the conclusion of the testing period.
- Demonstrating the extent to which ASR can be safely and successfully used within the SJRWMD.

The Program Plan established a framework for selecting ASR construction and testing projects. Facility planning factors included: demand, supply, storage requirement, and proposed use. Hydrogeologic factors included: storage zone confinement, transmissivity, aquifer gradient and direction, recharge and native water quality, and interfering uses and impacts.

The Program Plan included the proposed budget and funding for ASR construction and testing for the fiscal years 2002-2006. The plan identified funding with SJRWMD ad valorem and Florida Forever funds, as well as Cooperator funding in the form of in-kind services and/or cash contributions. Total program costs were budgeted for $19.72 million, and are shown in **Table 2-1**.

Table 2-1
SJRWMD ASR Construction and Testing Program Proposed Funding for Fiscal Years 2001 to 2006
($ million)

Sources	Fiscal Year						Total
	2001	2002	2003	2004	2005	2006	
SJRWMD ad valorem	0.000	0.350	0.000	0.000	0.000	0.000	0.350
Florida Forever	2.375	1.596	2.500	2.500	2.500	0.000	11.471
Cooperators	1.834	1.064	1.667	1.667	1.667	0.000	7.899
Total	4.209	3.009	4.167	4.167	4.167	0.000	19.719
Disbursements	0.000	6.219	4.167	4.167	4.167	1.000	19.719

The Program Plan identified the responsibilities of the SJRWMD to be:

- Selecting projects to be included in the ASR Construction and Testing Program;
- Providing partial funding for each project; and
- Take the lead in negotiating complex regulatory issues that may arise pertaining to ASR implementation at each site.

The Cooperator responsibilities were also identified and included:

- Providing an ASR facility site;
- Providing logistical, including but not limited to, facility access, a suitable source of water for testing and operations, power supply, and disposal of recovered water during initial testing and operational startup;
- Support which may include direct financial contribution or in-kind services, such as assistance during sampling, monitoring, and other testing and operational activities;
- Assistance in resolving any regulatory issues that may arise, including preparation for participation in agency meetings; and
- Upon completion the Cooperator will also be responsible for continued operation of the ASR facilities, assuming that their operational success has been demonstrated during the test program.

The SJRWMD prepared a detailed list of standard tasks for the ASR projects. The list would be adapted to the individual needs and opportunities at each site. The tasks include:

- **Task 1-** ASR Construction Testing and Program Plan
- **Task 2-** Project Evaluation and Site Selection
- **Task 3**- Cooperator Agreement
- **Task 4**- Site Specific Data Collection and Preliminary System Design
- **Task 5**- ASR Pilot Project Design
- **Task 6**- Regulatory Permitting
- **Task 7**- ASR Facilities Construction, Monitoring, and Testing
- **Task 8**- Startup and Training
- **Task 9**- Large Cycle Operational Monitoring Evaluations
- **Task 10**- Peer Review of ASR Consultant Team Work

Section 3
Desktop Assessment of ASR

3.1 Project Objectives

The primary objective of the ASR program is to evaluate the feasibility of ASR to provide the seasonal storage capacity needed to use the St. Johns River system as a potable water source. To accomplish this objective, the recommended ASR strategy for the City of Sanford was to select a site at which an exploratory well would be drilled. Based on the results of hydrogeologic testing of the exploratory well, the feasibility of successfully implementing ASR would be determined. The pilot system testing would provide data necessary for the evaluation of the effectiveness of well design and storage capacity of the ASR well within the selected storage zone.

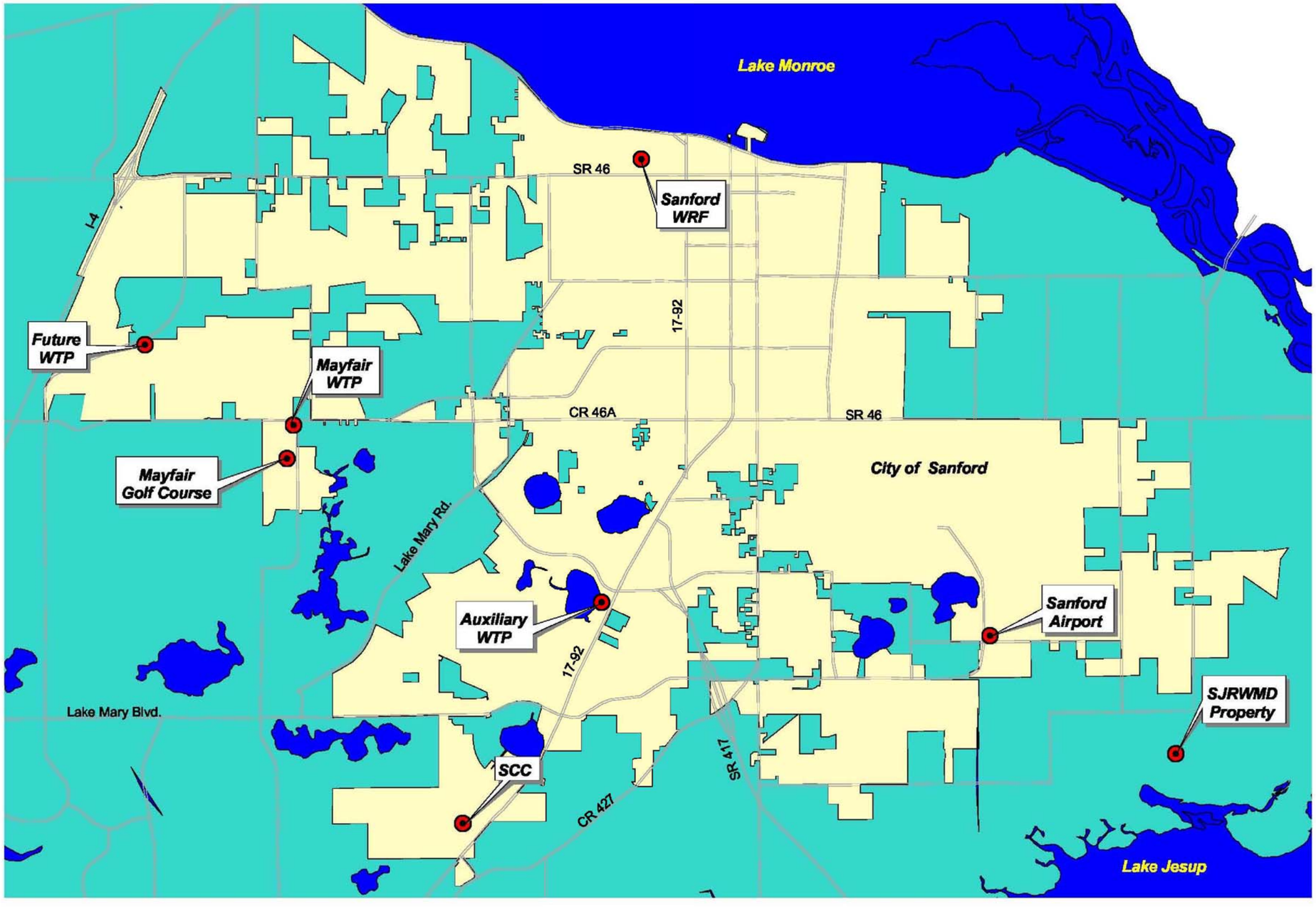
CDM performed a desktop evaluation on the feasibility of ASR throughout Sanford. The Desktop Assessment Report was submitted as final in October 2003 and is included on the DVD in Appendix F. The following is a summary of the results presented in that report.

The project consisted of an engineering and hydrogeological evaluation of candidate sites for an ASR well for the City of Sanford, shown on **Figure 3-1**. Eight locations were initially evaluated as potential sites for an ASR system:

1. Future WTP;
2. Mayfair Golf course;
3. Mayfair WTP;
4. Aux (No. 2) WTP;
5. Sanford North Water Reclamation Facility (WRF);
6. Sanford Airport;
7. SJRWMD Property (near Lake Jesup); and
8. Seminole Community College (SCC).

3.2 Site Selection

Of the eight sites originally identified by the City of Sanford, six were determined to have a high potential for the successful implementation of ASR. Of these six sites, three would have a storage zone in the lower Floridan aquifer (Future WTP, Mayfair WTP, and Mayfair GC) and three of the sites would have a storage zone in the upper Floridan aquifer (Airport, Aux (No. 2) WTP, and WRF). The storage zone of the Aux (No. 2) WTP was estimated to be in the lower part of the upper Floridan aquifer, at a



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LEGEND

- Potential ASR Well Site
- Sanford City Limit
- Water Body
- Major Roads

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Figure 3-1
Potential ASR Sites

CDM

slightly greater depth (440 feet below land surface (ft bls)) than the WRF or Airport sites (260 ft bls).

All three of the lower Floridan aquifer ASR sites are located within three miles of the proposed location of the Seminole County pilot ASR system (near the Markham Regional WTP), which would also use the lower Floridan aquifer as the ASR storage zone. Implementing two essentially identical ASR test programs so close together was inconsistent with the SJRWMD's program objective of evaluating ASR in a diversity of locations and hydrogeologic settings. Therefore, the Future WTP, Mayfair WTP, and Mayfair GC sites were eliminated from further consideration in the assessment.

Site selection then focused on the three sites that were considered to be the best candidates for ASR program implementation: Sanford Airport, Aux (No. 2) WTP, and the Sanford North WRF. There was relatively high confidence that ASR would be feasible at these sites, based on available hydrogeologic data. Moreover, all three sites would be advantageous in that the desirable potable water ASR storage zone is relatively shallow (≤ 450 ft bls), which would result in reduced well construction costs as compared to sites whose storage zone are in the lower Floridan aquifer. To assist with the evaluation, the site selection process utilized a ranking matrix, which is presented below.

3.2.1 Site Selection Summary

The advantages and disadvantages the three sites mentioned above were evaluated further with the development of a site selection matrix, **Table 3-1**. Eighteen criteria, grouped into five feasibility considerations, were identified and used to rank the sites. A more detailed description or explanation of the criteria follows:

1. *Existing hydrogeological data available near site*– allowed the sites to be ranked based on the availability of site-specific hydrogeological data. All three sites had similar data available.
2. *Potential for offsetting existing drawdown problems*– allowed the sites to be ranked based on how ASR would impact existing drawdown problems. The Aux (No. 2) WTP was ranked the lowest for this criterion because implementing ASR at this site will exacerbate existing drawdown problems.
3. *Storage zone confinement*– allowed the sites to be ranked based on how effective the storage zone confinement is expected to be. The Aux (No. 2) WTP site was ranked the lowest for this criterion because the storage zone at this site is more fractured as compared to the other two sites.
4. *Storage zone transmissivity*- allowed the sites to be ranked based on the expected transmissivity of the aquifer at each site. According to available data, all sites were judged equally transmissive.
5. *Storage zone water quality*- allowed the sites to be ranked based on native water quality and the expected geochemical impacts of ASR implementation. According to available data, the native water quality at all sites was judged equally.

Table 3-1
Site Selection Matrix for ASR Systems Proposed for Potable Water Recovery

ASR Feasibility Considerations	*No.*	*Criteria*	*Site Criteria Ranking* [1]			*Weighting Factor* [2]	*Site Score* [1]		
			Potable				*Potable*		
			Airport	*Aux No. 2 WTP*	*WRF* [4]		*Airport*	*Aux No. 2 WTP*	*WRF*
Hydrogeologic	1	Existing hydrogeologic data available near site	2	2	2	1	2	2	2
	2	Potential for offsetting existing drawdown problems	2.5	1	2.5	3	7.5	3	7.5
	3	Storage zone confinement	2.5	1	2.5	5	12.5	5	12.5
	4	Storage zone transmissivity	2	2	2	3	6	6	6
	5	Storage zone water quality (native)	2	2	2	3	6	6	6
	6	Storage zone well depth	2.5	1	2.5	3	7.5	3	7.5
Site Features	7	Land Availability & Environmental Constraints	2	3	1	5	10	15	5
	8	Potential for ASR wellfield expandability	3	2	1	5	15	10	5
	9	Proximity to area of high current water system demands	1	3	2	5	5	15	10
	10	Proximity to area of high projected growth & water system demands [3]	3	1.5	1.5	3	9	4.5	4.5
	11	Proximity to water main	1	2	3	5	5	10	15
	12	Suitability for potable water storage	2.5	2.5	1	5	12.5	12.5	5
Water Resources Management	13	Suitability for meeting cooperator's long-term goals	1.5	3	1.5	10	15	30	15
	14	Proximity to surface water sources	1.5	1.5	3	3	4.5	4.5	9
	15	Proximity to proposed surface water treatment plant	1	2	3	3	3	6	9
Cost	16	New disinfection facilities required with ASR system installation	1.5	3	1.5	3	4.5	9	4.5
	17	Pressure requirements for ASR injection pump	2.5	2.5	1	3	7.5	7.5	3
Testing	18	Ease of test water disposal	1.5	1.5	3	1	1.5	1.5	3
		TOTALS					***134.0***	***150.5***	***129.5***

[1] The highest score indicates the best alternative.

[2] Estimated absolute importance to success of ASR program implementation: 1 = minor importance, 3 = moderate importance, 5 = important, 10 = very important.

[3] Determined from traffic analysis zone projections (Water Facilities Plan; CPH, 1998a)

[4] If the WRF was considered for non-potable water recovery, criterion number 13 would receive a site criteria ranking of 3. Additionally, criterion number 12 would receive a site criteria of zero and the suitability for non-potable

6. *Storage zone well depth*- allowed the sites to be ranked based on expected depth to the ASR storage zone. According to available data, the depth to the storage zone at the Aux (No. 2) WTP site is expected to be somewhat deeper as compared to the other two sites; therefore, this site was given a lower score.
7. *Land availability and environmental constraints*- allowed the sites to be ranked based on the feasibility of land acquisition for the ASR well(s), and known or possible environmental hazards. According to conversations with City staff - and the City's engineering consultant, the Airport and WRF sites were ranked lower than the Aux (No. 2) WTP. The Airport site was ranked second because of easements that must be obtained from the Airport Authority for the ASR well and its past use as a military air base; the WRF site was ranked third because of its historical use as a landfill and the existing combined sewer overflow storage ponds.
8. *Potential for ASR wellfield expandability*– allowed the sites to be ranked based on land adjacent to initial ASR well that could be incorporated into an ASR wellfield. The Airport site ranked first for this criterion, the WRF site was ranked last since there are many sanitary hazards at this site that limit expandability of a potable ASR wellfield.
9. *Proximity to area of high current water system demands*– the Aux (No. 2) WTP was ranked first for this criterion since the City's greatest demands are currently in the central portion of its service area. The Airport site is furthest away from current water system demands and was, therefore, ranked last.
10. *Proximity to area of high projected growth and water system demands*– allowed the sites to be ranked based on projected relative growth within the eastern, central, and western portions of the City's service area. According to TAZ projections from Seminole County socioeconomic data (1997), the Airport site was ranked first for this criterion since the greatest growth is expected to occur in the east. The other two sites, both being located in the central portion of the service area, were tied for second.
11. *Proximity to water main*– allowed the sites to be ranked based on estimated distance from the ASR wellhead to a sufficiently sized potable water main where a wet tap could be made. According to conceptual site plans the Airport site was judged closest, and the WRF site was judged to be furthest from a suitably sized potable water main.
12. *Suitability for potable water storage*– allowed the sites to be ranked based on the stated use of the ASR pilot well, i.e., for eventual potable water withdrawal. The Airport and Aux (No. 2) WTP sites were judged equal in this respect, while the WRF site was ranked last because of the sanitary hazards on this site.
13. *Suitability for meeting cooperator's long-term goals*– allowed the sites to be ranked based on the ability of a site to meet the cooperator's needs for water resources management. Based on conversations with the City, the Aux (No. 2) WTP best meets the City's water resources management needs.
14. *Proximity to surface water sources*– The WRF was ranked first since it is located along the shore of Lake Monroe.

15. *Proximity to proposed surface water treatment plant*– The WRF was ranked first since it is the nearest site to the Yankee Lake property, a potential site for a regional surface water treatment facility sponsored by the SJRMWD.
16. *New disinfection facilities required with ASR system installation*– The Aux (No. 2) WTP ranked first for this criterion since existing chlorination facilities could be used to chlorinate recovered water prior to injection into a water main. Chlorination facilities would have to be installed at both the Airport and WRF sites.
17. *Pressure requirements for ASR injection pump*– allowed the sites to be ranked based on the estimated potentiometric surface of the Floridan aquifer at the injection site. Based on available water quality data provided by the SJRWMD for the nearby Central Florida Zoo monitoring wells, the WRF site has the highest potentiometric surface; therefore, it was ranked last. The other two sites were expected to have similar aquifer pressures.
18. *Ease of test water disposal*- allowed the sites to be ranked based on exiting site features that would facilitate disposal of water generated by cycle testing of the ASR well. The WRF site was ranked first for this criterion since water withdrawn during cycle testing could be placed into the combined sewer overflow ponds on site. The two other sites were judged equally second.

As shown in Table 3-1, the overall rankings of the three sites for potable water ASR were as follows: (1) Aux (No. 2) WTP, (2) Airport, and (3) WRF. Therefore, the Aux No. 2 WTP site was selected for the next phase of the ASR Program: exploratory well installation.

3.3 Water Supply Availability

At the time of the Desktop Assessment, the City's potable water production and treatment facilities included four wellfields and two WTPs. The City's two WTPs (Main and Aux No. 2) had a combined estimated treatment capacity of 16.4 million gallons per day (MGD). Additionally, the City's combined groundwater pumping capacity was estimated to be approximately 17.6 MGD.

The water supply availability was evaluated by estimating the quantity of water that may be available for the ASR well cycle testing on a month-to-month basis. This was computed by taking the difference between the City's Consumptive Use Permit (CUP) allocation, 8.16 MGD at the time of the study, and actual water use for each month. The calculation was performed using 2002 data. The results showed approximately 2.88 MGD may be available for ASR well cycle testing on an annual basis.

3.4 Preliminary Layouts

3.4.1 Design Overview

Based on the Desktop Assessment, the pilot ASR system was recommended to be designed for a capacity of one (1) MGD. The recommended ASR system components were identified:

- An exploratory well, which would later be used as a storage zone monitoring well,
- A confining zone monitoring well,
- A Storage (recharge) and Recovery well,
- A wellhead and associated above-ground appurtenances, and
- Ancillary facilities such as fencing, pump house, booster pumps, and chlorination system with detention tank.

3.4.2 Exploratory Well Construction

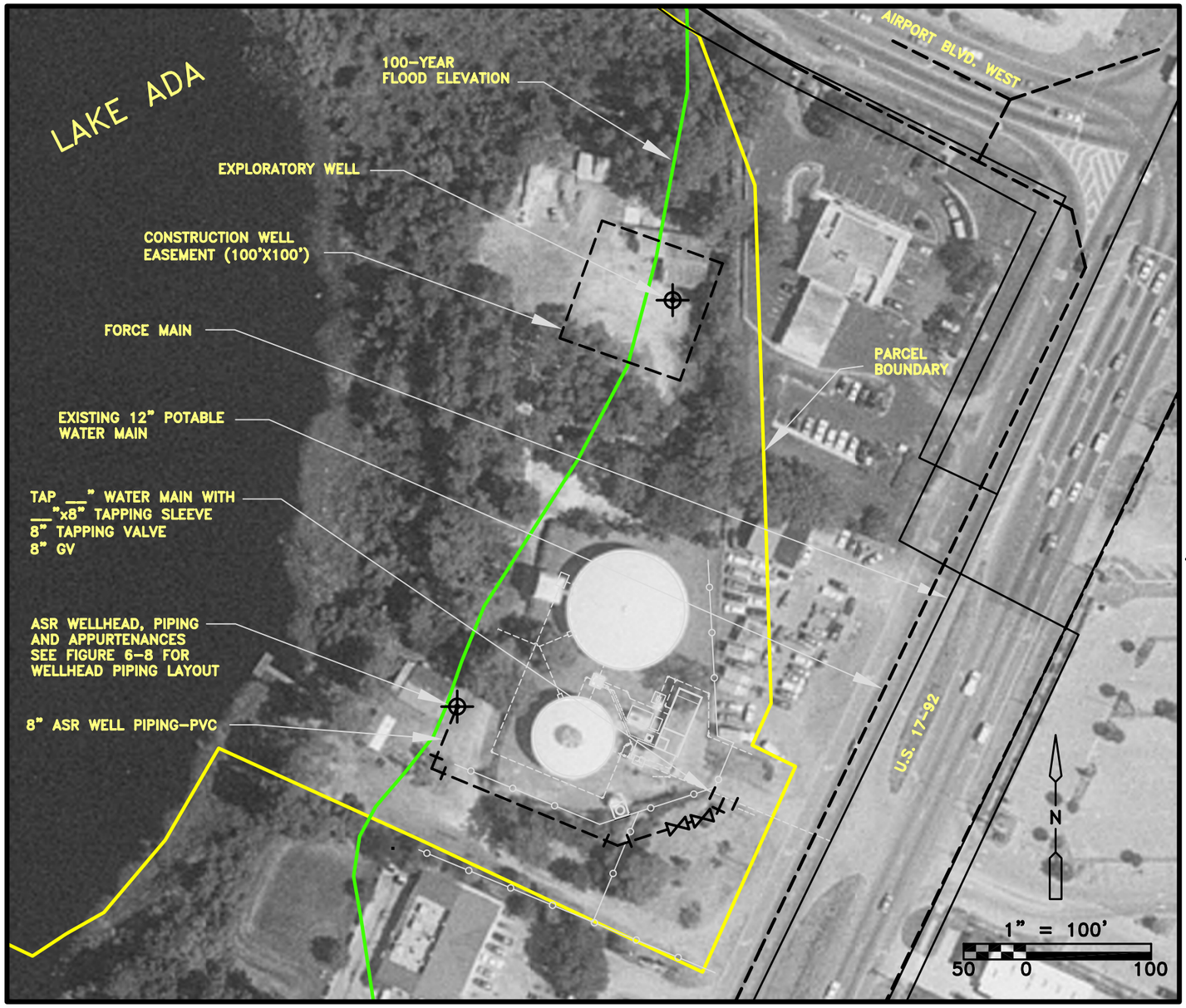
The purpose of the exploratory well was to allow for the collection of site-specific data on aquifer hydraulics and localized groundwater quality, and to be used as a storage zone monitoring well during cycle testing of the system. The exploratory well was planned for installation approximately 400 feet (ft) from the proposed ASR well location, as shown on **Figure 3-2**. A preliminary exploratory well construction diagram prepared for the Desktop Assessment is shown on **Figure 3-3**. Regional data for the Aux (No. 2) WTP site suggested that the depth to the 250 mg/L isochlor is likely located between 300 and 400 ft bls at the site. Therefore, it was anticipated that the 6-inch inner casing would be set below 300 ft bls, with the exact depth depending on data collected during pilot drilling and testing.

3.4.3 ASR Well Construction

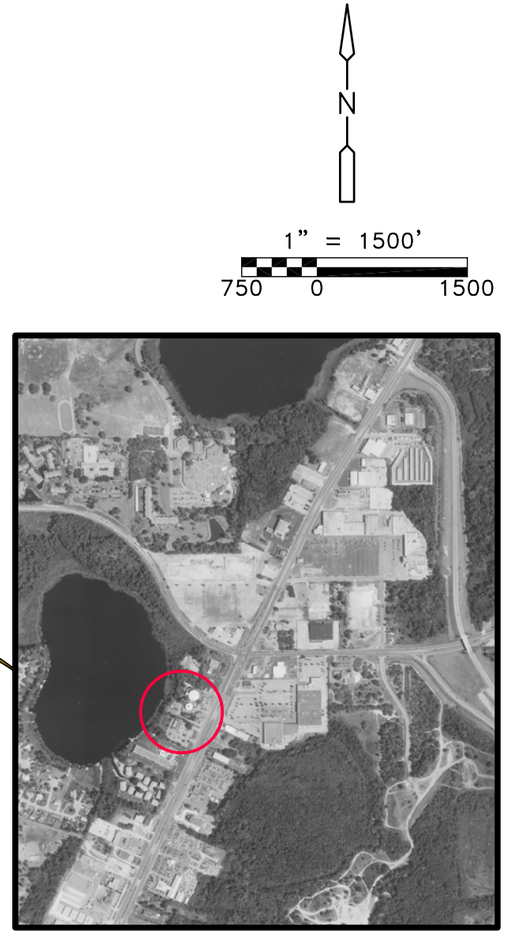
Casing depths of the surface and injection casings for the ASR well would be determined from hydrogeologic data collected during the drilling of the exploratory well and adjusted, if necessary, for borehole-specific conditions. The injection casing would be set just above the top of the ASR storage zone. The preliminary ASR well construction diagram for the Aux (No. 2) WTP site is provided on **Figure 3-4**.

3.4.4 Confining Zone ASR Well Construction

The confining-zone monitor well was planned for installation in a water-producing interval above the storage zone located approximately 100 ft from the ASR well. This monitor well serves to detect upward migration of injected fluids and associated pressure changes. Except for depth, the confining-zone monitor well would be constructed similarly to the storage-zone monitor well.



SITE MAP



LOCATION MAP

Desktop Assessment of ASR for City of Sanford

Figure 3-2
Preliminary Site Layout

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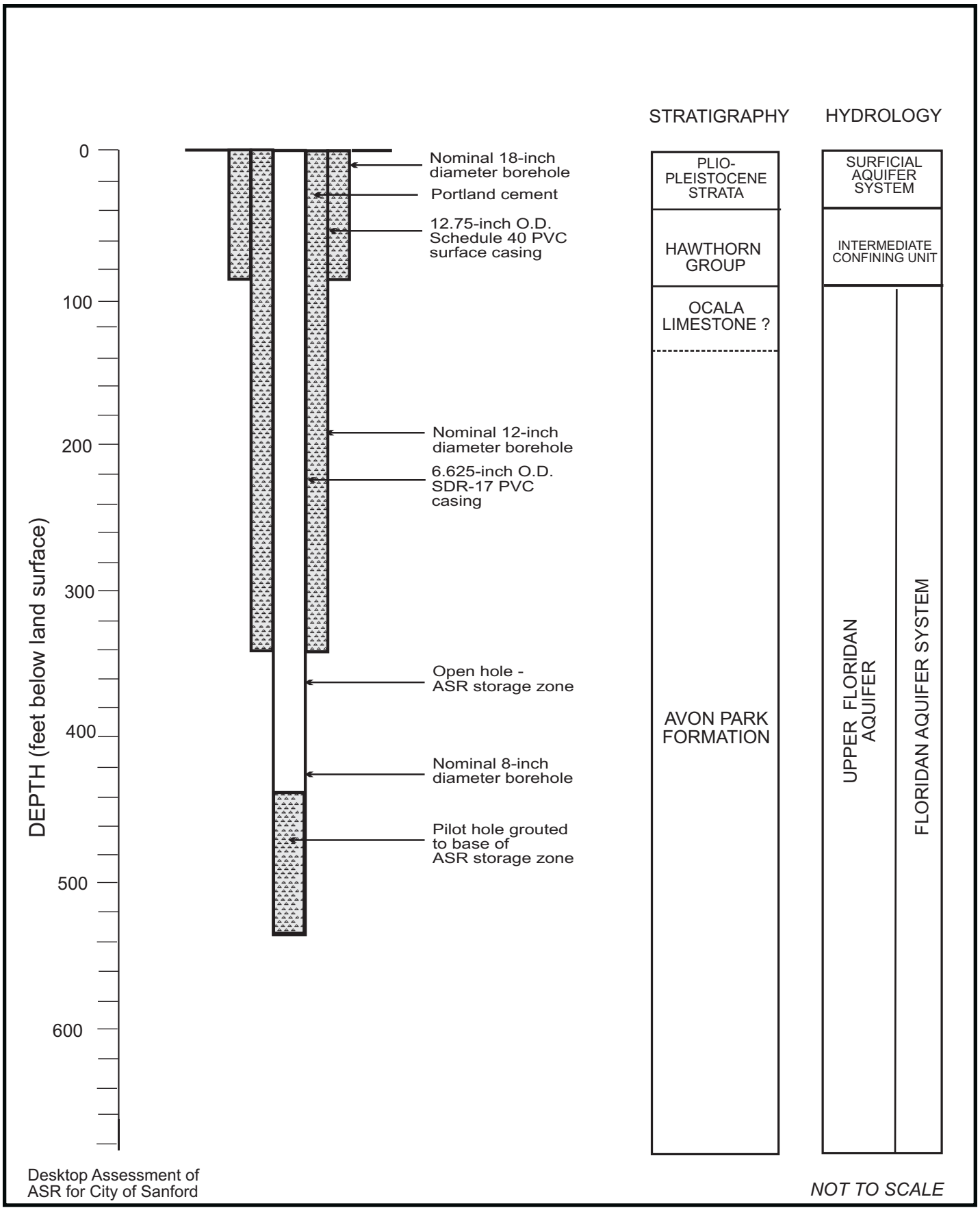

Figure 3-3
Exploratory Well Construction Diagram

CDM

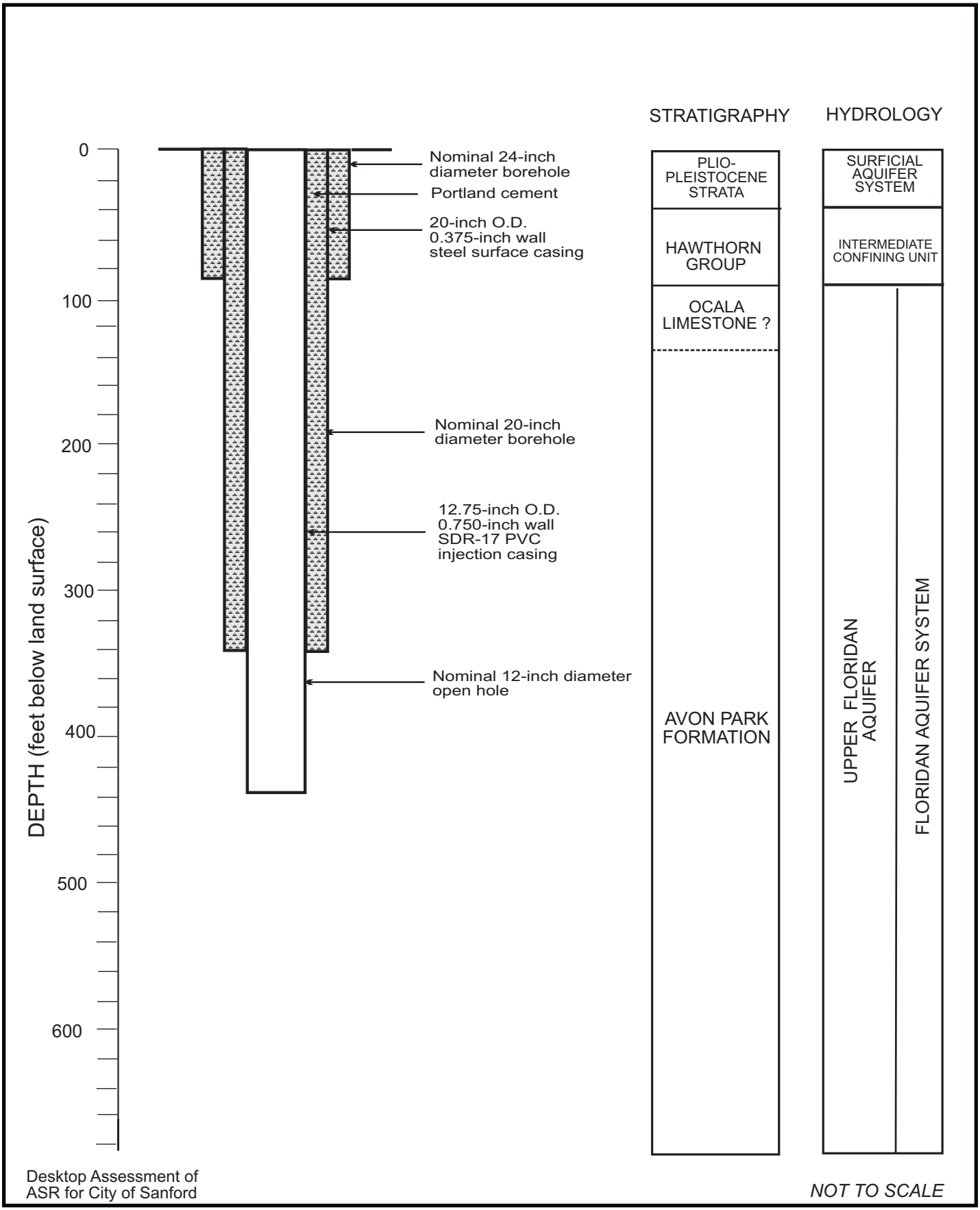

Figure 3-4
ASR Well Construction Diagram

CDM

The confining-zone monitor well would have a 6.625-inch outer diameter SDR-17 PVC casing. Both the storage-zone and confining-zone monitor wells would be equipped with dedicated submersible sampling pumps and combination water quality and level monitoring probes.

3.5 Hydrogeologic Testing

3.5.1 Exploratory Well Testing

Exploratory well sampling and testing is a crucial part of successful ASR system design and implementation. This is particularly so because areas that are most suitable for ASR wells typically have little available site-specific hydrogeology data since these areas tend to be slightly brackish, making them unsuitable for potable water wells. Consequently, a thorough sampling and testing regime was planned for the selected site so that site-specific data needed to assess the potential for success of ASR at a given site could be collected.

The hydrogeologic testing program included:

- While drilling the 8-inch diameter bore hole using the reverse-air rotary method, collect reverse-air discharge water at each drill rod addition (20 to 30 foot intervals) and analyze for chlorides and specific conductance.
- While drilling the 8-inch diameter bore hole using the reverse-air rotary method, collect approximately four, 4-inch diameter cores and perform three packer tests in order to obtain data on the porosity, hydraulic conductivity, and water quality of the upper part of the upper Floridan aquifer.
- A wireline core taken of the entire interval from the base of the surface casing to the total depth of the well.
- Collect a water sample from the completed well after a step-drawdown test and analyze for primary and secondary inorganic drinking water standards, as well as major cations and anions.
- Collect cuttings at 5-foot intervals during drilling and examination by a geologist for lithology, fossils, diagenetic (i.e., layering and porosity of sediments) features, and apparent porosity and permeability. Prepare and examine thin sections of cutting and core samples from the storage zone for texture, composition (mineralogy), and diagenesis. The SJRWMD ASR program geochemical sampling and testing protocol would be implemented to evaluate the potential for adverse fluid-rock interaction.
- Complete a full suite of geophysical logs on the borehole including:
    - Caliper,

  - Natural gamma ray,
  - Dual-induction (or 16- and 64-inch normal resistivity),
  - Sonic with Variable Density Log,
  - Dynamic and static flows,
  - Dynamic and static temperature,
  - Dynamic and static fluid resistivity, and
  - Down-hole video survey

- A step-drawdown test on the open hole interval. The time-drawdown data from the step-drawdown test and flow meter log results would provide information on the transmissivities of the storage zone intervals and adjoining confining strata.
- A step-drawdown test on the completed well.

The results of the hydrogeologic testing program would provide data that allow for an evaluation of ASR feasibility at the site.

Section 4
Cooperator Agreement

4.1 Cooperator Agreement

On June 15, 2004, the SJRWMD and the City of Sanford entered into a Memorandum of Understanding (MOU) #SH335AA (23412). The MOU was for the City to co-share funding costs with SJRWMD to design, permit and construct an ASR system on City property, and expired on June 15, 2009. A copy of the MOU is included in **Appendix B**. The MOU established that:

- Both the SJRWMD and the City would have programmatic authority and established sources to cost-share the project.
- A goal of the project is to demonstrate that ASR is a feasible technology for utilities in the east-Central Florida region.
- The SJRWMD would serve as the lead agency for the design, permitting, construction, and testing of the ASR project.

The MOU included a Statement of Work identifying the goals of the project and a scope of work for the project. The scope of work included the tasks that would be performed under the MOU, which were consistent with the tasks identified in the Program Plan (Section 2).

An amendment to the MOU was issued on June 15, 2009, and expired on September 30, 2010. A copy of the amendment is included in Appendix B. The amendment included a revised Statement of Work, which included work associated with the design, construction, permitting, and testing of the pretreatment system.

A second amendment to the MOU was effective on October 1, 2010, and will expire on September 30, 2013 or upon issuance of the aquifer storage recovery operations permit, whichever is earlier. This amendment modified the expiration date and included statements to share all project-related data with the District until that time. A copy of the amendment is included in Appendix B.

Section 5
Preliminary Basis of Design
5.1 Basic Operational Concept
5.1.1 ASR and Monitoring Wells

As part of the Desktop Assessment report (CDM, 2003), CDM prepared a conceptual ASR system design. The design consisted of an ASR recharge and recovery well (ASR well), one storage-zone monitor well, and a confining zone monitor well completed above the ASR storage zone. A second storage zone monitoring well was added to the ASR system as a requirement of the Florida Department of Environmental Protection (FDEP) Underground Injection Control (UIC) permit. The exploratory well was proposed to serve as storage zone monitor well 1 (SZMW-1) located approximately 350 feet from the proposed ASR well location. The second storage zone monitor well was proposed to be located 150 feet from the proposed ASR well. The confining zone monitor well was proposed to be located 50 feet from the proposed ASR well. A site plan showing the proposed well locations is provided in **Figure 5-1**. Proposed construction diagrams for the ASR well, storage zone monitoring well 2 (SZMW-2), and confining zone monitoring well 1 (CZMW-1) are shown on **Figures 5-2** through **5-4**.

5.1.2 Pipeline

The Desktop Assessment conceptual design included tapping into the City's water main near the Aux (No. 2) WTP with a single supply/return line. However, as the project progressed through the exploratory well program, the design included a supply line and a separate return line to be connected to the raw water line into the Aux (No. 2) WTP. This design allowed for greater flexibility in recovery options and eliminated the need for a rechlorination system at the wellhead. **Figure 5-5** presents the preliminary piping layout and **Figure 5-6** presents the wellhead and construction diagram as presented in the Exploratory Well Report (CDM, 2005.)

5.1.3 Pilot ASR System Capacity

The capacity of a one-well pilot ASR system depends largely upon the specific capacity of the ASR well. The target capacity of the pilot ASR system was a minimum of 1 MGD (694 gallons per minute (GPM)). The completed exploratory well had a specific capacity of 14.9 gallons per minute per foot at a pumping rate of 425 GPM, which corresponds to 47 feet of drawdown at a 1 MGD pumping rate. A drawdown of 50 feet or less at a 1 MGD pumping rate would be expected in a larger diameter well, which would be acceptable for an ASR system.

5.1.4 Recovery Efficiency

The recovery efficiency of the ASR system is dependent upon a number of variables including storage zone water quality (primarily salinity), the transmissivity, dispersivity, leakances, nature of hydraulic conductivity (conduit/fracture versus matrix), effective porosity, heterogeneity and anisotropy of the ASR storage zones,

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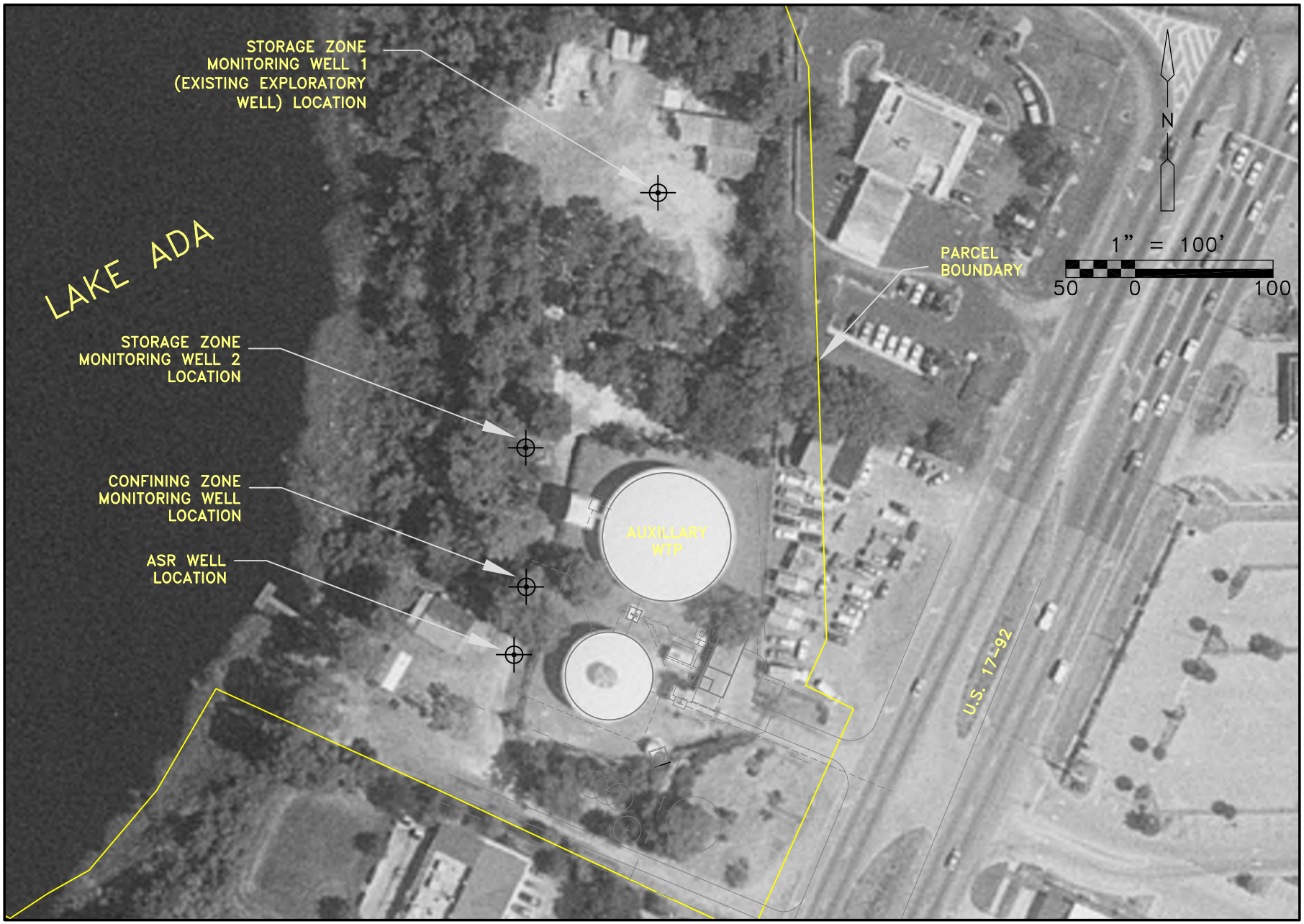
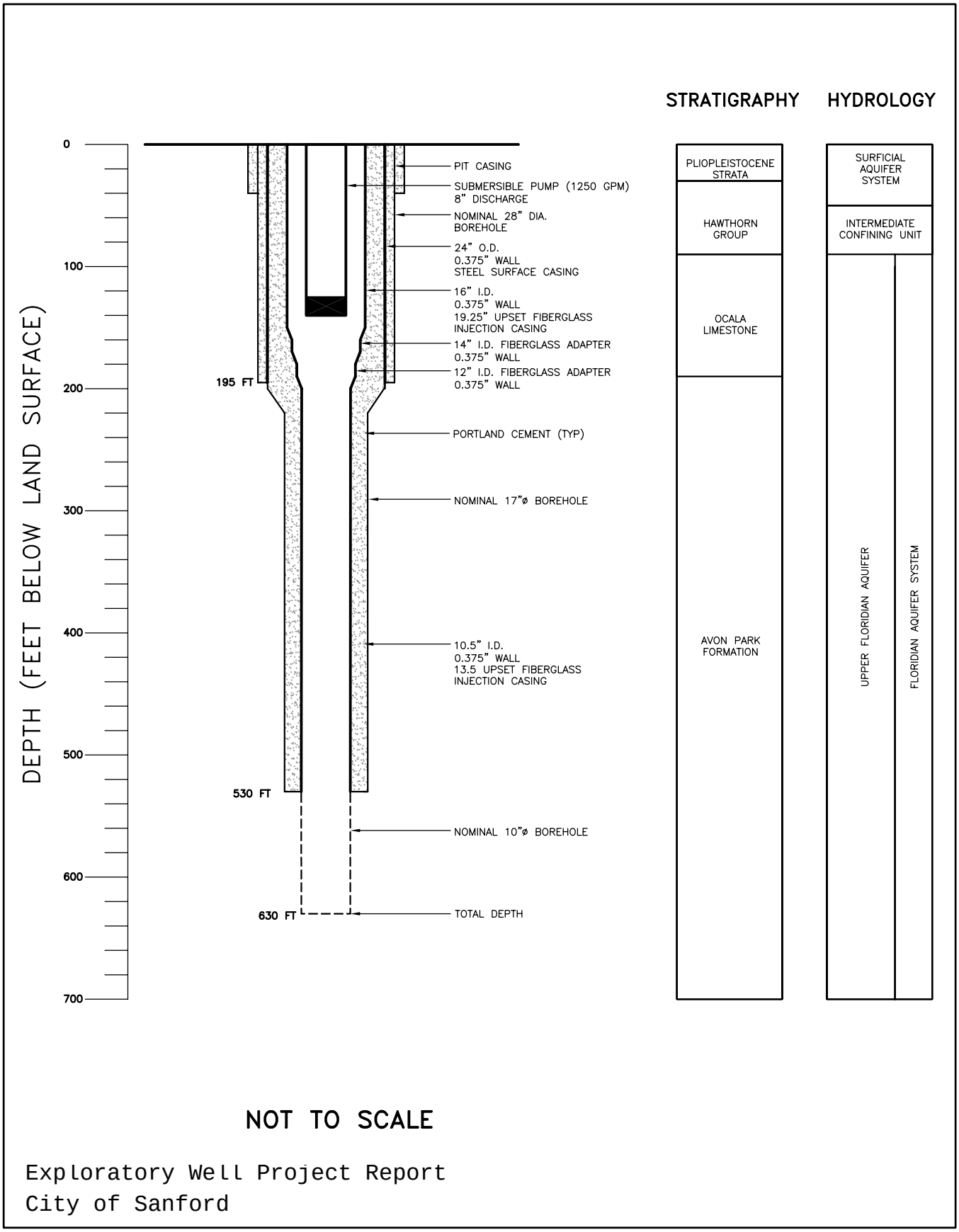


Exploratory Well Project Report
City of Sanford

CDM

Figure 5-1
Proposed Well Locations



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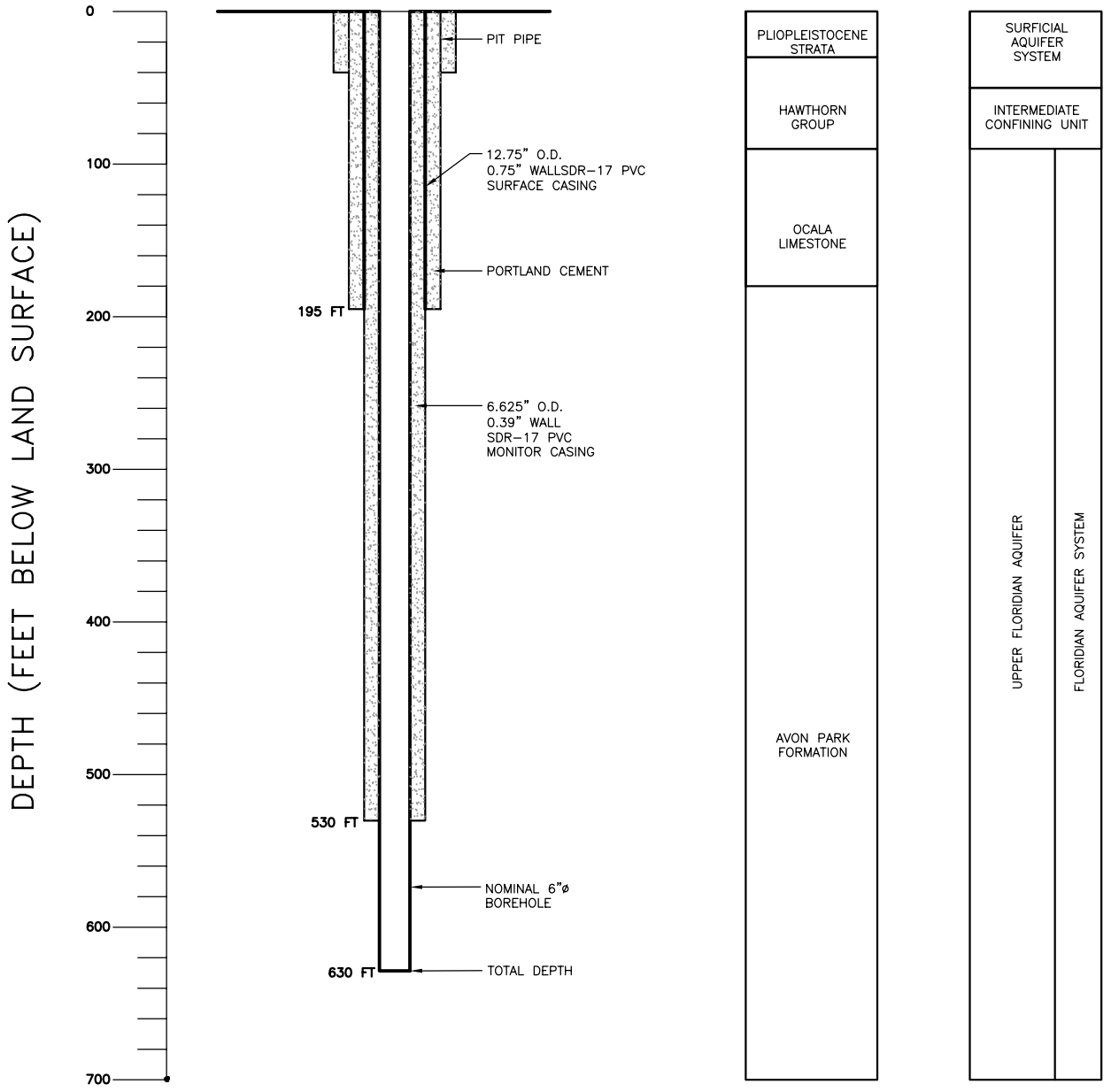
Exploratory Well Project Report
City of Sanford

Figure 5-2
Proposed ASR Well Construction Diagram



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Exploratory Well Project Report
City of Sanford

Figure 5-3
Proposed SZMW-2 Construction Diagram

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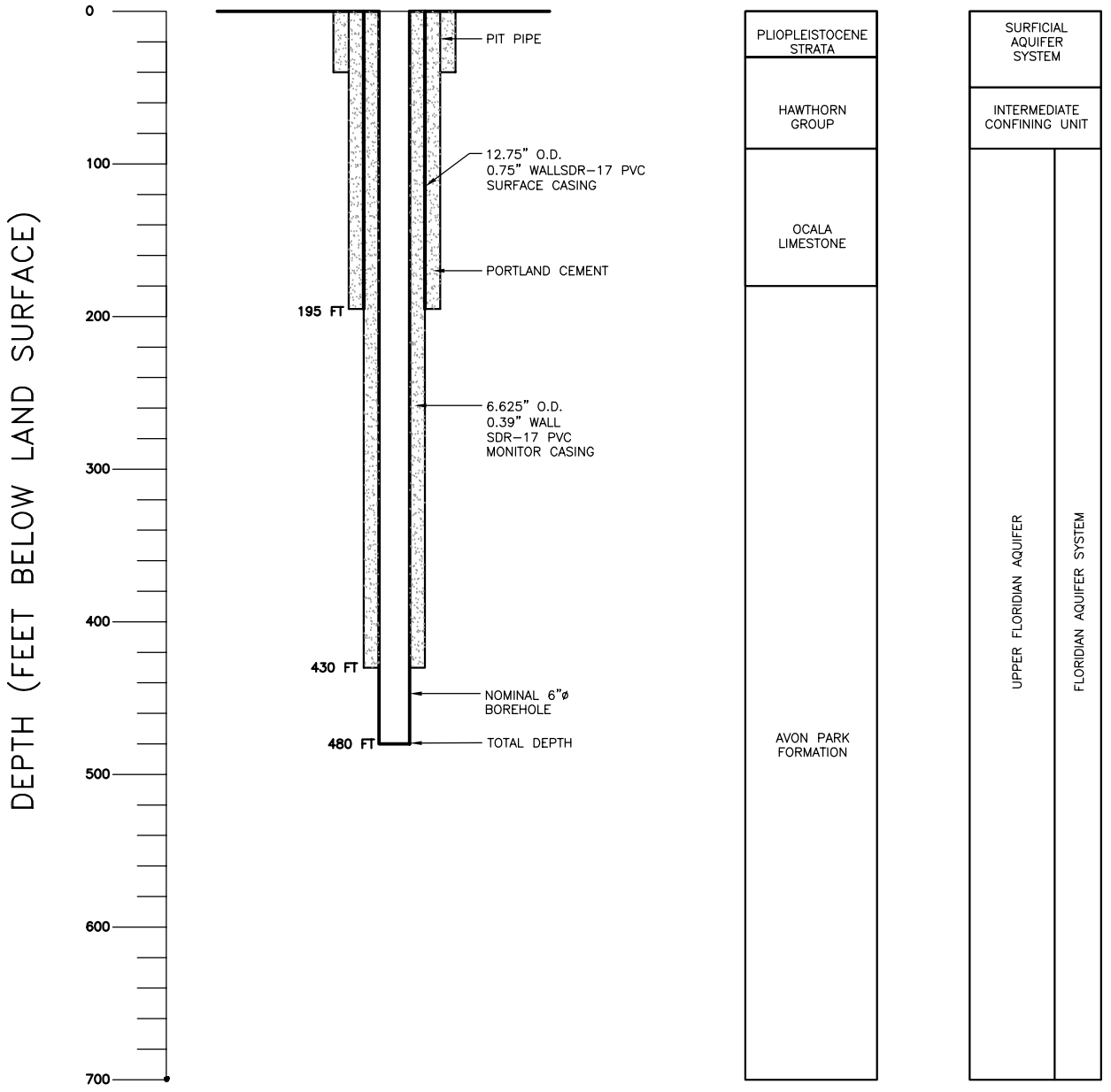

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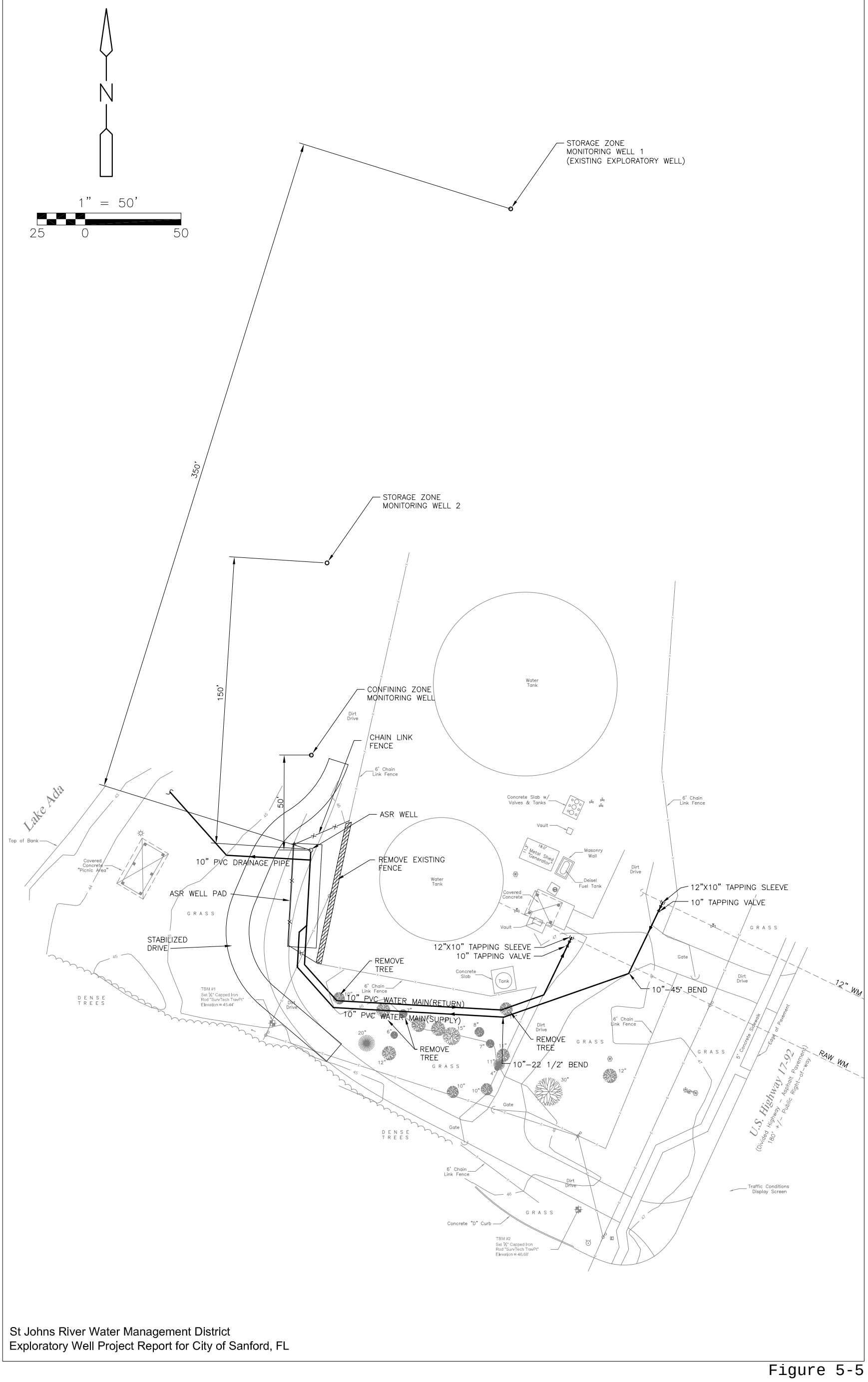
Exploratory Well Project Report
City of Sanford

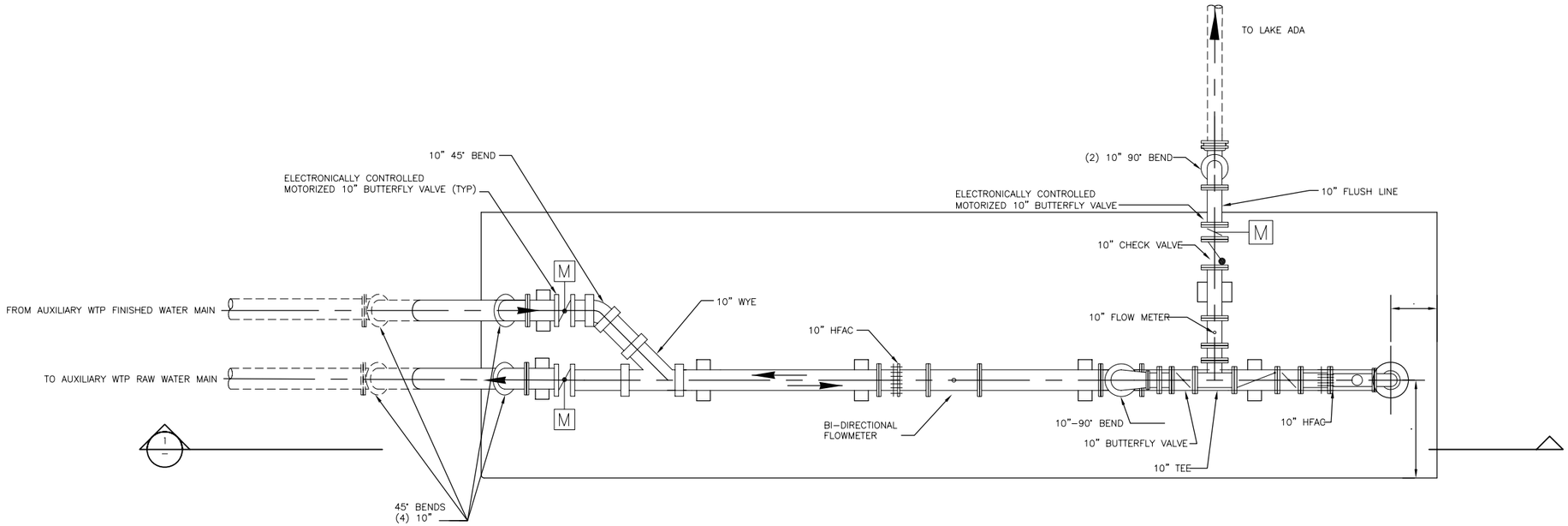
Figure 5-4
Proposed CZMW-1 Construction Diagram



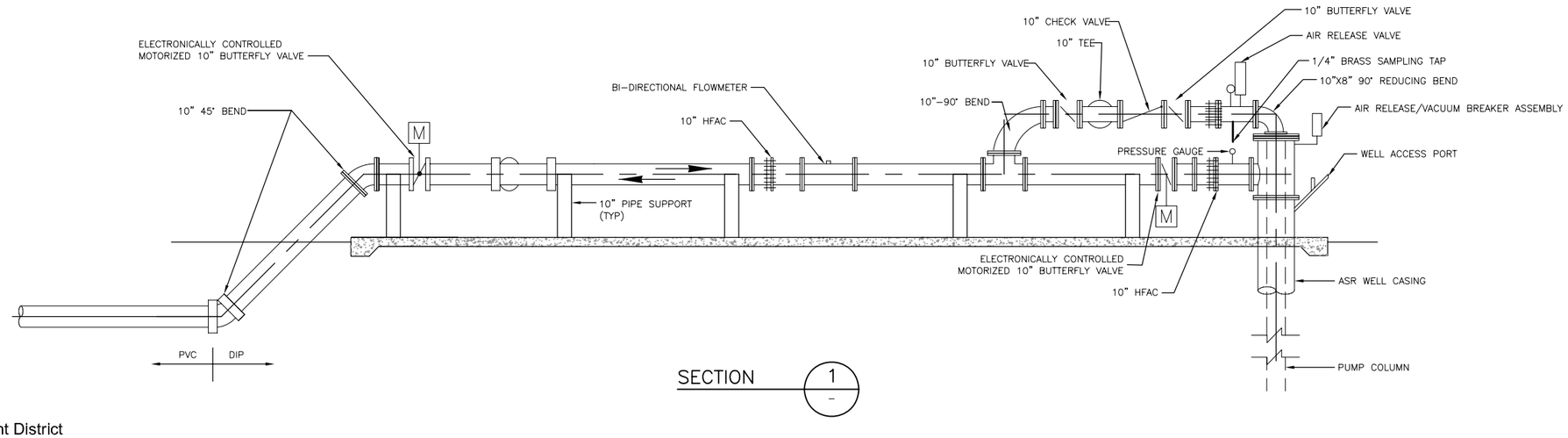
St Johns River Water Management District
Exploratory Well Project Report for City of Sanford, FL

Figure 5-5
Proposed Piping Layout

CDM



ASR SUBMERSIBLE WELL PIPING PLAN



SECTION 1

Figure 5-6
ASR Wellhead Construction and Piping Diagram

CDM

and hydraulic gradients. Solute-transport modeling can be used to predict ASR system performance, but the results of such modeling are of dubious value in the absence of data for model calibration.

Modeling studies performed by CDM (Maliva *et al.*, 2003) and others (Merritt, 1985; Quinones-Aponte and Wexler, 1995, Yobbi, 1996; 1997) all indicate that storage zone salinity is an important, if not the most important, variable in controlling the recovery efficiency of ASR systems in brackish water. Low salinities favor high recovery efficiencies because more mixing of recharge water and native water can occur before the recharge water exceeds drinking water standards for TDS and chloride.

The low salinities, as determined during the exploratory well drilling, in the Sanford Aux WTP ASR storage zone, as well as in the adjoining confining strata, are very favorable for high recovery efficiencies.

5.2 Preliminary List of Drawings and Specifications

The major preliminary design elements as reported in the Exploratory Well Project Report (CDM, 2005) consisted of:

- A 12-inch diameter ASR well;
- A 6.625-inch diameter Floridan aquifer storage zone monitor well (*i.e.* exploratory well);
- A second 6.625-inch diameter Floridan aquifer storage zone monitor well;
- A 6.625-inch diameter confining zone monitor well completed above the ASR storage zone;
- A submersible pump for the ASR well;
- 250 feet of 10-inch diameter supply water main between the Sanford Aux (No. 2) WTP and the ASR well;
- 227 feet of 10-inch diameter return water main between the ASR well and the Sanford Aux (No. 2) WTP;
- 88 feet of 10-inch diameter discharge pipe to Lake Ada;
- A double check valve and control valves; and
- Instrumentation and controls.

The following proposed drawings and specifications were included in the Exploratory Well Project Report for City of Sanford, Florida (CDM, 2005):

- Well construction and testing diagrams and specifications for the ASR well;
- Well construction and testing diagrams and specifications for the Floridan aquifer storage zone monitor well;
- Well construction and testing diagrams and specifications for the Floridan aquifer confining zone monitor well;
- Submersible pump and control valve specifications;
- Electrical and Instrumentation and Control plans;
- Piping layout of the utility connections with specifications; and
- Wellhead construction and piping diagram with specifications for the ASR well.

5.3 Exploratory Well Construction Program

The Exploratory Well Report was submitted as final in December 2005 and is included on the DVD in Appendix F. Sections 5.2 and 5.4 provide a summary of that report. An exploratory well program was implemented at the Sanford Aux (No. 2) WTP site to obtain site-specific data on hydrogeology and water quality in order to further assess ASR feasibility, identify a potential ASR system storage zone, and evaluate potential ASR system performance. The testing program included obtaining a 2.5-inch diameter core from 193 to 594 ft bls, geophysical logging, core porosity and permeability measurements, packer testing, thin-section and x-ray diffractometry analyses, step-drawdown testing, and whole-rock and water chemical analyses.

Drilling was initiated in August 2004 and completed in October 2004. The exploratory well was constructed with:

- 20-inch diameter steel pit pipe set to 95 ft bls (temporary);
- 20-inch diameter borehole drilled to 191 ft bls using mud-rotary drilling;
- 12-inch diameter steel surface casing set to 191 ft bls;
- 2.5-inch continuous wireline coring from 191 to 594 ft bls;
- 10-inch diameter borehole to a depth of 685 ft bls using reverse-air rotary drilling;
- 12-inch diameter borehole to a depth of 530 ft bls;
- 6.625 inch diameter steel casing installed to 530 ft bls;
- Back-grouted the ASR well to a depth of 628 ft bls; and
- ASR storage zone 530-628 ft bls.

5.4 Testing of Exploratory Well

The Sanford Aux (No. 2) WTP ASR exploratory well project had an extensive testing program in order to obtain site-specific hydrogeologic data to be used to identify a potential ASR system storage zone and evaluate potential ASR system performance. Testing included:

- Well cuttings and core samples described according to rock type, color, texture, mineralogy, and apparent porosity. Identification of dolomite and calcite were confirmed by screening using dilute hydrochloric acid and alizarin red staining.

- Geophysical logging program designed to collect information on the hydrogeology of penetrated strata, data on borehole geometry that would assist in the setting and cementing of casing strings, determining packer intervals, and identifying and evaluating potential ASR storage zones and confining strata.

- Thin sections prepared of 21 samples of the exploratory well core and cuttings from 453 to 685 ft bls. The objective of the thin section analyses was to obtain information on the lithology and composition of the main rock types encountered in the core, particularly mineralogy, texture, porosity (abundance and type), and apparent hydraulic conductivity. The sampled interval included the ASR storage zone and adjoining confining strata. The samples included representatives of the main rock types observed in the core and cuttings.

- X-ray diffraction (XRD) analyses performed on four bulk rock samples to confirm the mineralogical characterization made by thin section petrography. Samples were analyzed from 524, 540, 584, 593, and 685 ft bls.

- Whole-rock elemental analyses performed on six core samples and one duplicate sample by Activation Laboratories under contract with the Florida Geological Survey (FGS).

- Samples of the discharge water from the reverse-air circulation system were collected during the drilling of the nominal 12-inch diameter borehole for the 6.625-inch diameter casing to 530 ft bls, and the reaming of the core hole to total depth, and analyzed in the field for pH, specific conductance, and chloride concentration. In general, the reverse-air discharge water can provide some semi-quantitative insights into changes in aquifer water quality with depth.

- A total of eight packer tests performed on the reamed hole in order to obtain site-specific information of water quality and aquifer hydraulics. Five of the tests consisted of single packer tests while three of the tests were performed using a dual straddle packer assembly with a 25 ft spacing between elements.

- A total of 25 cores samples chosen for analysis of porosity and hydraulic conductivity (both vertical and horizontal). The analyses were performed by the FGS.

- The pumping test selected for the Sanford Aux (No. 2) WTP ASR Exploratory Well was a step-drawdown test performed on the completed well. The objectives of the step-drawdown test were (1) to evaluate potential ASR well yields, (2) to obtain an estimated transmissivity for the ASR storage zone, and (3) to obtain aquifer water quality data on the ASR storage zone.

A summary of the site-specific lithology and hydrostratigraphy based on the results of these tests is summarized below.

5.4.1 Site-Specific Lithology

The site-specific lithology at the Sanford Aux (No. 2) WTP site was derived from drill cuttings and continuous core samples and can be summarized by the following general descriptions:

- 0-25 ft bls - sand/silty sand, dark brown to grayish brown, mostly very fine to fine grained size quartz sand, undifferentiated plio-pliestocene surficial deposits.

- 25-45 ft bls – sandy clay / clayey sand, gray, soft, Hawthorn Group.

- 45-95 ft bls – clay with sand and shell hash, greenish gray, Hawthorn Group.

- 95-188 ft bls – limestone, pale yellow to light gray, Ocala Formation.

- 188-394 ft bls – limestone and limestone laminate, pale yellow, Avon Park Formation

- 394-685 ft bls – dolostone and limestone, laminate, pale yellow to dark grayish brown, Avon Park Formation.

5.4.2 Site Specific Hydrostratigraphy

The site specific hydrostratigraphy at the Sanford Aux (No. 2) WTP site can be summarized by the following general descriptions:

- 0-45 ft bls – surficial aquifer system; the water table aquifer consisting of undifferentiated plio-pleistocene sands, and the sandy clay of the upper Hawthorn Group.

- 45-95 ft bls – intermediate confining unit; described as the confining clays of the Hawthorn Group.

- 95-685 ft bls – Floridan aquifer system; the top of the Floridan aquifer system is placed at approximately 95 ft bls, at which depth there is a downward transition

from clay and shell hash (Hawthorn Group) to soft, porous non-phosphatic fossiliferous limestone (Ocala Limestone). The Floridan aquifer system continues into the limestones and dolostones of the Avon Park Formation to the total depth of the boring.

5.4.3 Water Quality Profile

Much of the Upper Floridan aquifer contains freshwater. The 250 mg/L chloride interface likely occurs between approximately 420 and 510 ft bls. The dynamic fluid conductivity log indicated that specific conductance (and thus salinity) gradually increases downhole. The water quality is fresh down to a large void encountered from approximately 414 to 420 feet bls, below which the water becomes slightly brackish.

5.4.4 Summary

Results of the testing showed that the native formation water is mildly brackish (ambient chloride concentration at time of testing is 280 mg/L), which is very favorable for high recovery efficiencies. High degrees of mixing of stored and native waters could occur without causing the stored water to exceed drinking water standards. For ASR systems in brackish water aquifers, native formation salinity is the most important variable in controlling recovery efficiency. Specific capacity data from the exploratory well indicate that a one-well pilot ASR system could have a capacity of at least 1 MGD. Evaluation of potential fluid-rock interactions and fluid-mixing suggested that there was a relatively low potential for adverse reactions, such as the leaching of arsenic. The exploratory well was completed as a 6-inch diameter well open to the proposed ASR storage zone (530-630 ft bls).

5.5 FGS Leaching Study

In August 2007, FGS submitted a *Bench-Scale Geochemical Assessment of Water-Rock Interactions: City of Sanford ASR Facility,* this report is included on the DVD in Appendix F. The purpose of the study was to characterize the geochemistry, bench-scale leachability and sources of soluble metals in the sediments comprising the proposed ASR storage zone. The study was divided into three main parts (1) general lithologic and hydrogeologic characterization of core samples from the Sanford ASR well collected from the storage zone within the Avon Park Formation, (2) geochemical and mineralogical characterization of aquifer rocks from the ASR well storage zone, and (3) bench-scale leaching of ASR core samples in response to variable redox conditions.

For the study, 300 grams of sample were placed in a vessel with 1,000 mL of source or deionized water. The experiments were run for 5 days under low DO conditions, followed by 41 days under high DO conditions, followed by a return to low DO conditions to approximate conditions that might occur during cycle testing. Samples were periodically collected and analyzed for 67 elements. Results of the study provided additional insight regarding application of the Avon Park Formation as an

ASR storage zone, specifically, information on relative mobility of metals and the potential order-of-magnitude changes in ASR storage zone water quality. Results and conclusions of the study include the following:

- Arsenic concentrations at end of experiment ranged from 1.35 to 34.9 ug/L.
- Uranium concentrations were less than 4.5 ug/L.
- The Avon Park formation in the ASR core is predominately a dolostone with intercalated limestone.
- Median vertical hydraulic conductivity of analyzed samples was 8.63E-05 feet per day (ft/day).
- Pyrite, which contains arsenic as part of the mineral matrix, is present in the aquifer matrix as euhedral and subhedral crystals as well as framboidal masses.
- While DO control was achieved during the bench study, redox conditions in the reaction vessels promoted desorption of several metals from the aquifer matrix, even during low-DO conditions. Some metals sorbed onto the aquifer solids as well.
- Arsenic mobility in the bench study is on the order of greater than 1,000%; however, less than 8% of the arsenic in the aquifer matrix is leachable based on these experiments. Despite periodic low-DO conditions in the reaction vessels, overall redox conditions led to desorption of arsenic bearing phases-primarily pyrite.
- Arsenic speciation confirms the oxidizing conditions in the reaction vessels. The speciation results also indicate that even under low DO conditions, As^{5+} is the dominant species.
- Based on literature review, chemical reactions guiding As mobilization indicate that source-water constituents such as DO, NO_3^-, Fe^{3+}, and HCO_3^- can lead to pyrite oxidation in the aquifer and subsequent release of arsenic.

5.6 Expansion Plan

In 2007, CDM performed a desktop evaluation of the existing Sanford Aux (No. 2) WTP ASR well system to determine the potential for expandability of the existing project into a small ASR Wellfield consisting of a total of three ASR wells. A copy of the report is provided in **Appendix C**. Several criteria were considered in the placement of the two new wells and well piping, specifically required distance between ASR wells, distance from existing water supply wells, easements and rights-of-way, and construction access and staging.

Based on the criteria listed above, placement of two additional ASR wells (ASR-2 and ASR-3), each with a capacity of 1 MGD, along Airport Boulevard on the City of Sanford property was determined to be the most feasible option. Locations of the ASR wells and associated monitoring wells are shown on **Figure 5-7**. Supply water to the new wells would be from the existing water main that runs along Airport Boulevard. Supply water for ASR-2 and ASR-3 would come from a direct connection to the existing water main via an 8-inch PVC pipe. Both ASR wells would have the ability to inject water simultaneously.

Assuming that return water quality meets the drinking water criteria, the return water could be chlorinated at the wellhead and pumped directly into the distribution system. Alternatively, Option B indicates, approximately 1,000 feet of 8-inch PVC pipe could be installed from ASR-3 within the City of Sanford property (along the Airport Boulevard right-of-way) to a connection point at ASR-2. From there, approximately 1,200 ft of 12-inch PVC pipe would extend along 17-92 to the entrance to the Aux (No. 2) WTP, where it would join the existing 12-inch raw water main and the existing 10-inch raw water main. Option B represents a more conservative approach that the City expressed a preference for, and could implement at its discretion; allowing for flexibility of treatment and blending, depending on water quality considerations.

williamsjo

9/30/2007

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SR 417

SZMW3

ASR-3

SZMW1

Airport Blvd

SZMW2

TSS2

SMW-1

Sanford Auxiliary WTP

SZMW-1

ASR-1

SZMW-2

US 17-92

Legend

0 150 300 Feet

N W E S

- ASR-1
- Monitoring Wells
- Proposed ASR wells
- Proposed Monitoring Wells
- Existing Wells
- Existing Water Distribution Main
- Raw Water Line
- Existing 10" SWM
- Existing 10" RWM
- Future 8" SWM
- Option B Future 8" RWM
- Option B Future 12" RWM
- 50x50 Staging Area
- Contruction Access
- Parcels
- 100 year Floodplain

CDM

Figure 5-7
Location of Proposed ASR and Associated Monitoring Wells

Section 6
Project Design

6.1 ASR Well and Monitoring Well Drilling and Testing Program

Details of the ASR well and monitoring well drilling and testing program can be found in the Sanford Aux (No. 2) WTP ASR Specifications 100% Submittal dated June 2006. The primary components of the program included:

- Part 1 - Construction and testing of the ASR well
    - Mobilize and set up drilling equipment
    - Install and sample surficial aquifer monitor wells
    - Install pit pipe thorough surficial unconsolidated sediments
    - Drill a nominal 28-inch diameter borehole to the top of the Avon Park Formation at approximately 195 ft bls
    - Install and cement in place approximately 195 feet of 24-inch outer diameter, 0.375-inch-wall steel surface casing
    - Drill using the reverse-air rotary method a nominal 17-inch diameter borehole to approximately 530 ft bls
    - Install and cement in place approximately 140 feet of 16-inch inner diameter, 0.375-inch wall fiberglass casing, a 14-inch inner diameter, 0.375-inch wall fiberglass adapter (20 foot section), a 12-inch inner diameter, 0.375-inch wall fiberglass adapter (20 foot section), a 10.5-inch inner diameter, 0.375-inch wall fiberglass adapter (20 foot section), and 330 feet of 10.5-inch inner diameter, 0.375-inch wall fiberglass casing (this was modified to CERTA-LOK PVC pipe during construction)
    - Drill using the reverse-air rotary method a nominal 10-inch diameter borehole to approximately 630 ft bls
    - Develop well until the water is free of sediment and flows clear to the satisfaction of the engineer
    - Perform geophysical logging of the borehole throughout drilling.
    - Perform step drawdown test

- Part 2 - Construction and testing of the storage zone monitor well
    - Mobilize and set up drilling equipment
    - Install pit pipe thorough surficial unconsolidated
    - Drill a nominal 17-inch diameter borehole to the top of the Avon Park Formation at approximately 195 ft bls
    - Install and cement in place approximately 195 feet of 12.75-inch outer diameter, 0.75-inch-wall SDR 17 PVC surface casing
    - Drill using the reverse-air rotary method a nominal 12-inch diameter borehole to approximately 630 ft bls
    - Perform geophysical logging of the borehole

- Perform Packer Testing
- Install and cement in place approximately 530 feet of 6.625-inch outer diameter, 0.390-inch wall, SDR 17 PVC casing.
- If required, drill out a nominal 5-inch diameter open borehole from 530 to 630 ft bls
- Develop monitor zone until the water is free of sediment and flows clear to the satisfaction of the engineer

- Part 3 - Construction and testing of the confining zone monitor well

  - Mobilize and set up drilling equipment
  - Install pit pipe thorough surficial unconsolidated sediments
  - Drill a nominal 17-inch diameter borehole to the top of the Avon Park Formation at approximately 195 ft bls
  - Install and cement in place approximately 195 feet of 12.75-inch outer diameter, 0.75-inch-wall SDR 17 PVC surface casing
  - Drill using the reverse-air rotary method a nominal 12-inch diameter borehole to approximately 480 ft bls
  - Perform geophysical logging of the borehole
  - Perform Packer Testing
  - Install and cement in place approximately 430 feet of 6.625-inch outer diameter, 0.390-inch wall, SDR 17 PVC casing
  - If required, drill out a nominal 5-inch diameter open borehole from 430 to 480 ft bls
  - Develop monitor zone until the water is free of sediment and flows clear to the satisfaction of the engineer

- Part 4 - Aquifer Performance Test for the ASR well

- Part 5 - Well disinfection

6.2 Conceptual Cycle Testing Plan

The cycle testing program was developed as part of the FDEP UIC permitting process. CDM submitted a *Cycle Testing and Monitoring Program* to the City of Sanford in April 2009. The initial cycle testing plan, as approved and incorporated into the initial UIC permit in September 2006, was modified as part of the major UIC permit modification and Administrative Order process in January 2009. The revision to the cycle testing plan established injection volumes that were expected to reach the closest storage zone monitoring well during Cycles 1 and 2 and the furthest storage zone monitoring well during cycles 3 and 4. The entire injected volume was intended to be recovered, dependent upon water quality results. Also, the revised cycle testing plan would allow for a range of volumes and durations to inject, store and recover water, allowing for more flexibility within the program. **Table 6-1** presents the final approved cycle testing program. The cycle testing monitoring program was also developed as part of the UIC permitting process and included bi-weekly, weekly, and

Table 6-1 Cycle Testing Program for the City of Sanford ASR Project				
Cycle	**Injection Volume**	**Storage**	**Recovery Volume†**	**Total Estimated Days**
	(MG)	**(days)**	**(MG)**	**(max)**
1	7 to 12	10 to 30	7 to 12	54
2	7 to 12	10 to 30	7 to 12	54
3*	32 to 64	30 to 60	32 to 64	188
4**	32 to 64	30 to 60	32 to 64	188
Totals	**110 to 152**	**105 to180**	**110 to 152**	**484**

Recovery will continue to the specified volume or until the chloride concentration in the recovered water increases to 250 mg/L, whichever is reached first.

† Recovery volumes will not exceed the injection volumes

* Used to simulate operational conditions

monthly monitoring of various parameters from the ASR well and associated monitoring wells. **Table 6-2** summarizes the monitoring program including the parameters sampled and frequency. During both cycle testing and operational testing it may be necessary to periodically discharge water to Lake Ada. These discharges are covered under the National Pollutant Discharge Elimination System (NPDES) Generic Permit for the Discharge of Produced Ground Water from Any Non-Contaminated Site Activity.

Table 6-2 Cycle Testing Monitoring Plan				
			Frequency	
Parameter	**Criteria**	**Units**	**ASR**	**MWs**
Arsenic	10	µg/L	Twice/week	Twice/week
Chloride	250	mg/L	Weekly	Weekly
Dissolved Oxygen (field)	NA	mg/L	Weekly	Weekly
Iron, total	0.3	mg/L	Weekly	Weekly
Sodium	160	mg/L	Weekly	Weekly
pH	6.0-8.5	std. units	Weekly	Weekly
Specific Conductance (field)	NA	µmhos/cm	Weekly	Weekly
Sulfate	250	mg/L	Weekly	Weekly
Temperature (field)	NA	°C	Weekly	Weekly++
Total Dissolved Solids	500	mg/L	Weekly	Weekly
Bicarbonate	NA	mg/L	Weekly	Monthly
Magnesium	NA	mg/L	Weekly	Monthly
Manganese	0.05	mg/L	Weekly	Monthly
ORP (field)	NA	mV	Weekly	Monthly
Potassium	NA	mg/L	Weekly	Monthly

Table 6-2 (Continued) Cycle Testing Monitoring Plan				
Total Alkalinity	NA	mg/L	Weekly	Monthly
Total Trihalomethane	80	ug/L	Weekly	Monthly
Total Coliform	0	#/100 ml	Weekly+	Monthly
Fecal Coliform	0	#/100/ml	Weekly+	Monthly
Gross Alpha	3 / 15	pCi/L	Monthly	Monthly
Uranium	30	ug/L	Monthly	Monthly
^{226}Ra / ^{228}Ra	5	pCi/L	O	---
Primary and Secondary DW Parameters	Various		Annually	---

MWs - SZMW-1, SZMW-2, and CZMW-1
O – Only required when gross alpha exceeds 5 pCi/L, sampled beginning and end of recovery cycle.
+ – Weekly through Cycle Test 4, then twice monthly thereafter with Department written approval
++ – Weekly during recharge and recovery, monthly during storage

6.3 Development of Plans and Specifications

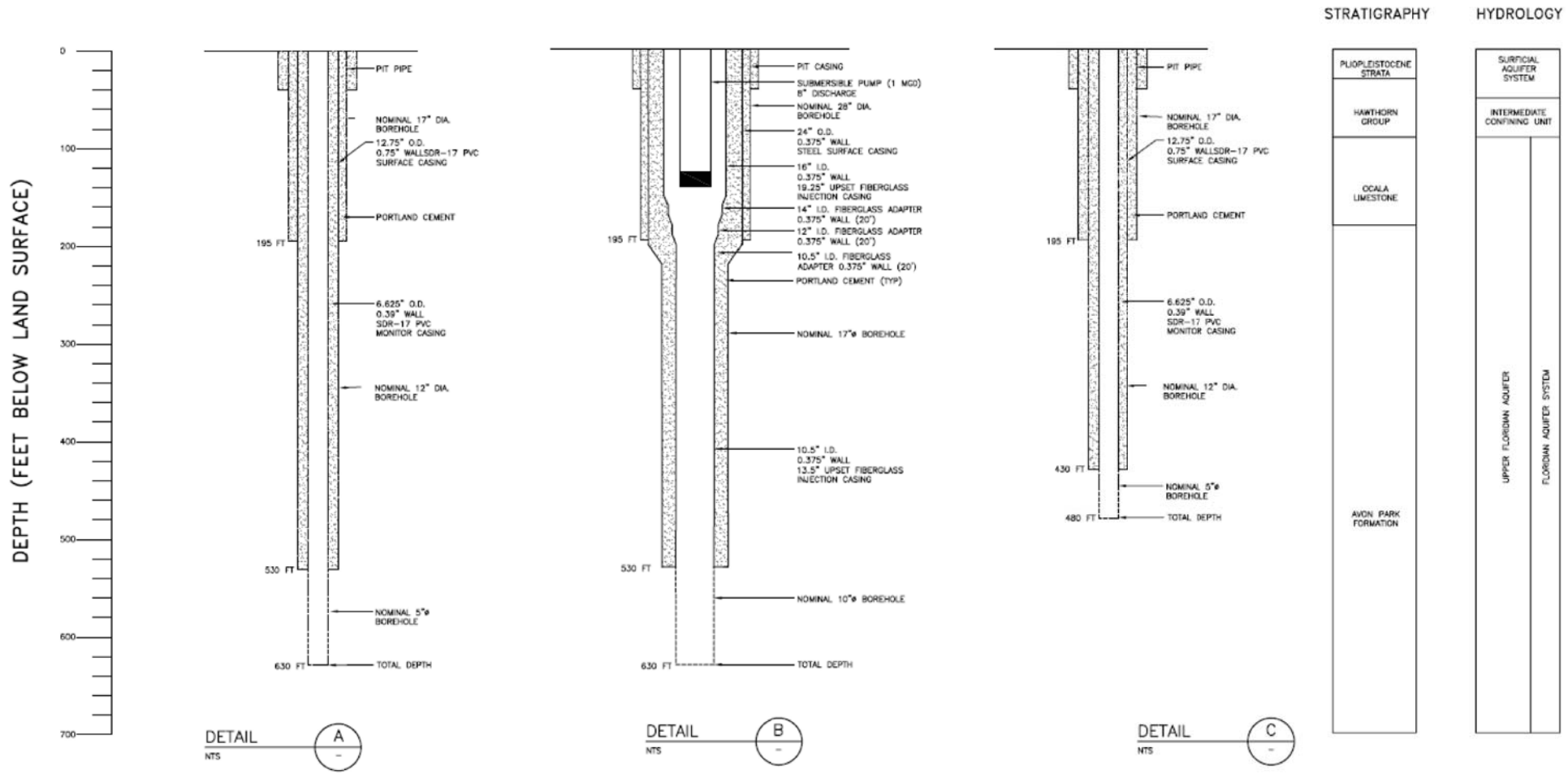
6.3.1 ASR Well, Monitoring Wells, and Surface Facilities

Plans and specifications for the ASR well, monitoring wells, and ASR surface facilities were developed by CDM. **Figure 6-1** shows the final design for the ASR well and associated monitoring wells and **Figure 6-2** shows the final piping plan. The follow documents were submitted to the SJRWMD and are included in Appendix F:

- Sanford Aux (No. 2) WTP ASR 100% Submittal Plans dated June 2006.
- Sanford Aux (No. 2) WTP ASR 100% Submittal Specifications dated June 2006.

Major components include:

- ASR well,
- Storage zone monitoring wells,
- Confining zone monitoring well,
- Submersible pump,
- Valves,
- Electrical, and
- Instrumentation and Control.



STORAGE ZONE MONITORING WELL 2 CONSTRUCTION DIAGRAM

ASR WELL CONSTRUCTION DIAGRAM

CONFINING ZONE MONITORING WELL CONSTRUCTION DIAGRAM

J:\924769409 (WO 33 Sanford)\Reporting\Executive Summary\Figures\Figure 6-1

Figure 6-1
Final ASR and Monitoring Wells Design Plans

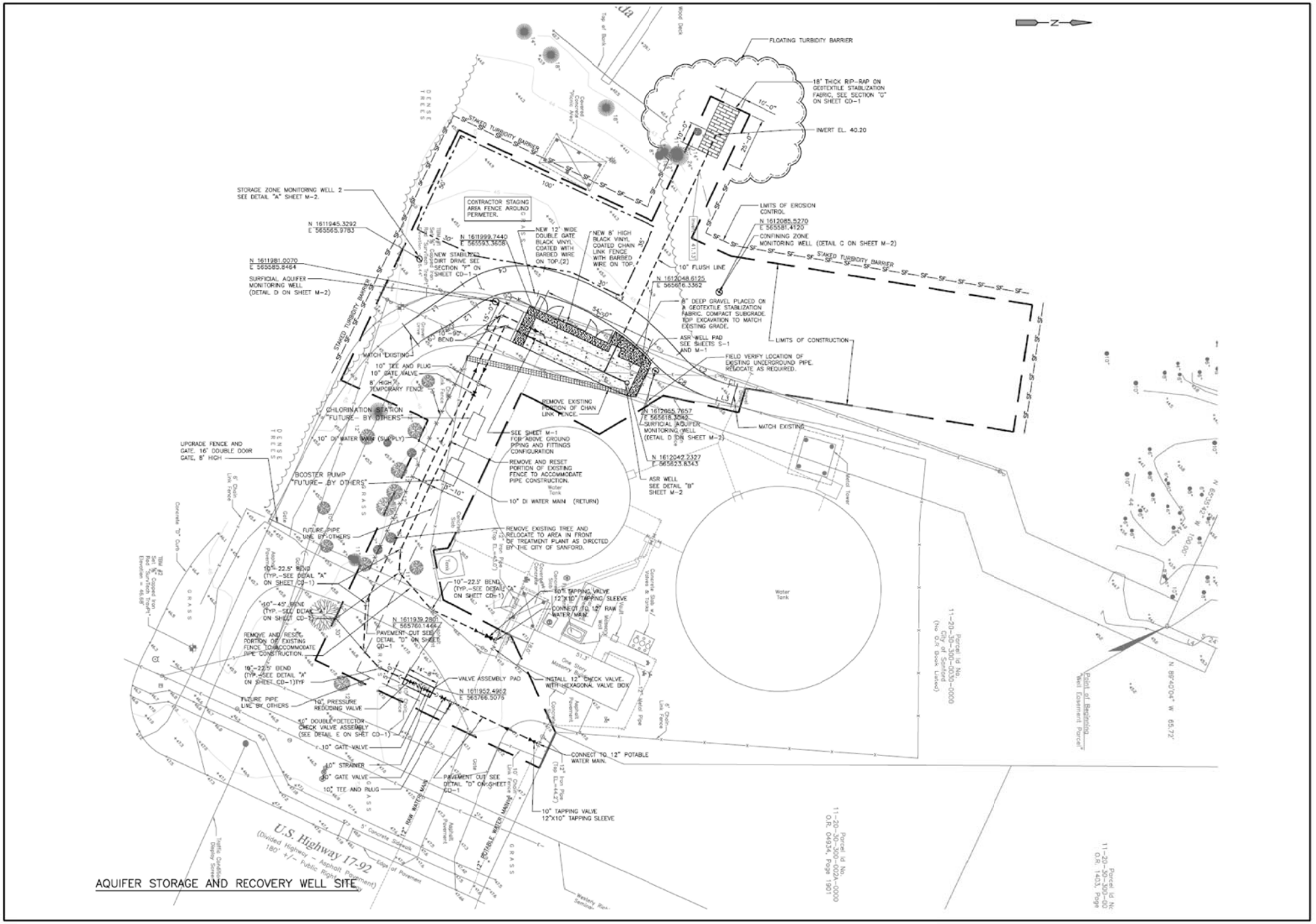


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Figure 6-2
Final ASR Well Site and Piping Plan

6.3.2 Pretreatment System

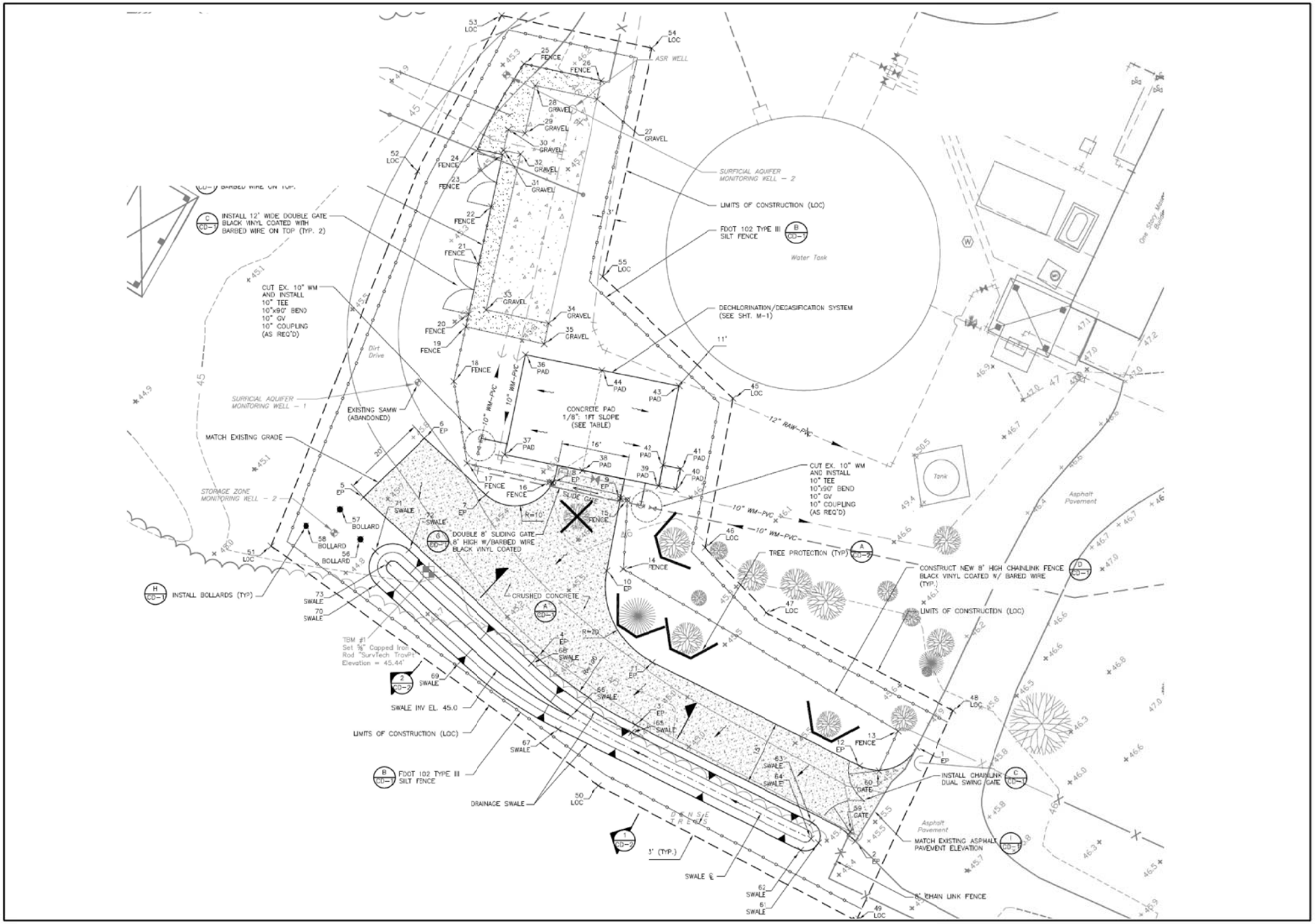
The goal of pretreatment is to produce recharge water quality similar to the storage zone native groundwater through chlorine residual (Cl_2) removal and DO reduction to reduce arsenic leaching potential. This degasification system requires removal of Cl_2 to protect the membranes, which also contributes to a decreased ORP; an added benefit. The final site layout for the pretreatment system is shown on **Figure 6-3.**

Plans and specifications for the ASR pretreatment system were developed by CDM. The follow documents were submitted to the SJRWMD and are included in Appendix F:

- ASR Dechlorination/Degasification System at the Sanford Aux (No. 2) (No. 2) WTP 100% Submittal for Construction Plans dated April 2009.
- ASR Dechlorination/Degasification System at the Sanford Aux (No. 2) (No. 2) WTP 100% Submittal for Construction Specifications dated April 2009.

Major components include:

- Dechlorination tank,
- Metering pumps,
- Sensors,
- Flow meter,
- Vacuum pump, and
- Control Panel.



J:\924769409 (WO 33 Sanford)\Reporting\Executive Summary\Figures\Figure 6-2

Figure 6-3
Final ASR Pretreatment Piping Plan

Section 7
Regulatory Permitting

7.1 Permits

Several permits were acquired prior to construction and testing activities at the City of Sanford ASR project site. The following sections summarize the permits obtained for the project, including pretreatment construction and cycle testing.

7.1.2 FDEP Underground Injection Control (UIC) Permit

FDEP UIC Permit Number 59-0259876-001-UC was issued on September 28, 2006 to construct a Class V, Group Seven, ASR injection well system. The FDEP issued a minor modification to this permit on December 22, 2006, to change the ASR well casing material from fiberglass to PVC. A second minor modification was issued by FDEP on July 8, 2008 to construct dechlorination and degasification pretreatment equipment for the ASR system. On January 6, 2009, FDEP issued a major modification to the UIC permit, to revise the cycle testing and monitoring plans, in conjunction with issuing an Administrative Order AO-08-0015. The Administrative Order (AO) outlines steps to perform if arsenic levels are found to exceed the Maximum Contaminant Level (MCL) of 10 µg/L during cycle testing. This permit expired on September 27, 2011, and the City is currently in the renewal process. The permit, modifications and AO are included in **Appendix D** and the permit application and renewal is included on the DVD in Appendix F.

7.1.2 SJRWMD Consumptive Use Permit (CUP)

A groundwater allocation from the Floridan Aquifer at the City of Sanford Aux (No. 2) WTP for cycle testing was included in the City's CUP. SJRWMD issued permit number 162 on February 7, 2006 to the City for its entire groundwater supply system including ASR. This CUP expires on February 8, 2026. The allocation for ASR testing water expired on April 1, 2010. The City of Sanford is currently seeking a renewal of this allocation. Copies of the existing CUP permit and renewal application are included on the DVD in Appendix F.

7.1.3 SJRWMD Well Construction Permits

A well construction permit was acquired prior to installation of the exploratory well. The exploratory well was constructed under SJRWMD well construction permit no. 94282-1, issued on November 1, 2004, and was later converted to SZMW-1. Three well construction permits were acquired from the SJRWMD to construct the ASR well and Floridan Aquifer monitoring wells at the City of Sanford Aux (No. 2) WTP site. Permit numbers 108689-1, 108688-1, and 108686-1 were issued on December 26, 2006 for wells ASR-1, SZMW-2, and CZMW-1, respectively. A copy of the permit is included on the DVD in Appendix F.

7.1.4 FDEP Public Water Supply (PWS) Permits

FDEP PWS permit number WC59-0080856-257 was acquired to equip and connect the ASR well, including supply and return water mains between the ASR well and the City of Sanford Aux (No. 2) WTP. The permit was issued May 16, 2007. This permit expires on May 16, 2012.

On August 12, 2008, FDEP issued PWS Permit Number WC59-0080856-299 to construct a dechlorination and degasification system to treat potable water prior to injection at the ASR well. The permit expires on August 11, 2013. Copies of the permits are included on the DVD in Appendix F.

7.1.5 FDEP NPDES Permit

A Generic Permit for Discharge of Uncontaminated Groundwater to Surface Waters was granted by FDEP on August 1, 2007. This permit allows for the discharge of water from cycle test 1 and purge water from the ASR well to Lake Ada. As the name implies this is a generic permit and no formal permit was issued by FDEP. Instead, it must be demonstrated prior to discharge of groundwater to Lake Ada that the groundwater quality meets the screening criteria in Chapter 62-621.300.

7.1.6 City of Sanford Building Permits

A City of Sanford Building Department Permit was obtained for the ASR wellhead slab and electrical connections to the well control panel - permit number 07864 on January 22, 2007. A building permit was also obtained to construct the pretreatment system slab and canopy on May, 21, 2009 – permit number 091609. Copies of the permits are included on the DVD in Appendix F.

Section 8
ASR Facilities Construction, Start-up, Monitoring and Training

8.1 Construction and Testing of the ASR Well and Monitor Wells

The ASR well (ASR-1), storage zone monitoring well 2 (SZMW-2), and confining zone monitoring well (CZMW-1) were constructed from March 2007 to August 2007. Well construction details were provided in the Project Record Drawings (CDM, January 2009.) The exploratory well, previously described in Sections 5.4 and 5.5, is defined as storage zone monitoring well 1 (SZMW-1). **Figure 8-1** shows the locations of the wells and the final site layout. **Figure 8-2** shows the final design of the ASR well, SZMW-2, and CZMW-1.

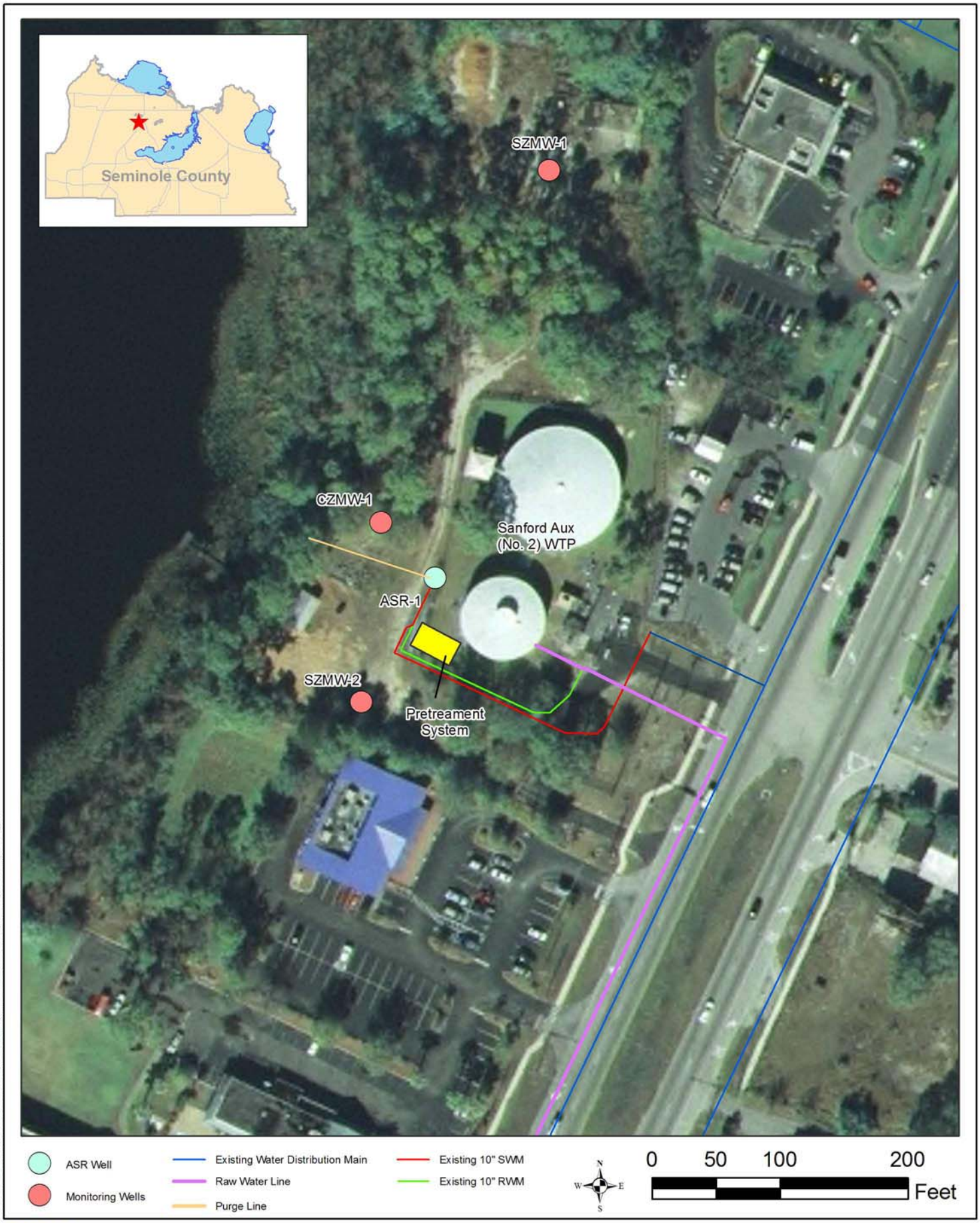
8.1.1 Hydrogeologic Framework

The hydrogeology of the Sanford Aux (No. 2) WTP site was evaluated from well cuttings, core, and geophysical logs obtained during the drilling of ASR-1, and monitoring wells CZMW-1, SZMW-1, and SZMW-2. Initial results based on the exploratory well (SZMW-1) were previously presented in Section 5.5

The site specific lithology at the Sanford Aux (No. 2) WTP site is derived from drill cuttings and continuous core samples and geophysical logs and can be summarized by the following general descriptions:

- 0-20 ft bls - sand/silty sand, dark brown to grayish brown, mostly very fine to fine grained size quartz sand, undifferentiated plio-pliestocene surficial deposits
- 20-45 ft bls – sandy clay / clayey sand, gray, soft, undifferentiated plio-pliestocene surficial deposits
- 45-95 ft bls – clay with sand and shell hash, greenish gray, Hawthorn Group
- 95-188 ft bls – limestone, pale yellow to light gray, Ocala Formation
- 188-495 ft bls – limestone and limestone laminate, dolomitic limestone, pale yellow, Avon Park Formation
- 495-540 ft bls – mostly dolostone with little limestone, pale yellow to dark grayish brown, Avon Park Formation

The site specific hydrostratigraphy at the Sanford Aux (No. 2) WTP site can be summarized by the following general descriptions:



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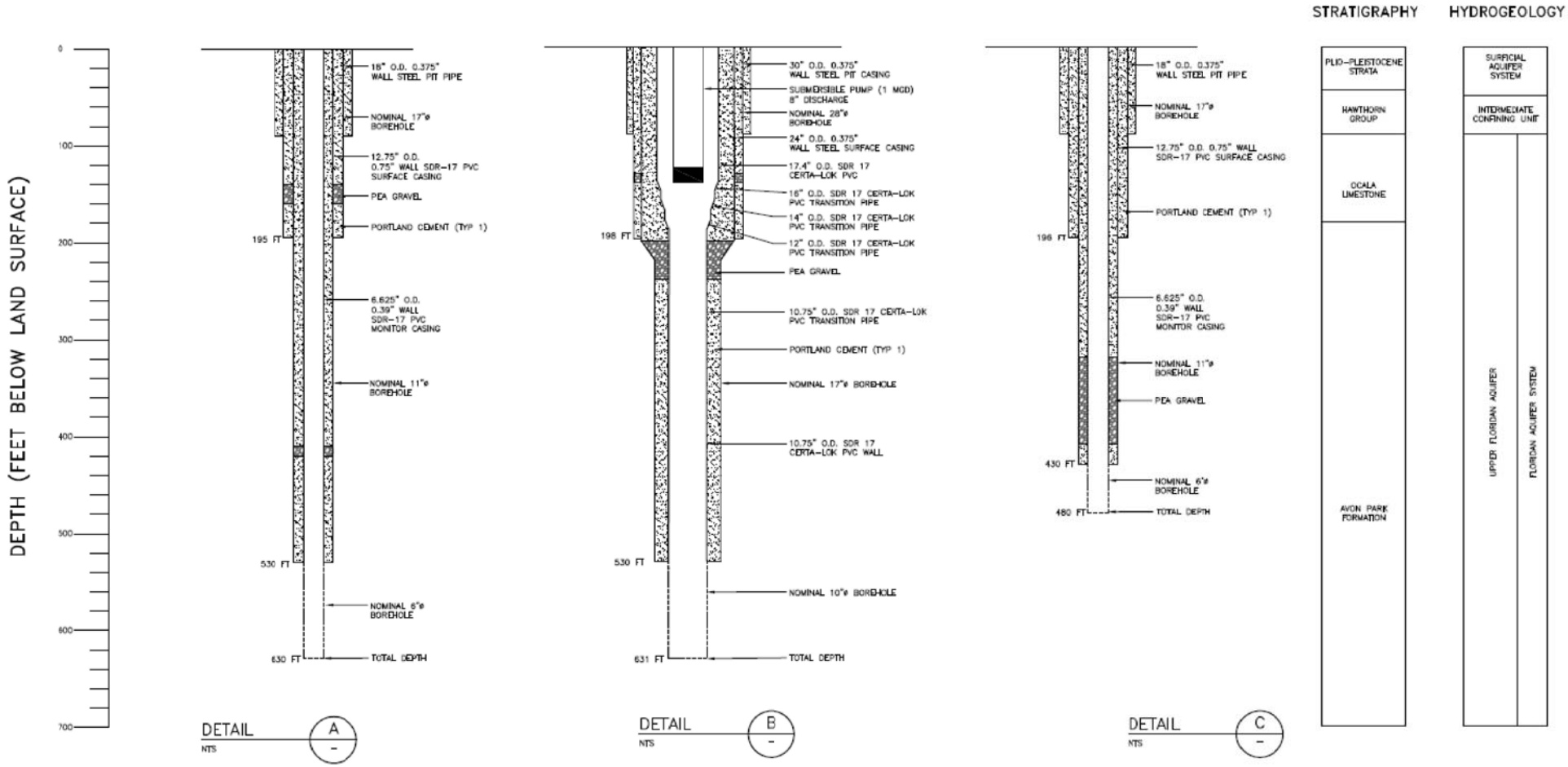
CDM

Figure 8-1
Final Site Layout



STORAGE ZONE MONITORING WELL 2 CONSTRUCTION DIAGRAM

ASR WELL CONSTRUCTION DIAGRAM

CONFINING ZONE MONITORING WELL CONSTRUCTION DIAGRAM

J:\924769409 (WO 33 Sanford)\Reporting\Executive Summary\Figures\Figure 8-2

Figure 8-2
Final ASR and Monitoring Wells Construction Diagrams

- 0-45 ft bls – surficial aquifer system; the water table aquifer consisting of undifferentiated plio-pleistocene sands

- 45-95 ft bls – intermediate confining unit; described as the confining clays of the Hawthorn Group

- 95-685 ft bls – Floridan Aquifer System; the top of the Floridan Aquifer System is placed at approximately 95 ft bls, at which depth there is a change in lithology from clay and shell hash (Hawthorn Group) to soft, porous non-phosphatic fossiliferous limestone (Ocala Formation). The Floridan Aquifer System continues into the limestones and dolostones of the Avon Park Formation to the total depth of the deepest boring (the exploratory well).

Much of the Upper Floridan Aquifer contains fresh water. The 250 milligram per liter (mg/L) chloride interface was encountered in the exploratory well (converted to SZMW-1) between approximately 420 and 510 ft bls. In ASR-1 and SZMW-2, the 250 mg/L isochlor was not encountered, but is likely near 630 ft bls as indicated by the field water quality analysis during drilling. The chloride concentration was 218 mg/L at 610 ft bls in ASR-1.

The dynamic fluid conductivity log indicates that specific conductance (and thus salinity) gradually increases downhole below 582 ft bls.

8.1.2 ASR Well

Construction of the ASR well began in March 2007, with testing completed in August 2007. ASR-1 has two strings of steel casing and one string of SDR 17 PVC casing. The 30-inch steel surface casing was set to 98 ft bls in order to case off the surficial aquifer system. The 24-inch steel surface casing was set to 198 ft bls in order to case off the Hawthorn Group and Ocala Formation and the upper most portion of the Upper Floridan Aquifer. The 17.4-inch OD SDR 17 PVC casing was set to 138 ft bls, where it begins a sequence of transition pipe: between 138 to 158 ft bls the pipe reduces from 17.4-inch to 16-inch OD; between 158-178 ft bls the pipe reduces from 16-inch to 14-inch OD; between 178-198 ft bls the pipe reduces from 14-inch to 12-inch OD, and finally transitions from 12-inch to 10.75-inch OD to 530 ft bls, the top of the ASR storage zone within the lower portion of the Upper Floridan Aquifer. A nominal 9-inch diameter open borehole extends from 530 to 631.5 ft bls

On June 5, 2007, a pressure test was performed for 1 hour at 67.5 pounds per square inch (psi), as required by the UIC Permit. During this time there was less than a 5% drop in pressure, which is within the acceptable limit specified in the UIC Permit. As part of the geophysical logging program, both video logs and temperature logs were collected for ASR-1. The results of the geophysical logging did not produce any evidence that would suggest that the well casing was not structurally sound.

8.1.3 Storage Zone Monitoring Well 2

Construction of SZMW-2 began in July 2007 and was completed in August 2007. SZMW-2 has an 18-inch steel pit pipe casing off the surficial aquifer system. The 12.75-inch OD SDR 17 PVC surface casing was set to 195 ft bls and cases off the surficial aquifer, Hawthorn Group, and Ocala Formation. The 6.625-inch OD SDR 17 PVC casing is set from land surface to 530 ft bls in order to monitor water quality in the storage zone at the southern boundary of the site. A nominal 6-inch diameter open borehole extends from 530 to 630 ft bls.

Video logs and temperature logs were collected for SZMW-2. The results of the geophysical logging did not show any evidence that would suggest that the well casing was not structurally sound.

8.1.4 Confining Zone Monitoring Well 1

Construction of CZMW-1 began in June 2007 and was completed in July 2007. CZMW-1 has an 18-inch steel pit pipe casing off the surficial aquifer system. The 12.75-inch OD SDR 17 PVC surface casing was set to 196 ft bls and cases off the surficial aquifer, Hawthorn Group, and Ocala Formation. The 6.625-inch OD SDR 17 PVC casing was set from land surface to 430 ft bls. A nominal 6-inch diameter open borehole extends from 430 to 480 ft bls. The purpose of CZMW-1 is to monitor if there is upward migration of injection water across the confining unit to the water supply production zone.

Video logs and temperature logs were collected for CZMW-1. The results of the geophysical logging did not show any evidence that would suggest that the well casing was not structurally sound.

8.1.5 ASR Storage Zone Characteristics

The storage zone rock consists mostly of dolomite with non-carbonate inclusions largely encapsulated within dolomite crystals. The native formation water is marginally saline (chloride concentration is 280 mg/L), which is very favorable for high recovery efficiencies. Evaluation of potential fluid-rock interactions and fluid-mixing suggests a low potential for adverse reactions, such as arsenic leaching.

8.2 Surface Facilities Construction

The following section describes the surface facility construction program followed during the Sanford Aux (No. 2) WTP ASR project, including the pipeline, well pump and wellhead piping, and pretreatment system.

8.2.1 Ductile Iron Pipeline and Directional Drill HDPE Pipeline

In September 2007, 289 feet of 10-inch ductile iron pipe (DIP) was installed for the supply and return lines. Prior to trench excavation, trees were cleared along alignments of the supply, return and purge lines. Additionally, three 40-foot sections of 10-inch high density polyethylene (HDPE) piping were installed, for the supply

and return lines, using horizontal directional drilling technology to tunnel under fences and asphalt driveways. Two sections were for the supply line, and ran under asphalt driveways to the tie-in at the 12-inch main. The third section was for the return line, and ran under the fence to the 12-inch raw-water main tie-in location. In November 2007, 102-ft of 10-inch ductile iron piping was installed for the purge line. Installation began at the discharge point in Lake Ada.

8.2.2 Above Grade Facilities

From October through December 2007, CDM installed the above grade facilities at the ASR site. This included approximately 68-ft of 10-inch ductile iron piping for the supply and return line, approximately 42-ft of 10-inch ductile iron piping for the purge line, four motor operated valves (one supply line valve, one return line valve, one purge line valve, and one inlet valve), one 10-inch bi-directional flow meter, one 10-inch flow meter, one 10-inch check valve, two 10-inch butterfly valves, one 1-inch air release valve, one 2-inch air release valve, one 2-inch air release valve/vacuum breaker, two pressure gauges, one high pressure switch, one low pressure switch, one conductivity meter, and one turbidity/suspended solids meter.

From September 2007 through September 2008, the ASR pad, wellhead, pump pedestal, and control panel were installed. Cogburn Electric and Revere Controls installed the electrical and instrumentation components and programmed the control panel. In April 2008, a 60 horsepower (HP) submersible pump was installed in the well. The well site is enclosed by a 2-inch chain link fence.

8.2.3 Pretreatment System

Pretreatment at the Sanford Aux (No. 2) WTP ASR project site consisted of a temporary dechlorination system for use during Cycle Tests 1 and 2 and a permanent pretreatment system composed of a dechlorination system and a degasification system for use during Cycle Tests 3 and 4, and for operational use. The following sections describe the construction of these systems at the site. Construction details for the permanent dechlorination system and degasification system are provided in the ASR Dechlorination/Degasification System at the Sanford Aux (No. 2) (No. 2) WTP Project Record Drawings (CDM, 2010)

8.2.3.1 Temporary Dechlorination System

From February 2009 through April 2009, CDM installed the temporary dechlorination system at the site. The temporary system consisted of two chemical metering pumps, 55 gallon drums of sodium bisulfite and a temporary containment pad. CDM and the City of Sanford calibrated the dosing rate for the chemical metering by monitoring chlorine concentrations in the injected water at a sample port on the ASR pad to verify chlorine removal.

8.2.3.2 Permanent Dechlorination System

In September 2009, CDM began installation of the permanent dechlorination system and components. Construction was complete in November 2009. The components of the dechlorination system are outlined below:

- Influent and effluent chlorine sensors;
- 550-gallon sodium bisulfite double walled poly tank;
- 2 diaphragm chemical metering pumps;
- Ultrasonic tank level sensor;
- Emergency eyewash and shower;
- Magnetic flow meter and static mixer; and
- 24-inch detention pipe.

8.2.3.3 Degasification System

The degasification system was installed from June 2009 through October 2009. Revere Controls installed the SCADA program and calibrated the instruments for the pretreatment system. The components of the degasification system are outlined below:

- Influent and effluent DO sensors;
- 4-14x40 inch Membrana Liqui-Cel® contactors;
- Liquid-ring vacuum pump;
- Nitrogen generator and buffer tank;
- Air compressor and dryer;
- Pressure indicators;
- ORP sensor; and
- Control panel.

8.3 Startup Activities

8.3.1 ASR System

CDM completed short term calibration testing of the ASR system in September 2008. The short term calibration testing consisted of the following:

- Verifying proper programming and electrical valve operation;

- Calibration of the high and low pressure switches;
- Calibration of the flow meters;
- Calibration of the level sensor;
- Calibration of the conductivity probe;
- Calibration of the turbidity probe; and
- Testing of the motor operated valves for the following scenarios:
  - Standby;
  - Purge;
  - Injection; and
  - Recovery.

On December 4, 2008, Revere Controls performed the Functional Demonstration Test on the ASR system. The test was witnessed by the City of Sanford and CDM. All functions were working properly and the ASR system was deemed fully operational.

CDM prepared an Operations and Maintenance (O&M) Manual detailing the one well pilot ASR system installed at the Sanford Aux (No. 2) WTP ASR project site (CDM, 2009). The manual describes the ASR system components, operation, the maintenance required, and troubleshooting guidelines for the equipment, including the injection well (ASR-1), confining zone monitoring well, storage zone monitoring wells, surficial aquifer monitoring wells, submersible well pump and motor, associated piping, flow control and isolation valves, instrumentation, and utility connections. The manual also provides general safety requirements and safety procedures to follow when operating or performing maintenance at the Sanford Aux (No. 2) WTP ASR facility. Additionally, the manual describes the monitoring and analytical requirements for the cycle testing program and required well monitoring. A copy of the manual is included on the DVD in Appendix F.

In December 2008, CDM, in conjunction with Revere Controls, conducted O&M training for the City of Sanford staff on the ASR system. The training included the following:

- Overview;
- Definitions associated with Aquifer Storage and Recovery (ASR) Wells;
- Regulations associated with ASR wells;
- Operation of the ASR well;

- Maintenance of the ASR well; and
- Troubleshooting the ASR well.

8.3.2 Pretreatment System

In October 2009, CDM and subcontractors conducted operations and maintenance (O&M) training for the City staff. The training included the following:

- ASR system overview;
- ASR operation with pretreatment;
- Data collection, entry, and reporting;
- Dechlorination system;
- Degasification system;
- SCADA; and
- Site walk through.

In November 2009, Revere Controls performed the Functional Demonstration Test on the pretreatment system. The test was witnessed by the City of Sanford and CDM. All functions were working properly and the pretreatment system was deemed fully operational.

CDM also prepared an O&M Manual detailing the pretreatment system (CDM, 2010). The manual describes the pretreatment system components, the operation, the maintenance required, and safety. Official startup occurred on January 25, 2010.

8.4 Permit Clearances

On February 25, 2009, FDEP cleared the ASR well for service. On November 9, 2009 FDEP issued clearance for the Dechlorination and Degasification System. Copies of the clearance documentation are included in Appendix F.

8.5 Transfer of Facilities to Cooperator

Certificates of Substantial Completion for the ASR system and the Pretreatment system are included in **Appendix E.**

Section 9
Cycle Operational Monitoring and Evaluations

9.1 Cycle Testing

The cycle testing program for the City of Sanford Aux (No. 2) WTP ASR project was developed to be consistent with FDEP UIC permitting process. The cycle testing program consisted of 4 cycles of injection, storage, and recovery of various durations, to allow for flexibility in the program and to condition the aquifer matrix with the injected water. As shown in **Table 9-1**, Cycle Tests 1 and 2 were designed for the injected water to reach the closest storage zone monitoring well (SZMW-1) to the ASR well, and of equal volumes. Cycle Tests 3 and 4 were designed to for the injected water to reach the farthest storage zone monitor well (SZMW-1), also of equal volumes.

Table 9-1
Cycle Testing Program for the City of Sanford ASR Project

Cycle	Injection Volume	Storage	Recovery Volume†	Total Estimated Days
	(MG)	(days)	(MG)	(max)
1	7 to 12	10 to 30	7 to 12	54
2	7 to 12	10 to 30	7 to 12	54
3*	32 to 64	30 to 60	32 to 64	188
4**	32 to 64	30 to 60	32 to 64	188
Totals	**110 to 152**	**105 to 180**	**110 to 152**	**484**

Recovery will continue to the specified volume or until the chloride concentration in the recovered water increases to 250 mg/L, whichever is reached first.

† Recovery volumes will not exceed the injection volumes

* Used to simulate operational conditions

Cycle Tests (CT) 1 through 4 have been completed. CTs 1 and 2 were conducted utilizing partial pretreatment (dechlorination with sodium bisulfite). CT 3 was conducted utilizing the Membrana pretreatment system for degasification, and partial use of sodium bisulfite for dechlorination. The dechlorination was discontinued during CTs 3 and 4 due to fouling of the Membrana Liqui-Cel® membrane contactors, in part due to overdosing sodium bisulfite and organics present in the source water.

CT 1 began on April 6, 2009 and was completed on May 29, 2009; CT 2 began on June 22, 2009 and was completed on August 14, 2009; and CT 3 began on January 1, 2010 and was completed on May 7, 2010. CT 4 began with injection on June 28, 2010. Injection was shut down on August 3, 2010 to clean the membrane contactors;

injection was resumed on August 18, 2010. CT 4 was completed on February 16, 2011. **Table 9-2** shows the injected volumes and durations for completed CTs.

Table 9-2
Cycle Testing Program Volumes for the City of Sanford ASR Project

Cycle	Injection Volume	Storage	Recovery Volume	Total Days
	(MG)	(days)	(MG)	(days)
1	11.6	30	11.9	57
2	10.7	30	11.3	55
3	44.6	30	45.5†	141
4	40.3	51	41††	220

†36.4 MG recovered to WTP for potable use
†† 40.5 MG recovered to WTP for potable use

As mentioned previously, fouling of the membrane contactors occurred during CT 3 and 4. Decreases in flow and DO removal during each cycle test occurred as a result. Initially, the sodium bisulfite used for dechlorination was suspected as causing the fouling of the membrane contactors. To determine the cause of the fouling, CDM and its contractors, Membrana and DPC performed many troubleshooting activities, including: changing out the membrane contactors, discontinuing the use of the sodium bisulfite dechlorination system, chemical analyses on the fouled membranes, and conducting mini pilot tests. The membrane contactors still failed after replacement with new contactors and discontinuing the use of the dechlorination system. Analyses led to the conclusion that the source of the fouling was organic materials in the finished potable water. Overdosing the system with sodium bisulfite also contributed to the fouling, which can be easily corrected. Membrana tested various cleaning agents and procedures in its internal laboratory, and established a cleaning procedure for the membrane contactors. This procedure was successfully utilized during CT 4, and is located in the "*Aquifer Storage and Recovery Pretreatment System Operations and Maintenance Manual for the City of Sanford, FL*" in Appendix F.

The ASR well and monitoring wells SZMW-1, SZMW-2, and CZMW-1 were sampled throughout CTs 1, 2, 3 and 4 in accordance with the UIC permit. The following is a summary of the results from CTs 1-4, additional details are located in the Cycle Testing Memos in Appendix F:

- During CTs 1, 2, 3, and 4, arsenic was detected in the ASR well above the maximum contaminant level (MCL) of 10 µg/L. However, during CT 3 and 4 recovered water did not exceed the MCL. Arsenic concentrations generally increased during the beginning of the storage period and decreased during the recovery period to below the MCL. Detected arsenic concentrations in the ASR well ranged from 2.8 µg/L to 39 µg/L, with overall arsenic concentrations decreasing with each successive cycle test. Background concentrations of arsenic in groundwater are generally in the range of 3 µg/L in Florida.

- Arsenic was detected in SZMW-1(farthest monitor well) during CT 1 through 4, but did not exceed the MCL. Arsenic was first detected on day 4 of injection during CT 1, day 11 of injection in CT 2, day 1 of injection in CT 3, and day 44 of CT 4. It should be noted that injection was stopped for approximately 16 days during CT 4 due to fouling and cleaning of the membranes. Generally, values returned to below detection limits during the end of the storage period and remained below detection limits during recovery. However, during CT 3 arsenic was detected twice at low concentrations (3.1 µg/L and 2.9 µg/L) during recovery. Detected arsenic concentrations in SZMW-1 ranged from 2.7 µg/L to 7.6 µg/L during CT 1, 3.1 µg/L to 3.3 µg/L during CT 2, 2.8 µg/L to 8.0 µg/L during CT 3, and 3.0 µg/L to 10.0 µg/L during CT 4.

- For SZMW-2 (closest monitor well), arsenic was detected during CT 1 through 4, but remained below the MCL. Arsenic was only detected once during CT 1 (3.1 µg/L). During CT 2, detected arsenic concentrations ranged from 2.7 µg/L to 3.8 µg/L, with the highest values occurring during the end of the storage period. During CT 3, detected arsenic concentrations ranged from 2.6 µg/L to 9.8 µg/L, with the highest values occurring during the injection period. During CT 4, detected arsenic concentrations ranged from 2.6 µg/L to 8.0 µg/L, with the highest values occurring during the injection period.

- Arsenic was not detected in CZMW-1 during CTs 1 or 2. Arsenic was detected sporadically in CZMW-1 during CT 3 and CT 4, but remained below the MCL. During CT 3, detected arsenic concentrations ranged from 2.6 µg/L to 4.7 µg/L. During CT 4, detected arsenic concentrations ranged from 3.1 µg/L to 3.5 µg/L.

- For the ASR well, during CTs 1 through 4, chloride concentrations were below background conditions (180 µg/L to 200 µg/L) at the beginning of the storage period and steadily increased during storage and recovery to near native groundwater chloride concentrations. This pattern also occurred for sodium and total dissolved solids (TDS) in the ASR well.

- For SZMW-1, chloride concentrations decreased during the injection period, indicating presence of the injected potable water, and increased during the storage and recovery periods during each cycle test, suggesting mixing with native groundwater and withdrawal of injected water during recovery.

- In SZMW-2, chloride concentrations decreased slightly with time during each cycle test, indicating minimal influence of the injected water.

- During CTs 1 through 4, iron concentrations increased above background conditions in the ASR well, with several exceedances of the MCL of 0.3 mg/L. During CT 3 and CT 4 iron concentrations returned to background conditions during the end of the recovery period.

- During CTs 1 through 4, manganese concentrations increase above background conditions in the ASR well, with two exceedances of the MCL of 0.05 mg/L during

the injection phase of CT 3 and two exceedances of the MCL during the injection phase of CT 4. Concentrations returned to background conditions during the recovery period of each cycle test.

The dechlorination results show that the dechlorination system successfully removed the chlorine residual from the injected water, and lowered the ORP thereby, bringing the injected water closer to native groundwater conditions. As demonstrated in CTs 1 and 2, successive cycle testing with dechlorination only showed a reduction in arsenic leaching in the ASR storage zone.

The degasification results show that degasification is successfully decreasing the DO of the injected water, bringing the injected water closer to native groundwater conditions and resulting in decreased arsenic concentrations compared to pretreatment with dechlorination alone. The injection volumes for CT 3 and 4 were four times higher than the injection volumes of CT 1 and 2, therefore impacting a greater area of the aquifer. The significant reduction in arsenic leaching during CT 3 and 4 demonstrates that reducing the DO of the injected water, thereby bringing the water closer to native groundwater conditions, is ideal for ASR success with regards to arsenic leaching.

Overall, the highest arsenic concentrations occur in the ASR well but remain below the MCL in the storage zone wells, indicating that compliance issues related to arsenic are contained to a close radius around the ASR well. Additionally, the decreases in arsenic concentrations from CT 1 to CT 2, CT 3, and CT 4 in the ASR well can be attributed to the attenuation of arsenic–containing minerals in the aquifer matrix in the storage zone during previous cycle tests, and the use of the degasification system in CT 3 and CT 4. These results are similar to other Florida ASR wellfields, where cycle test results have shown peak arsenic concentrations decrease with successive operating cycles, arsenic concentrations declining during extended storage periods, and elevated arsenic concentrations contained to a radius of about 350 feet from the ASR wells (Stuyfzand, 2008). Results of CT 3 and 4 showed that arsenic concentrations in recovered water were below the MCL and the facility is currently in compliance.

Changes in chloride concentrations compared to background concentrations in the native groundwater are due to lower concentrations of chloride in the injected potable water. The early decrease in chloride in SZMW-1 indicates that the injected water is reaching the far storage zone well. The quick rebound to initial chloride concentrations during the storage period may be due to a removal of the stored water from pumping that occurs during sampling events or due to mixing with native groundwater.

Water quality results show that CZMW-1 remained close to background conditions. The water level fluctuated however could be attributed to seasonal fluctuations. The water quality in SZMW-2 remained close to background conditions during CT 1 and 2 but showed some impacts with the larger concentration volumes during CT 3 and CT

4. This may be because the well is located upgradient of the ASR well and migration may have occurred predominately in the direction of groundwater flow.

Section 10
Preliminary Feasibility Determination and Conclusion

As part of its Districtwide water supply planning process, the SJRWMD sought to investigate several alternative water supply strategies to be used in conjunction with fresh groundwater to meet future potable water demands. ASR was identified as being an important component in the development of alternative water supplies in Florida, as it can potentially provide very large volumes of seasonal water storage, such as for excess wet-season surface water flows. As the District's program comes to a close, the ASR feasibility and testing program has resulted in many lessons learned and provided for growth potential for future ASR testing and water supply projects for several Cooperators

The results of from cycle testing of the Sanford Aux WTP ASR system have confirmed that ASR is feasible at the Sanford site. Recovered water was distributed to the public and supplemented the City's potable water supply. Based on the results of CTs 1 through 4, a fifth cycle test (CT 5) has been requested by FDEP. The injection and recovery volumes and storage times recommended for CT 5 are 120 MG of injected and recovered water with 30 days of storage. This larger volume will simulate the full-scale operating conditions of the system. It is recommended that recovered water initially be routed to Lake Ada to verify that arsenic concentrations are below the MCL of 10 µg/L, then routed to the Sanford Aux WTP for distribution to the public water supply. While not anticipated, if arsenic concentrations in the recovered water exceed the MCL of 10 µg/L, it is recommended that the recovered water be blended in a 1:3 ration with raw water from the WTP prior to distribution. To ensure that the blended water is below the MCL of 10 µg/L, lab sampling results for arsenic will need to be evaluated with a quick turnaround time. Alternatively, if concentrations are below the surface water standard of 50 µg/L water may be discharged to Lake Ada. However, it will not be possible to discharge the full volume of recovered water to Lake Ada, so a combination of routing water to Lake Ada as well as blending it for distribution may be necessary.

Degasification with the Membrana Liqui-Cel® membrane contactors was successful at minimizing arsenic leaching; however, the primary setbacks with the degasification system are the decrease in flow and decrease in efficiency of DO removal during each cycle test due to fouling of the membrane contactors. Cleaning of the membranes in accordance with the established cleaning procedure will be necessary. Cleaning frequency can generally be determined by system performance, such as flow rate decrease in 300 gallons per minute (gpm), pressure drop greater than 40 psi, and DO concentration greater than 1.2 milligrams per liter mg/L. It is anticipated that the membrane contactors will be require cleaning approximately every 30 days during and injection cycle. The City of Sanford is currently exploring upgrades to the Aux plant which may include Granulated Activated Carbon (GAC) and ozone treatment of

the raw water. These treatment processes have the potential to reduce the fouling of the membrane contactors.

Since the start of the District's ASR program, many developments both regulatory and institutional have been taken place, and many lessons have been learned regarding ASR operations and performance. The reduction of the drinking water arsenic standard from 50 µg/L to 10 µg/L, drove the need to seek a possible solution to mitigate or reduce arsenic leaching potential, thus pretreatment was instituted. The desire to allow continued development of ASR in Florida in light of this reduction in the maxim contaminant level of the arsenic standard, also led to the FDEP UIC Administrative Order (AO) process and conditions, including institutional control for possible migration of arsenic off property. This AO process followed issuance of the UIC permit for the City of Sanford Aux WTP ASR project. While the ASR system is located in the WTP site, there are adjacent neighbors within 200 ft of the ASR well. Future ASR site locations should have ample property line buffer to adjacent land owners to fully contain the zone of influence for ASR wells. The Aux WTP has been an ideal site with regards to fluid management to Lake Ada, which has allowed for adequate testing of the ASR and pretreatment systems.

The City of Sanford is currently in the process of obtaining a separate CUP for cycle testing and renewing the UIC Construction permit for this project for continued cycle testing and coverage under the AO for the next 5 years. The City will continue the cooperative process of developing its ASR and pretreatment systems with additional testing, training, continued vendor contact, and continued agency and industry contact. If the results of CT 5 or any subsequent CTs are consistent with CT 3 and 4, it is recommended that the City of Sanford apply for an operational permit for the system with FDEP. The City of Sanford recognizes that ASR will be an important storage/demand management resource tool to help meet future potable water demands.

Section 11
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Appendix A

St. Johns River Water Management District
Aquifer Storage and Recovery
Construction and Testing Program Plan

St. Johns River Water Management District

Aquifer Storage Recovery

Construction and Testing

Program Plan — FY 2002

St. Johns River Water Management District
and
Aquifer Storage Recovery Consultant Team:
Barnes Ferland & Associates, Inc.
Camp Dresser & McKee, Inc.
Water Resource Solutions, Inc.

Palatka, Florida
April 2002

St. Johns River Water Management District
Aquifer Storage Recovery
Construction and Testing Program Plan

1.0 Background

1.1 Introduction

The St. Johns River Water Management District (SJRWMD) in its 2000 District Water Supply Plan (DWSP) identifies the need for alternative water supplies other than fresh groundwater to meet projected future demands. Current SJRWMD groundwater modeling indicates that the increased use of groundwater to meet projected demands is likely to result in the potential for unacceptable impacts to water resources and related natural systems. The model results indicate Floridan aquifer potentiometric surface declines, reduction of spring flows, lowering of wetland and lake water levels, inland movement of saline water from coastal areas, and reduction of stream flows below minimum levels required to maintain natural systems.

The DWSP identifies surface water as one of the most cost-effective alternative water supply sources having significant capacity. Because of the seasonal variability of both quality and quantity, the use of surface water as a source of supply requires significant storage to provide a reliable supply. Other alternative sources such as seawater desalination could be developed to supplement existing freshwater supplies where needed — however, at higher cost. The use of reclaimed water or storm water for non-essential uses, such as lawn irrigation or agricultural irrigation, could also reduce the demand on limited fresh groundwater supplies.

The use of aquifer storage recovery (ASR) technology can be a cost-effective method of storing water. ASR provides a means of balancing the sources of water available for supply with the temporal aspects of water supply, water demand, and water quality. Successful ASR development generally requires that it be implemented as a component of an overall aquifer management plan. Water is stored during times when it is available, such as wet months when supply exceeds demand or when water quality is best, and is recovered during times when it is needed, such as dry months, emergencies, or when quality of water from other sources is poor. Water is stored and recovered through the same wells which, in Florida, usually penetrate the limestones of the Upper Floridan aquifer.

After appropriate development of the storage zone around an ASR well, approximately the same volume of water stored is typically recovered, without significant changes in water quality between the water recharged and recovered. The potential storage volume in the aquifer is essentially unlimited; however, care has to be taken to ensure that water level changes during recharge and recovery do not cause any significant adverse effects upon other wells or ecosystems. It is noteworthy that ASR can be developed close to the area of demand or in a more remote area for regional distribution.

The principal driving force behind ASR implementation has been its cost-effectiveness relative to other water storage alternatives, such as tanks and reservoirs, and water supply alternatives, such as demineralization/desalination of saline groundwater or surface water. The cost of meeting increasing peak demands with ASR is usually less than half the cost of meeting those demands with other water supply alternatives. An important secondary factor for ASR implementation has been its acceptance as an environmentally beneficial water management alternative. Some of the environmental benefits include reducing or eliminating the need for dams and surface storage reservoirs, reducing diversions from surface waters during low-flow periods, maintaining minimum flows and levels at lower cost, and reducing excess surface water discharge to coastal waters during wet weather periods.

ASR wellfields have been operating in the United States since the 1960s and in Florida since 1983, when the first system became operational in Manatee County. Ten ASR wellfields are now operating in Florida and about 30 more systems are in various stages of development. Within SJRWMD, the City of Cocoa ASR wellfield has been operational since 1987 and is now completing its third system expansion to 10 wells. Also, the Town of Palm Bay has a single ASR well that has been operational since 1989. Nationwide, about 50 ASR wellfields are operational, with at least 100 more in development. The largest ASR wellfield is in Las Vegas, Nevada, with a recovery capacity of about 100 million gallons per day (mgd). For the Everglades Restoration Plan in South Florida, an ASR capacity of about 1.7 billion gallons per day is planned.

For the SJRWMD ASR Construction and Testing Program, no regulatory changes are required to support proposed applications for construction and testing projects. Early coordination will be conducted with the Florida Department of Environmental Protection (FDEP) for permitting requirements. Water stored will comply with current federal and state regulations.

1.2 SJRWMD ASR Construction and Testing Program Goals and Objectives

The goal of the ASR Construction and Testing Program is to examine the appropriateness of integrating ASR technology into regional water resource and water supply development projects. Accomplishing this goal will require interfacing with governmental entities or private utilities that may actively participate, own, operate, or maintain a constructed facility arising out of this program. These entities are referred to as Cooperators. It is estimated that effective ASR could make economically feasible the use of multiple surface water or groundwater sources that may yield up to 350 mgd of additional resource. To achieve this goal, SJRWMD has identified several objectives that must be met:

- Determine the extent to which ASR can be applied to meet local or regional water supply needs through use of alternative water supplies (i.e., surface waters, reclaimed waters) in addition to limited groundwater supplies.
- Establish the fundamental criteria for successful application of ASR in SJRWMD.
- Provide test sites for a variety of applications in order to identify and address the different issues (e.g., permitting/regulatory, technical, logistics, political) unique to each application.

- Identify and secure Cooperators, through executed agreements, to participate in ASR construction and testing which would result in development of a functional ASR facility to be used by the Cooperator at the conclusion of the testing period.
- Demonstrate the extent to which ASR can be safely and successfully used within SJRWMD.

The desire of SJRWMD is to examine a broad range of ASR applications and alternative water sources. Possible ASR applications include such things as providing storage to meet seasonal supply and demand variations; supplementing water supplies for coastal communities; providing salinity intrusion control; maintaining minimum flows and levels in surface waters, wetlands, and other natural systems; impact avoidance; and agricultural irrigation. All of these ASR applications are currently in use at various locations in Florida or elsewhere in the United States.

Subject to regulatory requirements, such as treatment to meet water quality criteria, sources may include, for instance, drinking water from fresh water sources, drinking water from desalinated brackish or seawater sources, surface water from lakes and rivers, reclaimed water, groundwater from overlying or underlying aquifers, and groundwater from the same aquifer at distant locations where the water is fresh.

2.0 ASR Construction and Testing Program and Process

2.1 Framework for Selecting ASR Construction and Testing Projects

Criteria for inclusion of projects in the ASR Construction and Testing Program have been established based upon water use characteristics and the hydrogeology of the proposed project site. Those projects deemed by SJRWMD to be the more likely to contribute to successful achievement of regional water management goals are more likely to be selected for inclusion.

SJRWMD has established a process that allows for participation in the program by Cooperators. Participation in the program is guided by establishing the respective responsibilities for both SJRWMD and each Cooperator. SJRWMD may solicit participation by certain Cooperators whose participation is deemed essential to accomplishment of the program's goals and objectives. Others interested in participating in the program are encouraged to apply for consideration by submitting a letter of interest to SJRWMD. SJRWMD and its consultant team will screen proposed projects to ensure that the projects comply with SJRWMD's goals and objectives and will make decisions concerning inclusion of the proposed project in the program.

The primary feasibility factors in the Cooperator screening process are described in SJRWMD Special Publication SJ97-SP4 titled *A Tool for Assessing the Feasibility of Aquifer Storage Recovery* (CH2MHILL, 1997). These factors are highlighted in Sections 2.2 and 2.3 of this document.

2.2 Facility Planning Factors

The facility planning factors include the demands, supply, and storage needs associated with a Cooperator's water system service area.

- **Demand** — A Cooperator's demand consists of projected capacity and temporal water use patterns. A Cooperator's demand should be large enough (>1 mgd) to justify the expense of an ASR facility in lieu of conventional storage tanks.

- **Supply** — A Cooperator's water supply consists of the groundwater and/or surface water withdrawals authorized by allocations established through the SJRWMD consumptive use permitting process.

- **Storage Requirement** — A Cooperator's storage requirement is determined through evaluation of its historical average supply and demands. A Cooperator's storage requirement can be long-term storage, in which a Cooperator wishes to store excess water which is withdrawn in the future to offset the need for infrastructure expansion, or seasonal storage, in which a Cooperator wishes to store water during wet seasons and withdraw water during dry seasons.

- **Proposed Use** — A Cooperator's proposed use of ASR, as demonstrated by inclusion in a master plan or other similar document, is to provide storage to meet its future use projections using available water supply sources, in accordance with the DWSP.

2.3 Hydrogeologic Factors

The hydrogeologic feasibility factors used to evaluate an ASR storage option include storage zone confinement, transmissivity, aquifer gradient and direction, recharge and native water quality, and interfering uses and impacts.

- **Storage Zone Confinement** — The presence and degree of vertical confinement of an aquifer proposed for an ASR storage zone is important to determinations of the degree to which an ASR system can be protected from impacts and effects of external sources of contamination or competing withdrawals above or below the storage zone.

- **Storage Zone Transmissivity** — Transmissivity is a measure of water flow rate through the aquifer media. Storage zone transmissivity should be sufficiently high so that a volume of water can be injected at reasonable wellhead pressures and the same volume of water can be recovered from the storage zone without excessive drawdown in the wells. Additionally, optimal transmissivities should be sufficiently low to allow for the creation of discrete buffer and storage zones and avoid loss of stored water due to migration away from the well or significant mixing with poor/brackish quality native water.

- **Aquifer Gradient and Direction** — The aquifer gradient of a proposed site's storage zone identifies the direction of groundwater flow and any external influence from sources (e.g., recharge areas) and sinks (e.g., operating wellfields, springs). Additionally, the higher the gradient, the more likely stored water will migrate away from the well, potentially resulting in a poor recovery efficiency if the storage zone is in a brackish aquifer. Optimal gradient in the storage zone should be such that the stored water stays close to the well between recharge and recovery.

- **Recharge and Native Water Quality** — Recharge water quality determines the level of treatment that may be required prior to storage. Of critical concern is the potential for storage zone plugging due to recharge water solids content, nutrient and biological content (biofouling), and carbonate geochemistry. For SJRWMD's program, the recharge water quality must meet applicable federal and state standards.

  Native water quality is an important factor in the determination of buffer and storage zone volume requirements and recovery efficiency. For example, the higher the salinity concentration of the native water, the larger the volume of recharge water required to establish the buffer zone. Additionally, native water salinity can impact the thickness of stored water in the storage zone due to the effects of density stratification within the storage zone. For example, freshwater stored in a zone with highly saline native water could result in a very thin layer of freshwater at the top of the storage zone and brackish to saline water throughout the remainder of the zone's vertical depth. This situation would, in turn, reduce recovery efficiencies.

- **Interfering Uses and Impacts** — Interfering uses result primarily from other supply wells in the vicinity of the ASR system that directly withdraw from an ASR storage zone or cause a change in the gradient that, in turn, causes migration of stored water out of the storage zone.

  Impacts are considered to be any current or future contamination of the aquifer storage zone. The distance to any supply or injection well in the same aquifer zone and the distance to any contamination zone influence this factor.

SJRWMD will use these hydrogeologic and facility-planning factors as screening factors when considering potential Cooperators and proposed sites for ASR construction and testing.

2.4 Candidate Projects

SJRWMD and its consultant team have identified the following initial potential candidate projects for the ASR Construction and Testing Program:

Volusia County ASR Project — This project is proposed in association with SJRWMD's St. Johns River Water Supply Project. Successful development of water supplies from the St. Johns River is likely to depend largely on the feasibility of utilizing ASR as the primary storage technique.

Seminole County ASR Project — This project is associated with SJRWMD's St. Johns River Water Supply Project. Successful development of water supplies from the St. Johns River is likely to depend largely on the feasibility of utilizing ASR as the primary storage technique.

City of Cocoa Reclaimed Water ASR Project — This project is proposed to examine the feasibility of ASR as an effective means of storing reclaimed water during periods of excess supply for recovery and use during periods of short supply.

This document will be revised to add additional candidate projects as those projects are identified.

3.0 Project Funding

SJRWMD has developed a budget of $11.82 million for ASR construction and testing for the fiscal year 2002–2006 period. Projects are proposed to be accomplished with SJRWMD ad valorem and Florida Forever funds as well as Cooperator funding in the form of in-kind services and/or cash contributions currently estimated at approximately $7.90 million, for a total program budget of $19.72 million (Table 1).

Current legislation restricts the use of Florida Forever funds to construction components of the project. Planning and design costs must be funded using ad valorem and Cooperator funds. It is SJRWMD's intent to leverage the Florida Forever funds as much as possible by favoring proposed Cooperators who are willing to provide in-kind services and direct financial contributions for projects that are deemed by SJRWMD to contribute toward achieving the goals of the program. Additionally, those potential Cooperators who apply earlier are more likely to achieve funding than those who apply later. It is estimated that the current total program funding should be sufficient to provide for at least nine ASR investigations and possibly more, depending on the extent to which Cooperators are willing to share the cost.

Table 1. SJRWMD ASR Construction and Testing Program proposed funding for fiscal years 2001 to 2006 (in dollars)

	Total for Period	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006
Sources ($ million)							
SJRWMD ad valorem	0.350	0.000	0.350	0.000	0.000	0.000	0.000
Florida Forever	11.471	2.375	1.596	2.500	2.500	2.500	0.000
Cooperators	7.898	1.834	1.064	1.667	1.667	1.667	0.000
Total	**19.719**	4.209	3.009	4.167	4.167	4.167	0.000
Disbursements ($ million)	**19.719**	0.000	6.219	4.167	4.167	4.167	1.000

4.0 Project Implementation

4.1 Responsibilities of SJRWMD

SJRWMD will be responsible for selecting those projects to be included in the ASR Construction and Testing Program and for funding a portion of each project. SJRWMD will also be responsible for coordination between governmental agencies and other entities that may be involved in the ASR Construction and Testing Program. As part of this coordination, SJRWMD will take the lead in the negotiation of complex regulatory issues that may arise pertaining to ASR implementation at each site.

Additional SJRWMD responsibilities will depend upon the agreement to be developed between SJRWMD and each Cooperator. It is anticipated that SJRWMD will provide funding for planning, design, permitting (including permit fees), construction, testing, startup, and initial operations of ASR facilities (including operator staff training and transferring operation of the facilities to the Cooperator after the test program and initial startup are completed). Alternatively, SJRWMD may provide funding to the Cooperator, who would then complete ASR project development with review and approval of progress at selected checkpoints during the term of the project.

The assigned roles of SJRWMD and the Cooperator will be established in advance for each site as conditions of the Cooperator agreement. SJRWMD's consideration of a Cooperator's proposal to participate in the program will be influenced by the extent to which the Cooperator demonstrates a willingness to provide direct financial contributions or in-kind services and a commitment to the long-term operation of the ASR facilities.

4.2 Responsibilities of the Cooperator

The Cooperator will be responsible for providing an ASR facility site and appropriate logistical support to include, at least, facility access, a suitable source of water for testing and operations, power supply, and disposal of recovered water during initial testing and also during operational startup. In general, water supply sufficient to conduct the ASR investigations requires the ability to store at least 50 million gallons of water during a typical recharge season.

Support could also include direct financial contribution toward project costs, particularly to the extent that the Cooperator wishes to assume responsibility for directing activities at its site. Support may also include in-kind services such as assistance during sampling, monitoring, and other testing and operational activities, which could vary from minor assistance during initial portions of the testing program to primary responsibility during later portions of the testing program.

Upon completion of the ASR project, the Cooperator will be responsible for continued operation of the ASR facilities, assuming that their operational success has been demonstrated during the test program. The assistance of the Cooperator in helping to resolve regulatory issues would also be expected, including preparation for and participation in agency meetings.

4.3 Project Tasks

SJRWMD has developed a detailed list of standard tasks for its ASR projects. This list of standard tasks is based upon the process utilized for successful completion of 10 operational ASR systems in Florida and 40 others throughout the United States. A brief summary is included in this document as a guide to potential Cooperators and others who may be interested. A full copy of the task list is included as Exhibit A. This list will be adapted to individual needs and opportunities at each site. It should be noted that some tasks may require greater emphasis and some will require less. Additionally, it is possible that individual needs at selected potential ASR sites may require additional tasks not identified on this list.

Each project will include project coordination, management, and other meetings.

Task 1 — ASR Construction and Testing Program Plan
The ASR Construction and Testing Program Plan is intended to be suitable for distribution to policy makers, potential Cooperators, interest groups, and the technical community. It includes a description of evaluation criteria for potential projects and a preliminary listing of regional candidate projects. This plan will be revised as necessary.

Task 2 — Project Evaluation and Site Selection
This task includes a desktop project feasibility assessment based on the assessment approach described in SJRWMD Special Publication SJ97-SP4 titled *A Tool for Assessing the Feasibility of Aquifer Storage Recovery* (CH2MHILL, 1997). If the assessment indicates that the project is feasible, the project will advance to the preparation of a Cooperator Agreement. If the project is deemed to be not feasible, it will not be further considered.

Task 3 — Cooperator Agreement
An agreement that establishes the objectives of the project and the responsibilities of SJRWMD and the Cooperator will be developed. This task also includes preparation and presentation of project information to Cooperator decision makers.

Task 4 — Site-Specific Data Collection and Preliminary System Design
This task includes site-specific data collection and preliminary system design. A data collection plan for each site will be prepared based on a review of existing information and coordination with FDEP. In particular, the plan shall address the need for initial exploratory testing as the basis of development of ASR well design criteria and whether such exploratory testing may be conducted without having to first obtain all permits for the subsequent ASR system. To the extent possible based on FDEP guidelines, SJRWMD proposes to gather hydrogeologic information from the construction and testing of an initial test well at each site, which would then be converted to an observation well for the ASR construction and testing program. The data collection plan will be implemented, the data will be evaluated, and a preliminary system design will be developed.

Task 5 — ASR Pilot Project Design
This task includes the design of well and wellhead facilities at the selected site, including the proposed data collection and monitoring programs.

Task 6 — Regulatory Permitting
SJRWMD, and its cooperators and consultants, will adhere to the necessary regulatory permitting requirements, including preparation of permit applications, and responses to requests for information from regulatory agencies. The primary permitting effort will be through FDEP.

Task 7 — ASR Facilities Construction, Monitoring, and Testing
This task includes construction of ASR and monitor wells, and associated wellhead facilities. Initial hydraulic and water quality testing would be conducted, in addition to geophysical logging, geochemical modeling, and evaluation of any additional pretreatment requirements. A series of ASR test cycles would then be conducted to address technical and other issues pertaining to each site.

Task 8 — Startup and Training
SJRWMD's consultant will provide operational training of Cooperator staff to ensure a smooth transition from the test program into full operations.

Task 9 — Large Cycle Operational Monitoring and Evaluations
Operational monitoring and evaluation of ASR system performance will be conducted during the first two to three years of operations, making any needed adjustments to improve system performance. The Cooperator will be operating the system during this period.

Task 10 — Peer Review of ASR Consultant Team Work
This task includes the review of work products produced by ASR consultant team members by other team members as considered necessary by SJRWMD.

4.4 Project Schedule

Each project will have its own schedule, to be established during initial planning. For typical ASR projects in Florida, the schedule requires about three years, within a range of 2 to 5 years. Upon completion, the ASR facility is fully operational and fully permitted. A typical timeline is illustrated in Table 2.

Initial planning and feasibility assessment typically requires about 3 to 6 months, although shorter periods are reasonable in situations where existing ASR facilities are already in operation nearby.

Agreements with Cooperators and the completion of preliminary design efforts can be accomplished in 3 to 6 months.

Facilities final design typically requires about 2 to 6 months, during which time permit applications may be submitted.

Final permit approval for ASR systems complying with current water quality standards may require from 4 to 12 months from initial submittal, depending upon the number and scope of requests for information (RFIs) made by the permitting agencies. If there exists any public opposition, the permit issuance may be delayed until the public opposition issues are sufficiently addressed.

Bidding requires approximately 2 to 4 months and construction typically requires 4 to 8 months, depending upon the complexity of the facilities, the number of bid packages, and the project delivery method.

ASR testing duration will depend upon the conditions at each site, and will vary between sites. However, a typical duration for ASR testing is about 6 to 12 months, followed by operational startup. Experience has demonstrated the wisdom of providing close monitoring of operational performance during at least the first year of full operations.

Table 2. Aquifer Storage Recovery (ASR) project schedule

Task	Duration (days)
ASR Construction and Testing Program Plan	1
Project Evaluation and Site Selection	69
Cooperator Agreement	67
Site-Specific Data Collection and Preliminary Design	70
ASR Pilot Project Design	53
Regulatory Permitting	93
ASR Facilities Construction, Monitoring, and Testing	140
Startup and Training	67
Large Cycle Operational Monitoring and Evaluations	262

EXHIBIT "A" – SCOPE OF SERVICES

The St. Johns River Water Management District (DISTRICT) is implementing the District Water Supply Plan (DWSP). Successful development and implementation of Aquifer Storage Recovery (ASR) as a component of that plan is critical. In order to successfully evaluate and account for hydrogeologic variations and source water quality, it is important to establish a comprehensive, yet flexible, approach to consistent analysis of different projects, locations, and uses. Tasks may include interface with governmental entities or private utilities that may actively participate, own, operate, or maintain a constructed facility arising out of this project. These entities are referred to as co-operators. The task list provided herein provides an outline for consistent analysis and feasibility assessment at various sites through a full-scale ASR Construction and Testing Program. The site characteristics and conditions for each potential project will dictate the specific scope of work necessary to fully investigate the feasibility of ASR at a project location.

The following tasks A and B, and their subtasks are generic project tasks for routine meetings and other tasks not specifically associated with ASR but required by DISTRICT during the course of any Water Supply or Water Resource Development Project.

Task A. **Project Coordination, Management, and Meetings**

The purpose of this task is to provide for project management and coordination, including meetings of concerned parties. Also included in this task is the development of, and participation in, workshops designed to communicate the purpose and progress of the ASR Construction and Testing Project to the public, as well as to provide document production support to DISTRICT as needed.

The District's Office of Communications must approve all outreach tasks. Coordination must occur with the Office of Communications in a timely manner to provide opportunities for appropriate review. All media calls must be referred to the District's Office of Communications.

Task A.1 Project Progress Meetings

CONTRACTOR shall prepare for, attend, and participate in project coordination and progress meetings, as scheduled by DISTRICT, related to the work performed pursuant to this AGREEMENT. This will include preparation of monthly progress reports describing recent developments along with updates of the project schedule. The primary purpose of these meetings is to provide project coordination, scheduling, and needed information exchange among the ASR project work efforts. A total of two quarterly progress meetings and two quarterly progress teleconference meetings are anticipated each year of the contract. This task represents the face-to-face meetings portion of the task.

Task A.2 Teleconference Meetings

CONTRACTOR shall prepare for and participate in periodic teleconference meetings as needed for the purpose of reporting progress and exchange of information among the interrelated ASR Construction and Testing work efforts. A total of two face-to-face quarterly progress meetings and two quarterly progress teleconference meetings are anticipated each year of the contract. This task represents the teleconference meetings portion of the task.

Task A.3 Recurring Program Meetings

CONTRACTOR shall prepare for, attend, and participate in program progress meetings as scheduled by DISTRICT for the purpose of reporting progress and exchange of information among all parities involved in water supply planning and implementation within the DISTRICT. The primary purpose of these meetings is to provide project coordination, scheduling and needed information exchange among the many related DISTRICT water supply initiatives. This will include currently ongoing initiatives as well as initiatives begun during the course of the ASR Construction and Testing Contracts. The DISTRICT may schedule up to three such meetings each year.

Task A.4 Public Workshops

CONTRACTOR shall prepare for and participate in up to a total of three (3) public workshops per project, as scheduled by DISTRICT, designed to inform interested parties in the DISTRICT regarding the purpose and progress of the ASR Construction and Testing project. Coordination is required with the District's Office of Communications as addressed in Task A.

Task A.5 Other Meetings

CONTRACTOR shall prepare for and participate in other meetings, as may be needed, as determined by and assigned by DISTRICT's Project Manager for reporting the purpose, and or progress, of the ASR Construction and Testing project to interested individuals or groups. Coordination is required with the DISTRICT's Office of Communications as addressed in Task A.

Task A.6 Document Production Assistance

CONTRACTOR shall prepare fact sheets, brochures, presentations, or other documents, as may be needed, for the purpose of providing project information in support of DISTRICT public outreach programs, or other related report preparation activities, as authorized by DISTRICT Project Manager. Coordination is required with the District's Office of Communications as addressed in Task A. Materials, as required, shall be converted to web-compatible format and transmitted electronically to DISTRICT staff for inclusion in a DISTRICT-maintained web site.

Task B. **<u>Water Supply Program and Technical Assistance</u>**

The ASR Construction and Testing project activities may interface with many other ongoing DISTRICT water supply program activities including, but not limited to the following:

- Groundwater hydrologic modeling
- St. Johns River minimum flows and levels (MFL's) determination
- Facilitated decision making process
- ASR Construction and Testing (by others)
- St. Johns River Water Supply Project

It is likely that issues related to the many ongoing DISTRICT water supply program initiatives will arise during the course of the ASR Construction and Testing project. This task provides for addressing these issues as they may arise. Upon receipt of written instruction, referred to as DISTRICT Supplemental Instructions (DSI), from DISTRICT's Project Manager, CONTRACTOR shall assist DISTRICT in the evaluation of water supply program issues or strategies, and shall prepare documentation in conformance with guidelines provided by the DISTRICT's Project Manager. The schedule for completion of each document shall be included in the DSI.

Task 1 - ASR Work Plan

1.1 Develop ASR work plan describing ASR program suitable for distribution to policy makers, interest groups, and technical community. Work Plan shall include:

1.1.1 Executive summary

1.1.2 Program goals and objectives

1.1.3 Funding and participation requirements

1.1.4 Project selection process

1.1.5 DISTRICT and cooperator responsibilities

1.2 Develop evaluation criteria for potential projects that are compatible with DISTRICT goals.

1.3 Provide in plan a list by region of the candidate areas from which ASR projects of specific types will likely be chosen.

1.4 Deliverables:

Draft and Final ASR work plan document as described in section 1.1.

1.5 Decision Process:

Work plan shall be evaluated by DISTRICT staff for sufficiency and modified as necessary by CONTRACTOR before publication by DISTRICT. The DISTRICT will assign regional candidate sites or potential utility cooperator(s) to the CONTRACTOR for proceeding with the next task.

Task 2 - Desktop project/site feasibility and selection assessment.

2.1 Perform desktop assessment of assigned candidate ASR project(s). Sites will be assessed using criteria developed in Task 1.2. The assessments will include evaluation of the following:

2.1.1 Project objectives (i.e., natural systems impact mitigation, seasonal storage and recovery, long term aquifer recharge, saltwater intrusion barrier, etc.).

2.1.2 Water supply availability for ASR testing and long-term operation:

2.1.2.1 Pipe size and delivery pressure

2.1.2.2 Seasonal availability

2.1.2.3 Water supply trends

2.1.3 Water demands, including variability and demand center location relative to supply source, ASR well site, and treatment/distribution facilities.

2.1.4 Quality of source water (including seasonal variability) and treatment requirements of both recharged and recovered water.

2.1.5 Hydrogeology of proposed ASR system (including water quality, well inventory and potential hydrologic impacts such as interference effects).

2.1.6 Required ASR system capacity and storage volume requirements to achieve project objectives.

2.1.7 Conceptual design of ASR system (including cycle testing and monitoring requirements) at a level sufficient to identify site logistics (i.e., piping, electrical service provision, pumping, etc.).

2.1.8 Preliminary cost estimate (capital and operating). The cost estimate shall include a percentage-based allowance for final design, construction engineering, and inspection.

2.1.9 Preliminary appraisal of other non-technical issues (regulatory, environmental, community, land acquisition, and political support/opposition).

2.2 Prepare preliminary plans for site-specific hydrogeologic testing program (test well) with a construction cost estimate.

2.3 Deliverables:

Draft and final Technical Memorandum evaluating the technical and regulatory feasibility of assigned potential ASR project, a cost estimate (including the cost to cooperator) and an evaluation of the degree to which the project meets the construction and testing ASR program goals of the DISTRICT. The draft will be peer reviewed by the other DISTRICT CONTRACTORs and the DISTRICT.

2.4 Decision Process:

Pending the results of the collaborative CONTRACTOR peer review, a recommendation of the project feasibility and appropriateness of combining subsequent tasks will be determined. A decision by DISTRICT whether or not to proceed to next task will be made and subsequent task cost negotiated.

Task 3 - Cooperator Agreement

3.1 Submit Technical Memorandum (Task 2) to proposed Cooperator and meet to discuss ASR system objectives, conceptual design, testing program, DISTRICT-specific data collection and costs. The Technical Memorandum shall establish Cooperator goals and success criteria.

3.2 Prepare draft agreement with proposed Cooperator and submit to DISTRICT for review and comment. After DISTRICT approval, present draft agreement to Cooperator and assist DISTRICT in negotiations.

3.3 Present project before city/county commission/council/Cooperator to support staff in obtaining project agreement approval.

3.4 Deliverables:

Draft agreement between DISTRICT and Cooperator.
Attendance at meetings/presentations.

3.5 Decision Process

Pending the successful execution of a cooperative agreement between the DISTRICT and cooperator, the CONTRACTOR will be authorized to proceed to the next task.

Task 4 - Site-specific data collection and preliminary system design.

The approach outlined in Tasks 4 and 5 reflects the desire of the DISTRICT to coordinate with the Florida Department of Environmental Protection (FDEP) in the early stages of the test program development. The exact scope of work activities will vary dependent on specific site characteristics and conditions. The DISTRICT may authorize the CONTRACTOR to combine Task 4 and Task 5 in order to reduce costs, if the likelihood of successful permitting is sufficient to warrant the additional expenditure.

4.1 Develop and/or coordinate regulatory strategy for intended ASR permit application.

4.2 Identify agency and permit requirements applicable to site and intended use. Develop checklist of requirements.

4.2.1 Obtain FDEP – Exploratory Well Construction and Testing Permit if required. This would become one of the required monitor wells for operation. If required to enter the Underground Injection Control (UIC) permit program, then the CONTRACTOR will submit an application for the Exploratory Well Construction and Testing Permit with the appropriate information required. Such information will include, but may not be limited to, (1) a conceptual plan of the project, (2) a preliminary area of review study, (3) proposed other uses of exploratory well, (4) drilling and testing plan for the exploratory well, and (5) an abandonment plan, if needed. If it is determined that sufficient information exists at the site to omit Task 4, then the scope will follow the tasks outlined in Task 5 – ASR Pilot Project Design.

4.3 Construct test well and obtain site-specific hydrogeologic data. The DISTRICT may elect to self-perform this sub-task. The obtained data shall include:

4.3.1 Analysis of well cuttings.

4.3.2 Geophysical logging

4.3.3 Water quality

4.3.4 Cores and/or packer tests

4.3.5 Step drawdown test

4.4 Perform compatibility analysis that includes core analysis, geochemical compatibility analysis and modeling, and analysis that considers both the test water and alternative source waters.

4.5 Perform analyses to establish pre-treatment requirements of potential sources of recharge water.

4.6 Revised impact analysis (2.1.5), which may include preliminary hydraulic modeling.

4.7 Deliverables:

Draft and final Technical memorandum including the results of the testing program, a revised feasibility analysis (based on site-specific data), preliminary ASR system design, and revised cost estimate. The draft will be peer reviewed by other DISTRICT CONTRACTORs, the DISTRICT, and the cooperator.

4.8 Decision Process

Determination and recommendation by CONTRACTOR, peer reviewed by other teams, on whether project should proceed based on test results.

Pending the results of the collaborative CONTRACTOR peer review, a recommendation of the project feasibility and the appropriateness of continuing the project will be determined. A decision by DISTRICT whether or not to proceed to next task will be made and subsequent task costs may be negotiated.

Task 5 - ASR Pilot Project Design

5.1 Develop ASR and monitor well drilling and testing program (including all coring, packer testing, logging, laboratory analyses, special procedures etc.).

5.2 Finalize siting issues and design ASR and monitor wells (allowing for variations in geologic conditions).

5.3 Develop drilling and testing fluid management program.

5.4 Design surface facilities for pumping, pretreatment, post recovery treatment etc.

5.5 Develop cyclical testing and operational program.

5.6 Develop monitoring program.

5.7 Deliverables:

Well construction and testing program for the monitor/exploration well(s) and ASR well; designs for surface facilities; and operational and monitoring program. This information may be used in the permitting documents.)

5.8 Decision Process

Upon delivery by CONTRACTOR of program documents, review and comment will be conducted by FDEP and it will be peer reviewed by other DISTRICT CONTRACTOR teams.

Upon completion of a monitoring program that is satisfactory to FDEP, the DISTRICT will make a decision on whether to proceed with regulatory permitting.

Task 6 - Regulatory Permitting

6.1 Prepare permit applications with appropriate supporting documentation. Respond to requests for information.

6.2 Coordinate with appropriate agencies and gain approval for disposal of pumped water used in testing, and supply other information as required.

6.3 Deliverables

Permit applications.
Responses to request for additional information.
Permits.

6.4 Decision Process:

Pending successful issuance of FDEP UIC permit and the ability to move the project forward in a timely manner, a decision by DISTRICT whether or not to proceed to next task will be made and subsequent task cost may be negotiated.

Task 7 - ASR Facilities Construction, Monitoring and Testing

7.1 Construct ASR well and monitoring wells, and/or provides resident observation and construction services, depending upon the project delivery approach selected for each site. The DISTRICT may elect to self-perform the well construction portion of this sub-task.

7.2 Construct surface facilities, and/or provide resident observation and construction services, depending upon the project delivery approach selected for each site.

7.3 Prepare well completion report.

7.4 Implement monitoring plan, including sampling and laboratory analysis in accordance with FDEP-approved Comprehensive Quality Assurance Plan.

7.5 Perform field activities including geophysical logging, packer tests, coring and core analysis, specific capacity tests, well acidization, step pumping and step injection tests, and aquifer performance test as applicable on ASR and monitoring wells during well construction. The DISTRICT may elect to self-perform this sub-task.

7.6 Perform short-term "calibration cycle" recharge, storage, and recovery testing on ASR system. Provide start-up of operations, troubleshooting, and verification of treatment equipment operation, injected water quality. Evaluate well performance and potential needs for system adjustments.

7.7 Confirm/evaluate geochemical compatibility of proposed source water with native water and geologic formation.

7.7.1 Geochemical compatibility analysis should include core analysis, geochemical analysis and modeling in conjunction with alternative source waters.

7.8 Evaluate treatment requirements of recharged water and recovered water after withdrawal from ASR well and make adjustments as necessary.

7.9 Evaluate well performance with respect to recovery from first cycle and compare to earlier predictions. Calibrate ASR performance model to predict performance of future cycles.

7.10 Prepare final report on hydrology, geology, well performance, cycle testing and impacts in conformance with federal, state, and local permits.

7.11 Prepare operations and maintenance manual, and record drawings for well and wellhead construction.

7.12 Deliverables:

7.12.1 Constructed facilities.
7.12.2 Well completion report.
7.12.3 Monthly Progress Reports for testing and monitoring results.
7.12.4 Final report describing: Monitoring and facility test results (monitoring and testing data provided as appendices).
7.12.5 Long-term monitoring requirements.

7.13 Decision Process:

Pending successful construction and demonstration that the test ASR facilities are functional and capable of enhancing cooperator's operations, and any outstanding permitting issues have been addressed to the appropriate commenting agencies, the DISTRICT will make a decision whether to proceed with Task 8.

Task 8 - Start-up and Training

8.1 Provide start-up services to assist with initial operations, monitoring, data reporting, and operational adjustments, as needed.

8.2 Provide training to Cooperator staff responsible for future operation.

8.3 Deliverables:

Training programs for Cooperator staff.

8.4 Decision Process

Pending the CONTRACTOR's recommendation as to whether or not the cooperator is capable of operating and monitoring the test ASR facility in order perform the large cycle testing, a decision by DISTRICT whether or not to cooperate in large-cycle operational monitoring and evaluations will be made.

Task 9 - Large Cycle Operational Monitoring and Evaluations

9.1 Oversee operation and monitoring of operational cycles as needed (preferably 2 years or 3 large cycles). Operational monitoring should encompass a minimum of 2 large cycles. Large cycle is defined as one design cycle.

9.2 Prepare performance report for each cycle with analysis of well behavior and outline any issues that could jeopardize or improve injection process.

9.3 Address significant differences between predicted and actual recovery and make appropriate calibrations to the operational performance model. Indicate actions that might be taken to improve the system operation and performance.

9.4 Deliverables:

Assessment report on system performance.

9.5 Decision Process

Deliverables only.

Task 10 - Peer review of other ASR CONTRACTOR teamwork as determined by DISTRICT.

10.1 As directed by DISTRICT, CONTRACTOR shall review work product of other ASR CONTRACTOR teams and provide comments to DISTRICT.

10.2 Deliverables:

Review comments in letter format.

10.3 Decision Process:

None – Deliverables only.

Appendix B

Memorandum of Understanding

MEMORANDUM OF UNDERSTANDING BETWEEN
THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
AND CITY OF SANFORD, FLORIDA
FOR
AQUIFER STORAGE RECOVERY CONSTRUCTION AND TESTING

THIS MEMORANDUM OF UNDERSTANDING ("MOU") is made and entered into by and between the ST. JOHNS RIVER WATER MANAGEMENT DISTRICT (the "District"), whose mailing address is 4049 Reid Street, Palatka, Florida 32177, and CITY OF SANFORD, (the "City"), whose address is 300 North Park Avenue, Sanford, Florida 32772.

WITNESSETH:

WHEREAS, the parties to this MOU desire to design, permit, and construct an Aquifer Storage and Recovery ("ASR") system ("Project");

WHEREAS, the District and the City each have programmatic authority and established funding sources to cost-share this project;

WHEREAS, a goal of the Project is to demonstrate that ASR is a feasible technology for utilities in the east-Central Florida region; and

WHEREAS, the District and the City agree the District shall serve as the lead agency for the design, permitting, construction, and testing of the ASR project.

NOW THEREFORE, in consideration of the foregoing premises, which are made a part of this Memorandum of Understanding, the District and the City hereby agree to the following:

I. AUTHORITY:

This Memorandum of Understanding is entered into by the parties under the following authority:

A. The District enters into this Memorandum of Understanding under the authority of Section 373.083, Florida Statutes, which authorizes the Governing Board to enter into agreements with other public agencies to accomplish the directives and goals of Chapter 373.

B. The City enters into this Memorandum of Understanding under the authority of Sections 125.01(1)(k)1, and 125.01(1)(p), Florida Statutes, which authorize the City to enter into agreements with other public agencies to accomplish goals for providing water to its customers.

II. STATEMENT OF WORK:

All work shall be performed in accordance with Exhibit "A", Statement of Work. All work shall be performed by the District's Contractor under District Contract #SF409RA.

III. EFFECTIVE DATE, TERM, AMENDMENTS, TERMINATION:

A. This MOU shall commence on the date of full execution as evidenced by the last date this MOU is signed, and shall remain in effect for five (5) years, in accordance with this MOU.

B. This MOU shall be reviewed annually by the parties and may be amended upon mutual agreement of the parties. Amendments shall be in writing and approved by all parties.

C. Termination for convenience. This MOU may be terminated for convenience by the District upon 30 days prior written notice to the City.

D. Termination for Default. This MOU may be terminated for default in writing by either party in the event of substantial failure by the other party to fulfill its obligations under this MOU through no fault of the terminating party, provided that no termination may be effected unless the other party is given: (1) not less than ten (10) calendar days written notice, delivered by certified mail, return receipt requested, and (2) an opportunity to consult with the other party prior to termination and remedy the default.

E. Upon termination by either party pursuant to Paragraph "D" above, the party terminating this MOU may complete the work without the assistance of the other party. The party completing the Work may fully utilize existing work product in pursuing the completion of the Work. The District shall be afforded a right-of-entry by the City for the purpose of completing the Work..

IV. FUNDING OF THE AQUIFER STORAGE AND RECOVERY COST-SHARE PROGRAM:

A. The District agrees to fund the ASR Project as set forth in Exhibit "A," Statement of Work. The District's contribution is contingent upon and subject to annual budget approval by the District's Governing Board.

B. The City agrees to contribute to the Aquifer Storage and Recovery project in the manner and the amount described in Exhibit "A," Statement of Work. The City's contribution is contingent upon and subject to annual appropriation by the City Commission.

V. LIABILITY AND INSURANCE:

Both the District and the City:

A. Are responsible for all personal injury and property damage attributable to the negligent acts or omissions of that party and the officers and employees acting within the scope of their employment. In addition, each party is subject to the provisions of Section 768.28, Florida Statutes. Neither this provision nor any other in this MOU shall be construed as a waiver of sovereign immunity by either party.

B. Both the District and the City shall acquire and maintain throughout the term of this MOU such general liability insurance, automobile insurance, and workers' compensation insurance as required by their current rules and regulations.

C. District agrees that all contracts and subcontracts for any construction work described in the Statement of Work shall include hold harmless and indemnification provisions to protect the City and the District in a form acceptable to the City and the District. The District contractor or subcontractor shall provide the City with evidence of said hold harmless and indemnity prior to commencement of work and access to City property.

VI. PROJECT MANAGEMENT:

A. Project Managers - Each party hereby designates the employee set forth below as its respective Project Manager. Project Managers shall assist with project coordination and shall be the party's primary contact person. Notices or reports shall be sent to the attention of the parties' Project Manager by U.S. Mail, postage prepaid, to the parties' addresses as follows:

For the District:	For the City:
Douglas Munch, P.G.	Bill Marcous
4049 Reid Street	300 North Park Avenue
Palatka, FL 32177	Sanford, FL 32772
Tel: (386) 329-4173	Tel: (407) 330-5649

B. Either party may designate a new Project Manager at its discretion. Written notification of the new Project Manager and effective date shall be provided to the other party.

C. At a minimum, the District's Project Manager shall consult with the City's Project Manager prior to initiating each task. The District's Project Manager shall provide City's Project Manager a report as to the status of each task on a monthly basis. The District's Project Manager shall notify City's Project Manager of the completion of each task within 30 calendar days of the completion of each task.

VII. OWNERSHIP OF DOCUMENTS:

A. Ownership and copyright to all reports and all accompanying data (in all formats) produced pursuant to work done under this MOU shall be vested in both parties to this MOU. Any source documents or any other documents or materials developed, secured or used in the performance of this MOU shall be considered property of the District and the City.

B. All permits shall be in the name of the District. The District shall provide a copy of all permits, as well as design and construction plans, to the City's Project Manager. At the expiration or termination of the project, at the request of the City, the District shall transfer to the City all permits.

IN WITNESS WHEREOF, the following authorized representative of the ST. JOHNS RIVER WATER MANAGEMENT DISTRICT and the CITY OF SANFORD have executed this Memorandum of Understanding on the date signed by each party.

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT	CITY OF SANFORD
By: _____	By: _____
Kirby B. Green III, Executive Director	_____
	Typed Name and Title
Date: _____	Date: _____
APPROVED BY THE OFFICE OF GENERAL COUNSEL	
	Attest: _____
_____	_____
Stanley J. Niego, Sr. Assistant General Counsel	Typed Name and Title

EXHIBIT A

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
AND THE CITY OF SANFORD
AQUIFER STORAGE AND RECOVERY
CONSTRUCTION AND TESTING DEMONSTRATION PROGRAM

STATEMENT OF WORK

INTRODUCTION/BACKGROUND

Project Definition - The St. Johns River Water Management ("District") and the City of Sanford ("City") shall jointly endeavor to design, permit, and construct a Floridan Aquifer Storage and Recovery (ASR) system, consisting of an exploratory well, monitoring wells, ASR test well, site work, and related pipelines and appurtenances, all defined to be part of the Project. References to the District herein shall refer to St. Johns River Water Management District and its employees and agents.

Project Need – Determine the feasibility of aquifer storage and recovery (ASR) for storing seasonally available large volumes of alternative water supplies to offset the use of potable groundwater in east Central Florida.

Contract's Goals – Demonstrate the feasibility of ASR technology for utilities in the east Central Florida region. The District seeks to complete this cooperative project with the City and shall require its Contractor, under the District's Contract SF409RA, to prepare the design of the Project in accordance with the requirements of regulatory agencies, the City, and the District and to permit and construct the system in accordance with such design.

Consistency With the DISTRICT's Mission And Goals – This project is included in the Water Resource Development Work Program, dated September 2003, as required by Section 373.536(6)(a) 4, Florida Statutes. The design shall be consistent with the District's report entitled "City of Sanford Desktop Assessment of Aquifer Storage and Recovery", prepared by Camp Dresser & McKee (CDM), dated October, 2003.

Location Of The Work – The project will be located at the City's Auxiliary Water Treatment Plant site, or a different site if mutually agreed upon by both parties.

OBJECTIVES

Statements Of The Results To Be Achieved – The project will be implemented with design features approved by the District and the City, in sequential order to provide for maximum benefit of expended funds. Sequential progress will be based on exploration, permitting, and construction. The ASR Test Well will be drilled in accordance with Florida Department of Environmental Protection (FDEP) Underground Injection Control (UIC) requirements, and successfully cycle-tested with potable water, to demonstrate feasibility for water storage and recovery.

SCOPE OF WORK

Outline Of Extent Of Work

Note: Tasks 1 and 2 are included herein as reference only, as these tasks have been completed prior to the issuance of this MOU. Task 3 will be completed with execution of this Memorandum of Understanding.

Task 1 - Report titled "St. Johns River Water Management District Aquifer Storage and Recovery Construction and Testing Program Plan - FY2002", dated April, 2002, prepared by Barnes Ferland & Associates.

Task 2 - Report titled "City of Sanford Desktop Assessment of Aquifer Storage and Recovery", dated October 2003, prepared by CDM.

Task 3 - Preparation and approval of a City Memorandum of Understanding (MOU) and Statement of Work (SOW)

The following Tasks 4 through 10 are an outline of the extent of work to be performed under this MOU between the District and the City:

Task 4 — Site-Specific Data Collection and Preliminary System Design

Task 5 — ASR Pilot Project Design

Task 6 — Regulatory Permitting

Task 7 — ASR Facilities Construction, Monitoring, and Testing

Task 8 — Startup and Training

Task 9 — Large Cycle Operational Monitoring and Evaluations

Task 10 — Peer Review

Overview Of The Steps Of Project

The District will prepare a preliminary design plan for the ASR system, including an exploratory well. Based on the results of the exploratory well, final design of the ASR system will be conducted and coordinated with FDEP UIC permitting requirements. Once the design and permit are approved, the District will begin construction of the ASR Test Well and related appurtenances. After completion of drilling and verification of project requirements, cycle testing will be performed by the District to measure storage and recovery. If at any time the project is deemed infeasible, the District will coordinate with the City the salvage of any constructed wells for monitoring purposes, or the District will provide abandonment and decommissioning services, as required. Upon successful demonstration of feasibility, as mutually agreed on by the District and the City, the completed project will be transferred to the City for operation and ownership, including any transfer of the existing UIC permit that may be required, at no cost to the City.

Description Of The Methodology To Be Used

The District will utilize methodologies accepted in the professional practices of engineering and geology. Methodologies shall incorporate FDEP UIC permitting requirements and provide sufficient milestones for review, comment, and approval by the District and the City. Construction methods shall be in accordance with the General Conditions provided for in the District's Contract #SF409RA, incorporated herein by reference, including conformance with the City's local codes and requirements.

Description Of Location Of Work - The project will be located at the Auxiliary Water Treatment Plant site. The exact project location at the site will be determined based on preliminary design and coordinated with the location of potable source water and discharge facilities. The proposed potable water supply is the Auxiliary Water Treatment Plant. The proposed recovered water discharge is to the Auxiliary Water Treatment Plant.

TASK IDENTIFICATION

The following Tasks 4 through 10 are summarized from the District's Contract #SF409RA. These tasks will be performed on a work-order basis as each individual task is successfully completed or be grouped together where appropriate.

Task 4 — Site-Specific Data Collection and Preliminary System Design

Prepare a data collection plan for the project site based on a review of existing information and coordination with FDEP. In particular, the plan shall address the need for initial exploratory testing as the basis of development of ASR well design.

To the extent possible based on FDEP guidelines, the District proposes to gather hydrogeologic information from the construction and testing of an initial exploratory well at the project site, which would then be converted to an observation well for the ASR construction and testing program. Based on site conditions and availability of funding, a second exploratory well may be constructed at a separate location through mutual agreement by both parties. The data collection plan will be implemented, the data will be evaluated, and a preliminary system design will be developed for one project site. The City will provide the District access to project site for exploration well drilling and data collection. If the site is deemed to be infeasible for any reason, the District and the City shall endeavor to locate an alternative site for the ASR construction and testing program, through mutual agreement by both parties.

Task 5 — ASR Pilot Project Design

This task includes the design of well and wellhead facilities at the selected site, including supporting infrastructure such as pipelines, electrical service, and incidental site work. The design shall also specify the proposed data collection and monitoring programs. The City will be provided with design documents for review, comments and approval.

Task 6 — Regulatory Permitting

The District, the City, and the District's Contractor, will adhere to the necessary regulatory permitting requirements, including preparation of permit applications, and responses to requests for information from regulatory agencies. The primary permitting effort will be through the FDEP Underground Injection Control (UIC) program, although other ancillary permits may be required from local government. The District will provide services to support the cost of preparation of a) Well Construction permit applications, b) local government permit applications, as required, c) Florida Department of Environmental Protection (FDEP) Underground Injection Control (UIC) permit application, d) District Consumptive Use Permit (CUP) application for testing water, e) FDEP Drinking Water System extension permit application, f) FDEP NPDES permit for discharging brackish water obtained during the construction process, g) other FDEP water system permits, if required, and h) project reports.

The District's Agreement or contract work order with its third-party Contractor shall include site improvements required by the project and mutually agreed upon by the parties. The City will be responsible for processing and resolving any zoning or land use issues that may arise with regard to the Project. The City will be the Owner for well construction, FDEP UIC, FDEP water main extension construction and any other project related permit applications. The District or the District's Contractor will act as applicant and pay application fees.

Task 7 — ASR Facilities Construction, Monitoring, and Testing

Construct ASR well and monitor wells, and associated pipelines, electrical service, incidental site work, and wellhead facilities. Conduct initial hydraulic and water quality testing, in addition to geophysical logging, geochemical modeling, and evaluation of any additional pretreatment requirements. A series of ASR "small cycle" test cycles will be conducted to evaluate the project site.

The District will stake and define the boundaries of construction within the Auxiliary Water Treatment Plant site, based on property documents furnished by the City. The District shall be responsible for construction, inspection, testing, and progress reporting for the Project. The City shall allow the District full site access to conduct and inspect construction of the project. The City shall alert the District of any problems it knows of and the District, when appropriate, shall require its Contractor to correct any problems or non-conforming work discovered by the District's inspection or the City's observation.

Task 8 — Startup and Training

The District's Contractor will provide operational training of the City's staff to ensure a smooth transition from the test program into full operations. The final training plan will be developed subsequent to analysis of the small cycle testing program results.

Task 9 — Large Cycle Operational Monitoring and Evaluations

Conduct operational monitoring and evaluation of ASR system performance during the first two to three years of operations, making any needed adjustments to improve system performance. The City will operate the system during this period. The District will conduct periodic site visits and evaluate collected data to monitor large cycle performance and provide technical assistance to the City, as necessary. A preliminary plan outline of The City's responsibilities for conducting Large Cycle operation and monitoring is provided in Attachment 1. This plan outline will be developed further when permit conditions are known and the City and the District are implementing Task 9, for review and approval by the City and the District.

Task 10 — Peer Review of the District Contractor's Work

This task includes the review of work products produced by the District Contractor, by other District ASR team members and City.

TIMEFRAMES AND DELIVERABLES

Timeframe For Completion Of Entire Project

Successive task completion without major disruption will require a minimum of three (3) years, and up to five (5) years for final completion, in accordance with the Memorandum of Understanding.. Specific timeframes will be established after the District and the City have signed a Memorandum of Understanding (MOU).

DISTRICT Contractor Deliverables and Responsibilities

Contractor deliverables defined in the work orders shall be governed by the District's Contract #SF409RA and shall include both hard copy and electronic versions. All deliverables shall be provided to the District and the City's Project Manager and shall generally include the following items, by task. Other elements of the project may be added as mutually agreed upon by both parties.

Task 4, Site-Specific Data Collection and Preliminary System Design: As defined in the work order, to include the following.

- Data Collection Plan
- Preliminary Design Report
    - Exploratory Well Construction Plan
    - Exploratory Well Construction Specifications
    - Exploratory Well Contractor's Safety Plan
    - Exploratory Well Construction Schedule
    - Exploratory Well Sampling and Testing Plan
- Exploratory Well Construction Permit Application
- Well Salvage for Monitoring, or Abandonment if Site is Infeasible
- Completed Exploratory Well
- Water Quality Sampling and Testing
- Exploratory Well Project Report
- Construction security plan, including access provisions, work hours and construction site security facilities. The City, prior to commencement of any construction activities shall review and approve the plan.
- Project Schedule

Task 5, ASR Pilot Project Design: As defined in the work order, to include the following.

- ASR System Construction Plans
- ASR System Construction Specifications
- ASR System Construction Cost Estimate
- ASR System Construction Phase Services Plan
- ASR System Contractor's Safety Plan
- ASR System Construction Schedule
- ASR System Final Project Report

Task 6, Regulatory Permitting: DISTRICT to pay for all permit application fees. One or more of the following deliverables will apply to the project, as required:

- Well Construction Permit Application(s)
- Local Government Permit Application(s)
- FDEP Underground Injection Control (UIC) Permit Application
- Consumptive Use Permit (CUP) Application For Testing Water
- FDEP Drinking Water System Extension Permit Application
- FDEP NPDES Permit Application
- Other FDEP Water System Permit(s)
- Permitting Condition Progress Report(s)
- Permitting Condition Sampling And Testing Report(s)

Task 7, ASR Facilities Construction, Monitoring, and Testing: As defined in the work order, to include the following.

- Payment and Performance Bond
- Construction Survey Layout and Control
- Shop Drawings
- Updated ASR System Contractor's Safety Plan
- Updated ASR System Construction Schedule
- Monthly ASR System Project Progress Reports
- Laboratory Reports
- Well Testing Discharge Plan
- Initial (start-up) cycle testing
- Construction Inspection and Testing Records
- Completed ASR System
- Site Restoration
- Construction Record Drawings
- Certifications of Completion
- Releases for Final Payment
- Final Construction Report
- Startup and Training Plan

Task 8, Startup and Training: As defined in the work order, to include the following.

- Operation and Maintenance Manuals
- Training Instruction
- Operating Guidelines
- Large Cycle Operation and Monitoring Plan
  (Preliminary plan provided as Attachment 1)

Task 9, Large Cycle Operational Monitoring and Evaluations: Large Cycle Evaluation Reports as defined in the work order. The District shall provide technical oversight and assistance as required during this task.

Task 10, Peer Review: As defined in the work order.

CITY Deliverables and Responsibilities

The City shall deliver the following items and "like kind services" through staff and ongoing operations, according to the time they are needed as jointly determined by the City and the District during the course of the work:

1. CITY to provide project site and associated access for the project. The City shall provide evidence of ownership or easements providing access and control of facilities expected to be installed on the property.
2. Timely review comments on Contractor submittals.
3. Execution of permit applications, as project owner.
4. Relevant records pertaining to, or affecting, the project which may consist of, but not be limited to, survey data and legal descriptions, easement documents, soils data, water facilities record drawings, site plans, right of way use requirements, and other technical information pertaining to the planning, design, and construction of the ASR facility at the proposed site.
5. Unique construction requirements not covered under local permits or codes, such as site lighting requirements, site access constraints, other, and any limitations on construction activities.
6. Electrical power service to the site, as required during Task 7 described above, including offsite extensions, material purchases, new equipment, lighting, metering, and individual well service connections, in accordance with local power company requirements. The not to exceed capital cost to the City is $30,000 for the furnishing of labor, equipment, and materials to install the electrical service.
7. Water quality sampling and testing during large cycle operation phase of project, as required during Task 9 described above, after the City assumes ownership of project. The not to exceed cost to the City is $25,000 for this water quality sampling and testing. This analytical work shall be consistent with regulatory agency permitting and monitoring requirements. For estimated testing parameters, see Table 1 ASR Large Cycle Water Quality Testing Plan in Attachment 1.

8. Information regarding features and items that are required to comply with zoning and land development codes.
9. Necessary testing water; permission to use city drainage easements and rights of way for recovered water discharge purposes; and appurtenant operational requirements for the Project; including necessary coordination and related services from the City's staff. The City does not have an adequate allocation of water under existing consumptive use permits for the cycle testing. The District Contractor will be responsible for preparing the permit application necessary for the District review and approval of a separate (or additional) allocation of water sufficient for this purpose.
10. CITY will accept responsibility for operation and maintenance of completed project. The City agrees to assume total responsibility of ownership for continued operation, maintenance, and data collection for the ASR facilities following completion of the project, in perpetuity, but reserves the right to re-permit, modify, abandon, or decommission the project in accordance with applicable rules and regulations.

Comment And Review Time

Major milestone submittals defined in the work orders shall generally include four (4) weeks for review and comment by the District and the City. Review and comment for lesser submittals may be reduced to three (3) weeks, as mutually agreed.

Construction-phase data that must be reviewed and approved in a shorter timeframe to facilitate Contractor's activities shall be specified in the work order or determined by the the District Project Manager, and agreed to by the City.

The District will compile review comments from the District's staff and the City's project representatives into one document for transmittal to the District's Contractor. The City shall be available for explanation, discussion, and resolution of review comments.

CONTRACT BUDGET

The District will be responsible for all costs of the project with the exception of capital costs listed below and in-kind services as described in this Statement of Work. The estimated cost for the District's Contractor to implement the project is within the cost range estimated in the District report entitled "City of Sanford Desktop Assessment of Aquifer Storage and Recovery", prepared by CDM, and dated October 2003.

The City will be responsible for certain other costs for the project, as defined in the City Deliverables and Responsibilities section of this Statement of Work.

The District and the City estimated project capital costs are as follows:

The District Work by Contractor	
Using Current Florida Forever Funding *	$1,499,000
CITY Capital-related Cost Items:	
Task 7, Electrical Service	$ 30,000
Task 9, Water Quality Sampling and Analysis	$ 25,000
Sub Total CITY	$ 55,000
TOTAL	$1,554,000

* Includes an allowance of $300,000, as estimated by CDM, for a second exploratory well as described in Task 4.

End of Exhibit A Statement of Work.

ATTACHMENT 1

ST. JOHNS RIVER WATER MANAGEMENT THE DISTRICT
AND THE CITY OF SANFORD
AQUIFER STORAGE AND RECOVERY
CONSTRUCTION AND TESTING DEMONSTRATION PROGRAM

PRELIMINARY OUTLINE for LARGE CYCLE TESTING PLAN

BASIS OF PLAN:

ASR Well:	1 to 5 MGD Capacity
Monitoring Wells:	1 Background, 2 Down Gradient
Cycle:	90 Days Storage 90 Days Dormant 90 Days Recovery 2 Cycles to be tested (270 Days/ Cycle)

CITY OPERATIONAL REQUIREMENTS:

1. During well operation (Storage & Recovery Phases):

    a. Daily inspections and routine maintenance of mechanical equipment and instrumentation.

    b. Daily Recording of:

    - Well Head Pressure *
    - Water Level at ASR and Monitoring Wells *
    - Flow (Storage or Recovery)*
    - Operation of Valves and Well Pump as necessary for storage or recovery

    *These functions may be performed with continuous read instrumentation.

2. Flow meter annual calibration

3. Instrument calibration, as required (i.e. water level monitors, pressure monitors, etc)

4. Collection and analysis of water quality samples, See Table 1.

CYCLE OPERATIONAL PLAN:

1. Storage

    a. Open ASR well inlet valve to allow 1-5 MG volume into aquifer over 16 to 24 hour period.

    b. Shut/ throttle inlet valve as required during distribution system peak demand periods.

    c. Record flow, pressure and water levels on daily basis (or continuously, if equipped with instrumentation) for ASR and monitoring wells

    d. Collect water quality samples from storage source water, ASR well, and monitoring wells in accordance with frequency and chemical parameters shown in Table 1.

    e. Back flush ASR well to waste, as necessary, based on storage rate and well head pressure.

2. Dormant Phase

    a. Collect water quality samples and water levels from ASR well and monitoring wells – See Tables 1 for frequency and chemical Parameters.

    b. Periodic inspection of well equipment.

3. Recovery

    a. Open ASR discharge valve; Operate pump to discharge 1- 5 MGD on daily basis.

    b. Record flow, Pressure and water levels from ASR and monitoring wells.

    c. Collect water quality samples from ASR well and monitoring wells – See Table 1.

    d. Close ASR well on daily basis when target recovery volumes achieved.

Table 1. ASR Large Cycle Water Quality Testing Plan

Cycle Phase	No. of Samples	Frequency	Parameters for Storage Source Water	Parameters for ASR Well Ground water	Monitoring Wells (3)
Storage	2	At start of phase, before storage begins	Primary & Secondary Drinking Water Standards, pH, temp,D.O., Eh, Specific Conductance, Ca, Mg, K, Si, HCO_3, Total/non-carbonate/calcium hardness, Phosphate, Ammonia, H_2S, TOC, U.	Primary & Secondary Drinking Water Standards, pH, temp,D.O., Eh, Specific Conductance, Ca, Mg, K, Si, HCO_3, Total/non-carbonate/calcium hardness, Phosphate, Ammonia, H_2S, TOC, U.	
	60	Storage source water and ASR ground water- Daily for 1st 30 Days.	Cl, F, SO4, TDS,pH, Temp., D.O., Eh, Specific Conductance	Cl, F, SO4, TDS,pH, Temp., D.O., Eh, Specific Conductance	
	20	Every 3 Days for Days 31-60			
	8	Weekly for Days 61-90			
	4	Monthly	Na, Ca, Mn, Fe, Mg, Sr, K, Al, Si, Cu, Zn, Cd, Se, As, HCO3, Total/non-carbonate/calcium hardness, Phosphate, Ammonia, H2S, TOC, THM Species.	Na, Ca, Mn, Fe, Mg, Sr, K, Al, Si, Cu, Zn, Cd, Se, As, HCO3, Total/non-carbonate/calcium hardness, Phosphate, Ammonia, H2S, TOC, THM Species.	
	39	Weekly			Cl, F, SO4, TDS,pH, Temp., D.O., Eh, Specific Conductance
Dormant	1	At Day 45 of Dormant Phase		Primary & Secondary Drinking Water Standards, temp,D.O., Eh, Specific Conductance, Ca, Mg, K, Si, HCO3, Total/non-carbonate/calcium hardness, Phosphate, Ammonia, H2S, TOC, U.	
	2	Monthly		Cl, F, SO4, TDS,pH, Temp., D.O., Eh, Specific Conductance	

Cycle Phase	No. of Samples	Frequency	Parameters for Storage Source Water	Parameters for ASR Well Ground water	Monitoring Wells (3)
	6	Monthly			Cl, F, SO4, TDS,pH, Temp., D.O., Eh, Specific Conductance
Recovery	1	At start of phase, before recovery begins		Primary & Secondary Drinking Water Standards, pH, temp,D.O., Eh, Specific Conductance, Ca, Mg, K, Si, HCO_3, Total/non-carbonate/calcium hardness, Phosphate, Ammonia, H_2S, TOC, U.	Cl, F, SO4, TDS,pH, Temp., D.O., Eh, Specific Conductance
	30	ASR ground water- Daily for 1st 30 Days.		Cl, F, SO4, TDS,pH, Temp., D.O., Eh, Specific Conductance	
	10	Every 3 Days for Days 31-60			
	4	Weekly for Days 61-90			
	2	Monthly		Na, Ca, Mn, Fe, Mg, Sr, K, Al, Si, Cu, Zn, Cd, Se, As, HCO3, Total/non-carbonate/calcium hardness, Phosphate, Ammonia, H2S, TOC, THM Species.	
	39	Weekly			Cl, F, SO4, TDS,pH, Temp., D.O., Eh, Specific Conductance

SECOND AMENDMENT TO THE MEMORANDUM OF UNDERSTANDING BETWEEN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND CITY OF SANFORD, FLORIDA FOR AQUIFER STORAGE RECOVERY CONSTRUCTION AND TESTING

THIS AMENDMENT is entered into by and between the GOVERNING BOARD of the ST. JOHNS RIVER WATER MANAGEMENT DISTRICT (the "District"), whose mailing address is 4049 Reid Street, Palatka, Florida 32177, and CITY OF SANFORD (the "City"), whose address is 300 North Park Avenue, Sanford, Florida 32772, and is effective on October 1, 2010.

WHEREAS, the District and the City entered into a Memorandum of Understanding (MOU) #SH335AA (23412) on June 15, 2004, for the City to share funding costs with the District to design, permit, and construct an Aquifer Storage and Recovery System (Project), and amended the MOU on June 12, 2009 (Amendment #1); and

WHEREAS, the District and the City desire to modify the MOU.

NOW, THEREFORE, in consideration of the mutual covenants contained herein and for other good and valuable consideration, the District and the City, hereby agree to the following amendments:

1. **ARTICLE II – STATEMENT OF WORK**: delete this paragraph and replace it with the following paragraph:

   "All work shall be performed in accordance with Exhibit "A-1" - Revised Statement of Work, and all project-related data will be shared with or copied to the District in a form agreed to by the District and the City."

2. **ARTICLE III – EFFECTIVE DATE, TERM, AMENDMENTS, TERMINATION:** Paragraph A shall be deleted and replaced with the following:

   "A. This MOU shall commence on the date of full execution and shall expire on September 30, 2013, or upon issuance of the aquifer storage recovery operations permit, whichever date is earlier."

The District and the City agree that all other terms and conditions of the original MOU and Amendment are hereby ratified and continue in full force and effect.

The remainder of this page intentionally left blank.

IN WITNESS WHEREOF, the parties hereto have duly executed this Amendment on the date set forth below.

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

By: _____
Kirby B. Green III, Executive Director

Date:_____

APPROVED BY THE OFFICE OF GENERAL COUNSEL

_____
Stanley J. Niego, Sr. Assistant General Counsel

CITY OF SANFORD

By: _____

_____
Typed Name and Title

Date: _____

Attest: _____

_____
Typed Name and Title

Appendix C

Evaluation of Expandability of ASR Wellfield, City of Sanford, Florida

Memorandum

To: *Glenn Forrest, P.E.*

From: *Leslie Turner, P.E.*

Date: *September 30, 2007*

Contract No.: *SF409RA Work Order 25, Sanford Expandability Evaluation*

Contract Title: *Aquifer Storage, Recovery, Construction and Testing (ASR)*

Subject: *Evaluation of Expandability of ASR Wellfield, City of Sanford, Florida*

Background

The City of Sanford Aquifer Storage and Recovery Project consists of approximately 500 feet of supply and return water lines between the Sanford Auxiliary Water Treatment Plant (WTP) and a single Aquifer Storage and Recovery (ASR) well (ASR-1), which is located on the WTP property. This project is a part of the St. Johns River Water Management District's (SJRWMD) Aquifer Storage, Recovery, Construction and Testing program. The SJRWMD would like to determine the potential for expandability of the demonstration project into a small (3 MGD) ASR Wellfield, in the event the ASR Test Well Program is successful. This technical memorandum outlines the criteria used in determining the potential placement of additional ASR wells and associated monitor wells.

Well Placement Criteria

Based on certain considerations for ASR well spacing, distance from the City's public supply wells, constructability, hydraulics, and easement requirements, CDM recommends placement of two additional ASR wells (ASR-2 and ASR-3), each with a capacity of 1 MGD, and one additional storage zone monitoring well (SZMW-3) and two additional confining zone monitoring wells (CZMW-2 and CZMW-3) at the locations indicated on the attached Site Plan (**Figure 1).** The criteria and assumptions used in locating the wells are described in the sections below.

Spacing and Monitoring

Based on previous analysis of the exploratory well testing data, the storage zone of the ASR well will extend approximately 1,302 feet radially from the ASR well. The placement of additional wells was selected to minimize potential well interference and maximize recovery efficiencies. Based on experience at other ASR sites, recovery efficiencies are higher if the ASR wellfield shares the same "bubble". However, the operation of the ASR wellfield must be controlled to avoid entrapping native poorer quality groundwater within the ASR wellfield. As Figure 1 shows, ASR-2 would be located approximately 550 feet from the existing ASR well, and ASR-3 would be located approximately 1,100 feet from the existing well. Both proposed ASR wells would be installed to the same depth as the existing well [storage zone of 530 to 630 feet below land surface (bls)].

According to the FDEP ASR Position Paper (2005), at least two monitoring wells are required for each ASR well. That is, at least one storage zone monitor well within 150 feet of the ASR well and an additional storage zone monitor well at a greater distance but at close enough proximity to the ASR well that injected water will be encountered during a normal ASR cycle. As shown on Figure 1, only one additional storage zone monitoring well (SZMW-3) would be installed for the two proposed ASR wells. The proposed well coupled with the existing storage zone monitoring wells should be sufficient to meet the FDEP requirements. SZMW-3 would be installed with an open hole section from 530 to 630 feet bls.

The FDEP position paper does not contain specific requirements for the construction of confining zone monitoring wells, however, based on recent experience with the ASR well, CDM believes that they may needed. Confining zone monitoring wells are used to monitor the possible upward migration of the injected water into the zone above the storage zone and are typically installed within 50 feet of the ASR well. Figure 1 presents the location of 2 confining zone monitoring wells, one for each proposed ASR well. The confining zone monitoring wells would be installed with an open hole section from 430 to 480 feet bls.

Inventory of Existing Supply Wells

For the purposes of this evaluation, it was assumed that no additional water supply wells will be constructed at the Auxiliary Water Treatment Plant (WTP) in the future. Therefore, only the existing City production wells and wells of other existing legal users were considered in the evaluation. A well inventory of permitted wells within a one mile radius of the existing ASR well was completed using the databases of SJRWMD, Seminole County, City of Sanford, USGS, and FGS with field verification (**Attachment 1**). The following categories of wells were identified from the inventory:

- 4-inch diameter or smaller wells – typically privately owned wells used for domestic supply or irrigation;

- 6-inch diameter or larger wells which are included as part of a CUP – larger diameter wells which can be privately or publicly owned and probably used for community water supply and regulated by the SJRWMD; and

- All other wells – larger diameter wells that can be privately or publicly owned, are not used for community water supply and regulated by the SJRWMD or FDEP.

The locations of these wells are shown on **Figure A-1** and listed in **Table A-1**. Placement of the two additional ASR wells as shown was based on meeting the wellhead protection criteria per Chapter 62-521, F.A.C, which prohibits construction of new Class V injection wells within a 500-foot radial setback around potable water wells.

Hydraulics of Existing and Proposed Pipelines

The supply line for the Sanford ASR well connects to an existing 12-inch water main that runs along the west side of 17-92. The ASR supply line (SWM) that connects from the 12-inch water main to the ASR wellhead is 10-inch Ductile Iron (DI). The ASR return system consists of 10-inch diameter DI return water main (RWM) that runs from the ASR wellhead to the Sanford Auxiliary WTP raw water line. Both the SWM and RWM are located on the Auxiliary WTP property. In order to connect the future ASR wells, additional pipeline would be required. Locations of the future ASR wells were selected based on proximity to existing water mains to allow for the supply to the ASR wells. Two options exist for recovery from the ASR well: the recovered water could be chlorinated at the ASR wellhead and discharged back into the water main or the recovered water could be discharged to a RWM that would connect to the Auxiliary WTP (Option B on Figure 1). For the first option, the ASR well pump would need to be sized sufficiently to pump the recovered water into the distribution system. For the second option, the recovered water would not need to hydraulically load the WTP, but rather just be routed through the chlorination system to reestablish a residual and then through the high service pumps into the distribution system.

Preliminary hydraulic analyses were conducted to determine the sizing requirements for the SWM and RWM. The calculations are provided as **Attachment 2** and indicate the following:

- The proposed size for the SWM to both ASR-2 and ASR-3 is 8-inch PVC. This will maintain a velocity of 4.59 feet per second with is below the recommended maximum velocity of 5 feet per second.

- For Option B or the RWM to the Auxiliary WTP, the pipeline from each of the proposed ASR wells is recommended to be 8-inch PVC. After the point where the RWM from the two proposed wells connect, recommended pipeline size is 12-inch PVC. The velocity in

the 8-inch PVC RWM would be 4.59 feet per second, while the velocity in the 12-inch RWM would be 4.18 feet per second.

Rights-of-Way and Easements

All additional monitoring wells and the ASR wells were located within the City of Sanford property. No easements are required for the wells.

A new SWM to ASR-2 would be a short branch from the distribution main that runs along Airport Boulevard. The 8-inch PVC branch main would be installed within the City of Sanford property and the right-of-way along Airport Boulevard. A new SWM to ASR-3 would also be a branch from the distribution main that runs along Airport Boulevard. The SWM to ASR-3 would be constructed of 8-inch PVC and be approximately 1,000 feet long, located within the Airport Boulevard right-of-way and the City of Sanford property.

For the purposes of this evaluation, it was assumed that arsenic would not be an issue at the ASR wellfield (as determined during cycle testing and operation of ASR-1), and that water extracted from the ASR wells would meet all of the drinking water criteria (Chapter 62-550, FAC). The RWM would, therefore, not need to go back to the water treatment plant and could be chlorinated at the wellhead and sent directly to water distribution system. For this option, the ASR well pump would need to be sized sufficiently to pump the recovered water into the distribution system. Alternatively, approximately 1,000 feet of 8-inch PVC pipe could be installed from ASR-3 within the Sanford Auxiliary WTP site (along Airport Boulevard right-of-way), to a connection point at ASR-2. From there, approximately 1,200 feet of 12-inch PVC pipe would extend along 17-92 to the entrance to the Auxiliary WTP, where it would join with the existing 12" raw water main and the existing 10" RWM as it entered the plant. This alternative is labeled as Option B on Figure 1. For this option, the recovered water would not need to hydraulically load the WTP, but rather just be routed through the chlorination system to reestablish a residual and then through the high service pumps into the distribution system.

If the routing option along Airport Boulevard and 17-92 was determined not to be feasible, it is possible to route the RWM through the Sanford property. This was not depicted on the figure due to the clearing requirements associated with this option.

Construction Access and Construction Staging

Access to ASR-2 and ASR-3 would be via 17-92 and Airport Boulevard. Staging areas would need to be cleared in order to provide adequate areas for construction activities. Each new ASR well would be fenced within a 10-ft x 35-ft chain link enclosure.

Discharge During Construction and Cycle Testing

For ASR-1, water pumped from the well that cannot be sent to the Auxiliary WTP is discharged directly to Lake Ada under a Generic NPDES permit. For the proposed ASR wells, water could be discharged to nearby wetlands which would drain to Lake Ada. NPDES permitting would be required for any discharge to wetlands or surface water bodies.

Conclusions

CDM performed a desktop evaluation of the existing Sanford Auxiliary WTP ASR well system to determine the potential for expandability of the existing project into a small ASR Wellfield consisting of a total of three ASR wells. Several criteria were considered in the placement of the two new wells and well piping, specifically required distance between ASR wells, distance from existing water supply wells, easements and rights-of-way, and construction access and staging.

Based on the above mentioned criteria, placement of two additional ASR wells along Airport Boulevard on the City of Sanford property was determined to be the most feasible option. Supply water to the new wells would be from the water main that runs along Airport Boulevard. Supply water for ASR-2 and ASR-3 would come from a direct connection to the existing water main via an 8-inch PVC pipe. Both ASR wells would have the ability to inject water simultaneously.

Assuming that return water quality is of an acceptably high standard, the return water could be chlorinated at the well and sent directly into distribution. Alternatively, Option B indicates, approximately 1,000 feet of 8-inch PVC pipe could be installed from ASR-3 within the City of Sanford property (along the Airport Boulevard right-of-way) to a connection point at ASR-2. From there, approximately 1,200 feet of 12-inch PVC pipe would extend along 17-92 to the entrance to the Auxiliary WTP. Option B represents a more conservative approach that the City has expressed a preference for, and could implement at its discretion; allowing for flexibility of treatment and blending, depending on water quality considerations.

References

CDM, 2003. Desktop Assessment of Aquifer Storage and Recovery for the City of Sanford.

FDEP, 2005. Position Paper Permitting Increased Arsenic Level at Aquifer Storage and Recovery Facilities (dated June 20, 2005)

FDEP, 2006. Chapter 62-521, Florida Administrative Code – Wellhead Protection.

FDEP, 2006. Chapter 62-550, Florida Administrative Code – Drinking Water Standards, Monitoring, and Reporting.

cc: Bill Marcous
Migdalia Hernandez
Doug Munch
Don Maurer
Lee Wiseman
Barika Poole

williamsjp

9/30/2007

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SR 417

SZMW-3

ASR-3

SZMW-8

Airport Blvd

SZMW-2

ASR-2

SZMW-4

Sanford Auxiliary WTP

SZMW-1

ASR-1

SZMW-5

US-17/92

Legend

- ASR-1
- Monitoring Wells
- Proposed ASR wells
- Proposed Monitoring Wells
- Existing Wells
- Existing Water Distribution Main
- Raw Water Line
- Existing 10" SWM
- Existing 10" RWM
- Future 8" SWM
- Option B Future 8" RWM
- Option B Future 12" RWM
- 50x50 Staging Area
- Contruction Access
- Parcels
- 100 year Floodplain

0 150 300 Feet

Figure 1
Evaluation of Expandability of ASR Wellfield
Location of Proposed ASR and Associated Monitoring Wells
City of Sanford, Florida

ATTACHMENT 1

Well Inventory

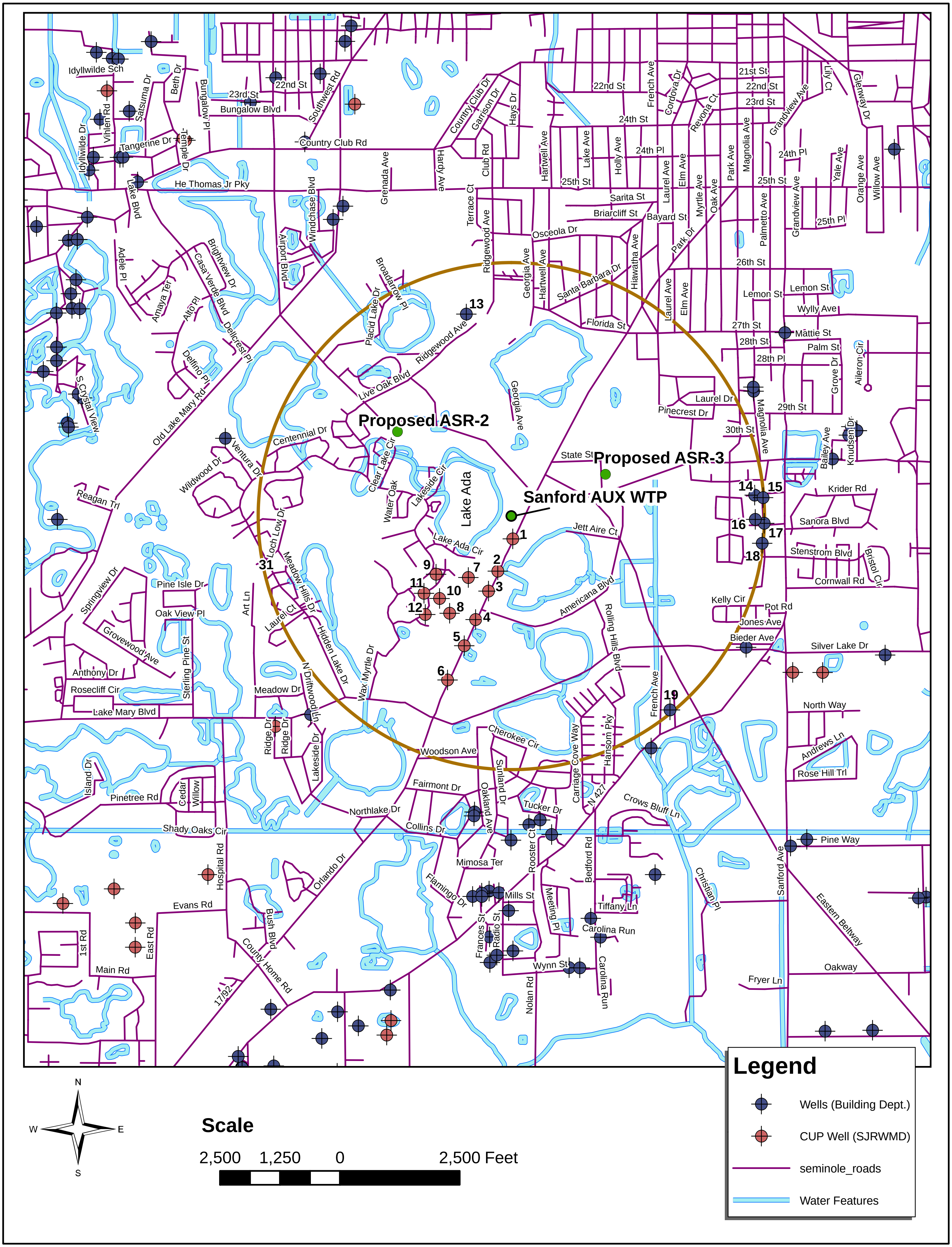

Proposed ASR-2
Proposed ASR-3
Sanford AUX WTP
Lake Ada
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
31
Legend
Wells (Building Dept.)
CUP Well (SJRWMD)
seminole_roads
Water Features
Scale
2,500 1,250 0 2,500 Feet
N
S
E
W

Table A-1 Well Inventory Within One-Mile Radius of Sanford AUX WTP ASR Well (ASR-1)								
Assigned ID	**Permit Number**	**Diameter (in)**	**Casing Depth**	**Depth**	**Capacity (gpm)**	**Static Water Level (feet bls)**	**Location**	**Source**
1	162	8	*	199	250	*	City of Sanford, Seminole County	SJRWMD
2	162	12	*	80	350	*	City of Sanford, Seminole County	SJRWMD
3	162	8	*	84	300	*	City of Sanford, Seminole County	SJRWMD
4	162	8	*	NA	700	*	City of Sanford, Seminole County	SJRWMD
5	162	8	*	300	190	*	City of Sanford, Seminole County	SJRWMD
6	162	6	*	191	700	*	City of Sanford, Seminole County	SJRWMD
7	162	12	*	162	325	*	City of Sanford, Seminole County	SJRWMD
8	162	12	*	350	375	*	City of Sanford, Seminole County	SJRWMD
9	162	8	122	302	700	19	City of Sanford, Seminole County	SJRWMD
10	162	8	107	303	700	18	City of Sanford, Seminole County	SJRWMD
11	162	12	140	328	400	20	City of Sanford, Seminole County	SJRWMD
12	162	8	100	303	700	16	City of Sanford, Seminole County	SJRWMD
13	8080	NA	104	180	NA	*	2710 Ridgewood Ave., City of Sanford	Building Department
14	6557	NA	113	126	23	29	3302 Palmway, City of Sanford	Building Department
15	3380	NA	*	NA	NA	*	3301 Palmway, City of Sanford	Building Department

* No data available

Table A-1 Continued Well Inventory Within One-Mile Radius of Sanford AUX WTP ASR Well (ASR-1)								
Assigned ID	**Permit Number**	**Diameter (in)**	**Casing Depth**	**Depth**	**Capacity (gpm)**	**Static Water Level (feet bls)**	**Location**	**Source**
16	6887	NA	*	NA	NA	*	3322 Palmway, City of Sanford	Building Department
17	6122	NA	*	NA	NA	*	302 Poinsetta Dr., City of Sanford	Building Department
18	7223	NA	*	NA	NA	*	3405 Palmway, City of Sanford	Building Department
19	5510	NA	*	NA	NA	*	3682 Laurel Ave., City of Sanford	Building Department
20	30523	4	78	105	23	10	3648 Laurel Ave., City of Sanford	SJRWMD
21	*		117	119	25	25	3522 Palway, City of Sanford	SJRWMD
22	31102	4	107	130	*	29	296 Rose Dr., City of Sanford	SJRWMD
23	*	4	105	140	45	27	3315 Palmway, City of Sanford	SJRWMD

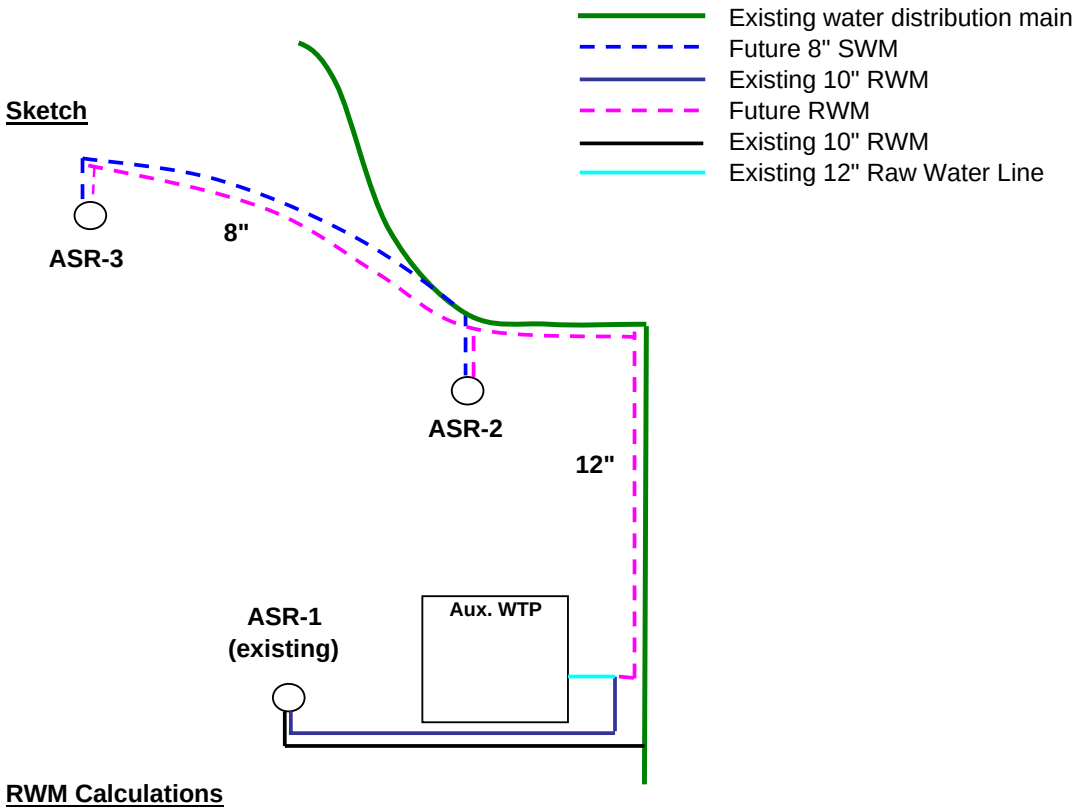
* No data available

ATTACHMENT 2

Hydraulic Calculations

HYDRAULIC CALCULATIONS

Sketch



RWM Calculations

1. Check velocity in proposed PVC RWM (to serve ASR-2 and/or ASR-3)

ASR wells pumping	Inside Dia (in.)	Area (ft^2)	Flow (gpm)	Flow (cfs)	Velocity (fps)	
one	7.863	0.34	694	1.55	4.59	ok
two	7.863	0.34	1388	3.09	9.17	
two	9.79	0.52	1388	3.09	5.92	
two	11.65	0.74	1388	3.09	4.18	ok

SWM Calculations

2. Check velocity in Proposed PVC water main (SWM) (to serve ASR-2 or ASR-3)

ASR wells injecting	Inside Dia (in.)	Area (ft^2)	Flow (gpm)	Flow (cfs)	Velocity (fps)	
one	7.863	0.34	694	1.55	4.59	ok

Appendix D

FDEP Underground Injection Control Permit and Administrative Order

FDEP Permit Number 59-0259876-001-UC

Underground Injection Control Permit
ASR Injection Well System

Department of Environmental Protection

Jeb Bush
Governor

Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

Colleen Castille
Secretary

BY ELECTRONIC MAIL: Moorep@ci.sanford.fl.us

In the Matter of an
Application for Permit by:

Paul R. Moore, P.E.
Director of Utilities
City of Sanford
300 N. Park Avenue
Sanford, FL 32771-0000
Moorep@ci.sanford.fl.us

Seminole County – UIC
FDEP File No. 59-0259876-001-UC
Potable Water ASR Program
Class V ASR Injection Well

NOTICE OF PERMIT ISSUANCE

Enclosed is Permit Number 59-0259876-001 to construct one Class V, Group Seven, Aquifer Storage and Recovery (ASR) injection well system, issued pursuant to Section(s) 403.087, Florida Statutes.

The purpose of the ASR well is to store and recover potable water in the Floridan aquifer in order to meet the potable water demands in a priority water resource caution area, provided that injection testing is successful.

Any party to this Order (permit) has the right to seek judicial review of the permit pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000; and by filing a copy of the Notice of appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this Notice is filed with the Clerk of the Department.

Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

for Vivian F. Garfein
Director, Central District

CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this PERMIT and all copies were e-mailed before the close of business on September 28, 2006 to the listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGMENT

FILED, on this date, pursuant to Section.120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Carol O'Keefe
Clerk

September 28, 2006
Date

VFG/CCF/dw
Enclosures
Copies furnished to:

Technical Advisory Committee

.

Department of Environmental Protection

Jeb Bush
Governor

Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

Colleen Castille
Secretary

BY ELECTRONIC MAIL: Moorep@ci.sanford.fl.us

PERMIT

PERMITTEE:
Paul R. Moore, P.E.
Director of Utilities
City of Sanford
300 N. Park Avenue
Sanford, FL 32771-0000
Moorep@ci.sanford.fl.us

Seminole County – UIC
Permit File Number: 59-0259876-001-UC
Date of Issue: September 28, 2006
Expiration Date: September 27, 2011
County: Seminole
Latitude: 28° 46' 04.67" N
Longitude: 81° 16' 57.59" W
City of Sanford Potable Water ASR Project
Class V ASR Injection Well

This permit is issued under the provisions of Chapter 403 of the Florida Statutes (F.S.) and Rules 62-4, 62-520, 62-528, 62-550, 62-600, 62-601, and 62-610 of the Florida Administrative Code. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents, attached hereto or on file with the Department and made a part hereof and specifically described as follows:

Construct one Class V Group Seven Aquifer Storage and Recovery (ASR) injection well system with two storage zone monitoring wells (SZMW-1 (exploratory well – already constructed) and SZMW-2), one confining zone monitoring well (CZMW-1). The basic ASR well design will consist of a 10.5-inch diameter injection well to a proposed total depth of approximately 630 feet and cased to approximately 530 feet below land surface (bls). The ASR system will have a maximum storage capacity of 200 to 300 MG. The overall objective of this ASR well is to store, in the Floridan aquifer, potable water from the City of Sanford Auxiliary Water Treatment Plant water main and retrieve the stored potable water for use in a priority water resource caution area. Initially, the ASR well will be cycle tested by injecting, storing and recovering potable water for a period of approximately 2 years. Provided that the testing is successful, the ASR system will be put in use.

The Application to Construct V Injection well System, DEP Form 62-528.900(1), was received January 10, 2006, with supporting documents and additional information last received April 25, 2006. The location for this project is 3100 South Orlando Drive, Sanford, Seminole County, Florida.

Subject to Specific Conditions 1-8 and General Conditions 1-4.

1. Specific Conditions:

   a. This permit approval is based upon evaluation of the data contained in the application, plans and specifications submitted in support of the application. Any changes, except as provided elsewhere in this permit, must be approved by the Department before implementation.

   b. No drilling operations shall begin without an approved disposal site for drill cuttings, fluids or waste. It shall be the Water Well Contractor's responsibility to obtain any necessary Department and local agency approval for disposal prior to the start of construction. It is anticipated that wastes will be disposed of on site using a closed loop system. In this event, permits shall be obtained accordingly.

   c. No fluid shall be injected without written authorization from the Department. The issuance of this construction permit does not obligate the Department to permit its operation, unless the well, monitoring system and surface appurtenances qualify for an operation permit.

   d. Those conditions imposed by the St. Johns River Water Management District in this project's Water Use Permit(s) regarding the testing of the ASR system remain in effect.

   e. No underground injection is allowed that causes or allows movement of fluid into an underground source of drinking water if such fluid movement may cause a violation of any primary drinking water standard or may otherwise adversely affect the health of persons.

   f. If historical or archaeological artifacts, such as Indian canoes, are discovered at any time within the project site, the permittee shall notify the FDEP Orlando Central District office and the Bureau of Historic Preservation, Division of Archives, History and Records Management, R. A. Gray Building, Tallahassee, Florida 32301, telephone number (850) 487-2073.

   g. Signatories and Certification Requirements

      (1) All reports and other submittals required to comply with this permit shall be signed by a person authorized under Rules 62-528.340(1) or (2), F.A.C.

      (2) In accordance with Rule 62-528.340(4), F.A.C., all reports shall contain the following certification:

      "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

   h. Plugging/abandonment and Alternate use plans – Permittees who are unable to operate the ASR well to meet its intended purpose shall within 180 days of FDEP notification:

      (1) Submit a plugging and abandonment permit application in accordance with Rules 62-528.625 and 62-528.645, F.A.C., or

      (2) Submit an alternate use plan for the well. Alternate use may commence after the plan has been approved by the Department, including any necessary permit or permit modifications as required by the Department or any other agency.

i. Prior to operational testing under this permit, the permittee shall obtain from the Department, a Water Quality Criteria Exemption (pursuant to Rule 62-520.500, F.A.C.) for sodium or any secondary standards that may be exceeded, where applicable.

j. The permittee shall be aware of and operate under General Conditions F.A.C. Rule 62-528.307(1)(a) through (x). General Conditions are binding upon the permittee and enforceable pursuant to Chapter 403 of the Florida Statutes (see attachment I).

k. The permittee shall refer to Rule 62-610.466, F.A.C., in its entirety, to ensure compliance with all requirements for ASR wells.

2. Quality Assurance/Quality Control

a. The permittee shall ensure that the construction of this facility shall be as described in the application and supporting documents. Any proposed modifications to this permit shall be submitted in writing to the Underground Injection Control program manager for review and clearance prior to implementation. Changes of negligible impact to the environment and staff time will be reviewed by the program manager, cleared when appropriate, and incorporated into this permit. Changes or modifications other than those described above will require submission of completed application and appropriate processing fees as per Rule 62-4.050, F.A.C.

b. A Florida registered professional engineer, pursuant to Chapter 471, Florida Statutes (F.S.), shall be retained throughout the construction period and operational testing to be responsible for the construction operation and to certify the application, specifications and completion report and other related documents, pursuant to Rule 62-528.440(5), F.A.C. A professional engineer or professional geologist shall provide monitoring of the drilling and testing operation. The Department shall be notified immediately of any change of the Engineer of Record.

c. All water quality samples required in this permit shall be collected and analyzed in accordance with Department Standard Operating Procedures (SOP), pursuant to the FDEP Quality Assurance, Chapter 62-160, F.A.C. The various components of the collection of the FDEP SOPs are found in DEP-SOP-001/01 (Field Procedures) and DEP-SOP-002/01 (Laboratory Procedures).

d. The permittee shall calibrate all pressure gauge(s), flow meter(s), chart recorder(s), and other related equipment associated with the injection well system on a semi-annual basis. The permittee shall maintain all monitoring equipment and shall ensure that the monitoring equipment is calibrated and in proper operating condition at all times. Laboratory equipment, methods, and quality control will follow EPA guidelines as expressed in Standard Methods for the Examination of Water and Wastewater. The pressure gauge(s), flow meter(s), and chart recorder(s) shall be calibrated using standard engineering methods.

e. Continuous on-site supervision by qualified personnel (engineer and/or geologist, as appropriate) is required during all testing and geophysical logging operations.

f. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures.

g. Hurricane Preparedness - Upon the issuance of a "Hurricane Watch" by the National Weather Service, the preparations to be made include, but are not necessarily limited to, the following:

(1) Secure all on-site salt and other stockpiled additive materials to prevent surface and/or ground water contamination.

(2) Properly secure drilling equipment and rig(s) to prevent damage to well(s) and on-site treatment process equipment.

3. Source Water Fluid Analysis

a. Potable Water – within the 60 days prior to beginning cycle testing and an additional event during the construction phase of the ASR well. Results from four (4) sampling events dated 12/09/99, 6/11/02, 10/15/04 and 6/15/05 have been previously submitted and found satisfactory.

(1) Prior to injection, the potable water analyses shall include:

(a) Primary and Secondary drinking water standards established in Chapter 62-550, Part III, F.A.C., (excluding asbestos, acrylamide, epichlorohydrin, and dioxin);

(b) Giardia lamblia and Cryptosporidium (count and viability testing where applicable) dissolved oxygen, E. coli and enteroccoci (a single event test for characterizing the background water quality);

(c) Fecal and total coliform.

4. Construction, Testing and Reporting

a. Prior to the commencement of any work, the name of the Florida-registered driller(s) supervising the drilling operations and the driller's registration number shall be submitted to the Department. The permittee or the engineer of record shall provide the Department with copies of all required federal, state or local permits prior to the commencement of drilling the wells.

b. If any problem develops that may seriously hinder compliance with this permit, construction progress or good construction practice, the Department shall be notified immediately. The Department may require a detailed written report describing what problems have occurred, the remedial measures applied to assure compliance and the measures taken to prevent recurrence of the problem.

c. During the construction period allowed by this permit, daily progress reports shall be submitted to the Department, the U.S. Environmental Protection Agency (EPA) and the Technical Advisory Committee each week. The reporting period shall run Friday through Thursday and reports shall be mailed on Friday of each week. The report shall include, but is not limited to, the following:

(1) A cover letter summarizing each week's activities and a projection of activities for the next reporting period;

(2) Description of daily footage drilled by diameter of bit or size of hole opener or reamer being used;

(3) Description of work during installation and cementing of casing, including amounts of casing and cement used;

(4) Lithologic log with cuttings description, formation, and depth encountered;

(5) Collection of drilling cuttings at least every 5 feet and at every formation change;

(6) Water quality analyses;

(7) Description of work and type of testing accomplished including geophysical logging, video logs, and pumping tests;

(8) Description of any construction problems that developed during the reporting period and current status;

(9) Copies of the driller's log are to be submitted with the weekly summary;

(10) Description of any deviation survey conducted;

(11) Details of any packer tests, pump tests and core analyses; and

(12) Details of the additions of salt or other materials to suppress well flow (if applicable), and include the date, depth and amount of material used.

d. Upon completion of construction of the injection well and all monitor wells, detailed in this permit, a complete set of as-built engineering drawings (Florida registered P.E. signed and sealed) shall be submitted to the Department's district office and Tallahassee UIC Program.

e. Background ground-water quality samples shall be obtained from the ASR test well and all monitor wells for the specific water quality criteria listed for potable water in specific condition 3. "Background" means the condition of waters in the absence of the activity or discharge under consideration, based on the best scientific information available to the Department [Rule 62-520.200(3), F.A.C.]. The samples shall be taken after final completion and clearance of drilling fluids from each well, and prior to the initiation of any pump tests.

f. Within 30 days of well completion of the ASR test well and monitor wells, the permittee or the authorized representative shall submit to the Department for each well the following information:

(1) Certification of Class V Well Construction Completion, DEP Form 62-528.900(4);

(2) A copy of the St. Johns River Water Management District permit to construct a well;

(3) A copy of the Water Management District's Well Completion Report; and

g. This project shall be monitored by the Department with the assistance of the U.S. Environmental Protection Agency (EPA) - Region 4 and the Technical Advisory Committee (TAC), which consists of representatives of the following agencies (see attached TAC list):

Department of Environmental Protection – Orlando
Department of Environmental Protection – Tallahassee
St. Johns River Water Management District – Palm Bay
US Environmental Protection Agency, Region 4 - Atlanta

h. Permitee shall provide copies of all correspondence relative to this permit to each member of the TAC and EPA. Such correspondence includes but is not limited to reports, schedules, analyses and geophysical logs required by the Department under the terms of this permit. The permittee is not required to provide specific correspondence to any TAC member who submits to the permittee a written request to be omitted as a recipient of specific correspondence.

i. After completion of construction and testing, a final engineering report shall be submitted to the Department, the EPA and the TAC. The report shall include, but not be limited to, all information and data collected under Rules 62-528.605, 62-528.615, and 62-528.635, F.A.C., with appropriate interpretations. Mill certificates for the casings shall be included in the report. To the extent possible, the transmissivity and storativity of the injection zone and the maximum capacity within safe pressure limits shall be estimated. This report shall also be signed and sealed by a Florida licensed professional engineer and professional geologist.

j. After completion of construction and testing, the following items shall be submitted to the State Geologist at the Florida Geological Survey, 903 West Tennessee Street, Tallahassee, Florida 32304-7707:

(1) Cuttings obtained during well construction;

(2) Any cores obtained during well construction when no longer needed by the permittee;

(3) Any geophysical logs run during well construction; and

(4) A copy of the final report described in Condition 4.i. above.

k. A written, detailed evaluation of the ASR system performance shall be included with the permit renewal or operation permit application.

l. The specifications for a temporary containment structure around the borehole during the drilling of the ASR well shall be submitted to and approved by the Department prior to the ASR well construction.

5. Cycle Testing Requirements Using Potable Water

a. After authorization by the Department, the permittee shall conduct cycle testing of the ASR well system using potable water to demonstrate that the ASR well(s) can maintain water quality standards and assimilate the design daily flows prior to receiving approval for full operation using potable water. Cycle testing using potable water shall not commence until issuance of authorization from the Department. Prior to Department authorization of operational cycle testing:

(1) The permittee shall submit at a minimum the following information to the U.S.EPA and to each member of the Technical Advisory Committee for review:

(a) Draft operation and maintenance manual;

(b) Lithologic and geophysical logs with interpretations;

(c) Results of pressure tests on the final casing for the ASR well and the storage zone monitor wells;

(d) Surface equipment completion certification or certification of interim completion for the purposes of testing;

(e) Signed and sealed as-built engineering drawings of all wellheads and subsurface well components;

(f) A consumptive use permit and all other applicable permits; and

(g) Submittal of a plugging and abandonment plan.

(h) Completion report for the storage zone monitoring well (SZMW-2) and the confining zone monitoring well (CZMW-1) located in the vicinity of well ASR-1.

(2) Before authorizing operational testing, the Department shall conduct an inspection of the facility to determine if the conditions of this permit have been met.

(3) The permittee shall provide an updated well inventory and physically verify all wells that are within a 1.0-mile radius of the ASR test well. Operational status, existing use, depth of final casing, and total depth of the wells shall be determined and submitted with the above-mentioned information.

(4) Prior to approval to inject into Class G-II ground water, the permittee shall meet the applicable criteria in Rule 62-610.466, F.A.C. Compliance with public and utility notifications in Rule 62-610.574(4), F.A.C., is also required.

b. A cycle testing schedule shall be submitted to the FDEP for review and final authorization of cycle testing of the ASR well. The cycle testing schedule shall include a proposed monitoring parameter list based on the Primary and Secondary drinking water standards established in Chapter 62-550, Part III, F.A.C., (excluding asbestos, acrylamide, epichlorohydrin and dioxin).

c. The Florida Geological Survey (FGS) is currently investigating the effects of ASR systems on storage zones. The Department requests that the permittee contact the Hydrogeology Program at the FGS (850-488-9380) at least 30 days prior to operational testing to allow the Survey to coordinate a sampling schedule during the operational testing phase of this project.

d. A set back distance for the ASR well(s), in accordance with Chapter 62-521.200(7), F.A.C., has been established to be at least 500 feet from potable water supply wells.

6. Post Cycle Testing Operational Conditions Using Potable Water

a. A qualified representative of the Engineer of Record must be present for the start-up operations and the Department must be notified in writing of the date operational testing began for the subject well.

b. Proposed Class V ASR Test Well:

Well Name	Casing Diameter [OD] / Depth*	Injection Interval	Formation
ASR	10.5" fiber glass / 530'	530 – 630’	Avon Park

* below land surface; approximate depths.

Monitor Well System

Well Name	Casing Diameter / Depth*	Monitored Interval	Formation
SZMW-1 (existing explorator y well)	6.625" steel / 530'	530 – 628'	Avon Park
SZMW-2	6.625" PVC / 530'	530 – 630'	Avon Park
CZMW-1	6.625" PVC / 720'	430 - 480’	Avon Park

* below land surface; approximate depths.
(SZMW – Storage Zone Monitoring Well)
(CZMW – Confining Zone Monitoring Well)

c. Prior to operational use of the ASR, the authorization referenced in Specific 5.a. above shall have been obtained and a monitoring plan shall have been approved using the existing and newly installed monitoring wells (both SZMWs, one CZMW). Results of the water quality analyses of the potable water and background water quality pursuant to Specific Conditions 3. and 4.e. of this permit shall have been submitted. Aquifer test data, analysis and evaluation shall have been submitted and a monitoring program plan that includes construction diagrams, well specifications, well locations, construction specifications and drilling and testing plans shall have been submitted, approved by the Department and the new wells shall have been installed.

The ASR test well shall be monitored in accordance with the approved monitoring plan referenced above. The Department anticipates that the standard monitoring parameters and frequency listed below (and attached as Table 2) will apply during each recharge and recovery period. The monitor wells shall be sampled and analyzed in accordance with the schedule listed below and on the attached Table 2 based on the approved monitoring plan. Once the monitoring plan and parameters are approved, the permittee will be submitting a summary of the monthly monitoring data developed from the injection well instrumentation. The report may include the following data:

Parameter	Units	Recording Frequency	Frequency of Analysis	
			ASR	Monitoring Wells
Flow Rate, max.	Mgd	continuous	D/M	
Flow Rate, min.	Mgd	continuous	D/M	
Flow Rate, avg.	Mgd	continuous	D/M	
Total Volume Recharged	Mg	daily	D/M	
Total Volume Recovered	Mg	daily	D/M	
Net Storage Volume	Mg	daily	M*	
Injection Pressure, max.	Psi	continuous	D/M	
Injection Pressure, min.	Psi	continuous	D/M	
Injection Pressure, avg.	Psi	continuous	D/M	

+ -Weekly through cycle test 4, then twice monthly thereafter with Department written approval.
++ - January, April, July, October
* - Monthly net storage volume per ASR well and total ASR wellfield.
W - weekly; B - twice-monthly; D/M - daily and monthly; M - monthly; Q - quarterly.

Note: During extended storage periods (greater than 30 days), the water quality parameters listed above may be sampled and analyzed monthly.

e. The permittee shall submit monthly results of all injection well and monitoring well data required by this permit, and monthly progress reports which include both the current status of operational testing and a summary of all monthly activities, no later than the 28th day of the month immediately following the month of record. The results and progress reports shall be sent to the Department of Environmental Protection, 3319 Maguire Boulevard, Suite 232, Orlando, FL 32803-3767. A copy of the results and reports shall also be sent to the Department of Environmental Protection, Underground Injection Control Program, Mail Station 3530, 2600 Blair Stone Road, Tallahassee, FL 32399-2400.

f. A final engineering report shall be submitted to the Department, the FGS, EPA and each TAC member and include the following information:

(1) A detailed analysis of all cycle testing;

(2) An operation and maintenance section;

(3) Record drawings sealed by the Engineer of Record;

(4) Summary of all water quality and water level data collected, conclusions and recommendations; and

(5) Estimated ASR well capacity.

7. Abnormal Events

a. In the event the permittee is temporarily unable to comply with any conditions of this permit due to breakdown of equipment, power outages, destruction by hazard of fire, wind or by other cause, the permittee shall notify the Department. Notification shall be made in person, by telephone or by electronic mail within 24 hours of breakdown or malfunction to the UIC program staff, Orlando Central District, (407) 893-3308.

b. A written report of any noncompliance referenced in Condition 7.a. above shall be submitted to the Orlando Central District office within five days after discovery of the occurrence. The report shall describe the nature and cause of the breakdown or malfunction, the steps being taken or planned to be taken to correct the problem and prevent its reoccurrence, emergency procedures in use pending correction of the problem, and the time when the facility will again be operating in accordance with permit conditions.

8. Emergency Disposal

a. All applicable federal, state and local permits shall be in place to allow for any alternative discharges due to emergency or planned outage conditions.

b. Any changes in emergency disposal methods shall be submitted for TAC review and Department approval.

c. The permittee shall notify the Department within 24 hours whenever an emergency discharge has occurred. Written notification shall be provided to the Department within five days after each occurrence. The Permittee shall indicate the location and duration of the discharge and the volume of fluid discharged.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

for Vivian F. Garfein
Director, Central District

VFG/CCF/dw

Department of
Environmental Protection

Jeb Bush
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Central District
3319 Maguire Boulevard, Suite 232
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Colleen Castille
Secretary

BY ELECTRONIC MAIL: Moorep@ci.sanford.fl.us

Paul R. Moore, P.E.
Director of Utilities, City of Sanford
300 N. Park Avenue
Sanford, FL 32771-0000
Moorep@ci.sanford.fl.us

ATTENTION Paul R. Moore, P.E.
Director of Utilities, City of Sanford

Seminole County - UIC
Potable Water ASR Program
Construction Permit No. 59-0259876-001
Application No. 59-0259876-002
Modification of Conditions

Dear Mr. Moore:

The Department is in receipt of your Application No. 59-0250382-002 to modify the conditions of the injection well operation permit referenced above. The conditions are changed as follows:

1. Specific Condition 6.b. of the permit is modified to refer to PVC and the reference to fiberglass is deleted in the first section which addresses the ASR well specifications.

2. Section 2.E. of the Fact Sheet is modified to refer to PVC and the reference to FRP is deleted in the section which addresses the ASR well specifications.

Specifically, the 16-inch I.D. fiberglass casings will be replaced with 17.4-inch O.D. PCV casings and the 10.5-inch I.D. fiberglass casings will be replaced with 10.75-inch O.D. PVC casings. In addition, the 6-inch casing for monitoring wells CZMW-1 and SZMW-2 is modified to Schedule 80 PVC from SDR 17 PVC.

This letter must be attached to Injection Well Operation Permit No. 59-0259876-001 and becomes a part of and subject to all conditions of that permit.

The Department's proposed agency action shall become final unless a timely petition for an administrative hearing is filed under Sections 120.569 and 120.57 of the Florida Statutes before the deadline for filing a petition. The procedures for petitioning for a hearing are set forth below.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received by the clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000.

Petitions by the applicant or any of the parties listed below must be filed within fourteen days of receipt of this written notice. Petitions filed by any persons other than those entitled to written notice under Section 120.60(3) of the Florida Statutes must be filed within fourteen days of publication of the notice or within fourteen days of receipt of the written notice, whichever occurs first.

Under Section 120.60(3) of the Florida Statutes, however, any person who has asked the Department for notice of agency action may file a petition within fourteen days of receipt of such notice, regardless of the date of publication.

The petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57 of the Florida Statutes. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205 of the Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information:

(a) The name, address, and telephone number of each petitioner; the name, address, and telephone number of the petitioner's representative, if any; the Department permit identification number and the county in which the subject matter or activity is located;
(b) A statement of how and when each petitioner received notice of the Department action;
(c) A statement of how each petitioner's substantial interests are affected by the Department action;
(d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
(e) A statement of facts that the petitioner contends warrant reversal or modification of the Department action;
(f) A concise statement of the ultimate facts alleged, as well as the rules and statutes which entitle the petitioner to relief; and
(g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wants the Department to take.

A petition that does not dispute the material facts on which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under Section 120.573 of the Florida Statutes is not available for this proceeding.

This action is final and effective on the date filed with the Clerk of the Department unless a petition is filed in accordance with the above. Upon the timely filing of a petition this order will not be effective until further order of the Department.

Any party to the order has the right to seek judicial review of the order under Section 120.68 of the Florida Statutes, by the filing of a Notice Of Appeal under Rule 9.110 of the Florida Rules of Appellate Procedure with the Clerk of the Department in the Office of General Counsel, Mail Station 35, 3900 Commonwealth Boulevard, Tallahassee, Florida, 32399-3000; and by filing a copy of the Notice Of Appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The Notice Of Appeal must be filed within 30 days from the date when the final order is filed with the Clerk of the Department.

Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Christianne C. Ferraro, P.E.
Program Administrator
Water Facilities
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767
(407) 894-7555

Date: December 21, 2006

FILING AND ACKNOWLEDGMENT

FILED, on this date, pursuant to Section 120.52, F.S., with the designated Department Clerk, receipt of which is hereby acknowledged.

Clerk — December 22, 2006 Date

CERTIFICATE OF SERVICE

This is to certify that this MODIFICATION OF CONDITIONS and all copies were e-mailed before the close of business on December 22, 2006 to the listed persons by Duane Watroba.

VFG/ccf/akd/dw

cc: George Heuler, PG, UIC, Tallahassee
David King, SJRWMD, Palm Bay
Lee Wiseman, CDM

Florida Department of Environmental Protection
Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

BY ELECTRONIC MAIL:

Paul Moore, P.E.
Director of Utilities
City of Sanford
300 N. Park Avenue
Sanford, FL 32771-0000
Moorep@ci.sanford.fl.us

Attention: Paul Moore, P.E.
Director of Utilities

Seminole County - UIC
Potable Water ASR Program
Construction Permit 59-0259876-001-UC
Application No. 59-0259876-004-UC
Modification of Conditions

Dear Mr. Moore:

The Department is in receipt of your Application No. 59-0259876-004-UC to modify the conditions of the injection well construction permit referenced above. The conditions are changed as follows:

1. The following language is added to page one of ten of the permit:

   Dechlorination and degasification pre-treatment equipment will also be constructed for the Aquifer Storage and Recovery (ASR) system. Dechlorination will occur prior to degasification using sodium bisulfate to reduce Oxidation Reduction Potential (ORP) and chlorine. Degasification will be accomplished afterwards using a Membrana Liqui-Cel system to reduce dissolved oxygen and to further reduce ORP.

This letter must be attached to Injection Well Construction Permit No. 64-0259876-001-UC and becomes a part of and subject to all conditions of that permit.

The Department's proposed agency action shall become final unless a timely petition for an administrative hearing is filed under Sections 120.569 and 120.57 of the Florida Statutes before the deadline for filing a petition. The procedures for petitioning for a hearing are set forth below.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received by the clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000.

Petitions by the applicant or any of the parties listed below must be filed within fourteen days of receipt of this written notice. Petitions filed by any persons other than those entitled to written notice under Section 120.60(3) of the Florida Statutes must be filed within fourteen days of publication of the notice or within fourteen days of receipt of the written notice, whichever occurs first.

Under Section 120.60(3) of the Florida Statutes, however, any person who has asked the Department for notice of agency action may file a petition within fourteen days of receipt of such notice, regardless of the date of publication.

The petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57 of the Florida Statutes. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205 of the Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information:

(a) The name, address, and telephone number of each petitioner; the name, address, and telephone number of the petitioner's representative, if any; the Department permit identification number and the county in which the subject matter or activity is located;
(b) A statement of how and when each petitioner received notice of the Department action;
(c) A statement of how each petitioner's substantial interests are affected by the Department action;
(d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
(e) A statement of facts that the petitioner contends warrant reversal or modification of the Department action;
(f) A concise statement of the ultimate facts alleged, as well as the rules and statutes which entitle the petitioner to relief; and
(g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wants the Department to take.

A petition that does not dispute the material facts on which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under Section 120.573 of the Florida Statutes is not available for this proceeding.

This action is final and effective on the date filed with the Clerk of the Department unless a petition is filed in accordance with the above. Upon the timely filing of a petition this order will not be effective until further order of the Department.

Any party to the order has the right to seek judicial review of the order under Section 120.68 of the Florida Statutes, by the filing of a Notice Of Appeal under Rule 9.110 of the Florida Rules of Appellate Procedure with the Clerk of the Department in the Office of General Counsel, Mail Station 35, 3900 Commonwealth Boulevard, Tallahassee, Florida, 32399-3000; and by filing a copy of the Notice Of Appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The

Notice of Appeal must be filed within 30 days from the date when the final order is filed with the Clerk of the Department.

Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Christianne C. Ferraro, P.E.
Program Administrator
Water Resource Management
3319 Maguire Boulevard
Suite 232
Orlando, Florida 32803-3767
(407) 894-7555

Date: July 8, 2008

FILING AND ACKNOWLEDGMENT

FILED, on this date, pursuant to Section 120.52, F.S., with the designated Department Clerk, receipt of which is hereby acknowledged.

Clerk July 8, 2008
Date

VFG/CCF/AKD/dw

cc: George Heuler, PG, UIC, Tallahassee

CERTIFICATE OF SERVICE

This is to certify that this MODIFICATION OF CONDITIONS and all copies were e-mailed before the close of business on July 8, 2008 to the listed persons by Duane Watroba.

Florida Department of Environmental Protection
Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

BY ELECTRONIC MAIL:

Paul Moore, P.E.
Director of Utilities
City of Sanford
300 N. Park Avenue
Sanford, FL 32771-0000
Moorep@ci.sanford.fl.us

Attention: Paul Moore, P.E.
Director of Utilities

Seminole County - UIC
Potable Water ASR Program
Construction Permit 59-0259876-001-UC
Application No. 59-0259876-005-UC
Modification of Conditions

Dear Mr. Moore:

The Department is in receipt of your Application No. 59-0259876-005-UC to modify the conditions of the injection well operation permit referenced above. The conditions are changed as follows:

1. The following language is added to page one of ten of the permit:

   This Permit is issued in conjunction with Administrative Order Number AO-08-0015 (attached to this permit modification). Cycle testing and monitoring plans are modified in accordance with the attachments (1 and 2) to this permit.

This letter must be attached to Injection Well Operation Permit No. 64-0259876-001-UC and becomes a part of and subject to all conditions of that permit.

The Department's proposed agency action shall become final unless a timely petition for an administrative hearing is filed under Sections 120.569 and 120.57 of the Florida Statutes before the deadline for filing a petition. The procedures for petitioning for a hearing are set forth below.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received by the clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000.

Petitions by the applicant or any of the parties listed below must be filed within fourteen days of receipt of this written notice. Petitions filed by any persons other than those entitled to written notice under Section 120.60(3) of the Florida Statutes must be filed within fourteen days of publication of the notice or within fourteen days of receipt of the written notice, whichever occurs first.

Under Section 120.60(3) of the Florida Statutes, however, any person who has asked the Department for notice of agency action may file a petition within fourteen days of receipt of such notice, regardless of the date of publication.

The petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57 of the Florida Statutes. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205 of the Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information:

(a) The name, address, and telephone number of each petitioner; the name, address, and telephone number of the petitioner's representative, if any; the Department permit identification number and the county in which the subject matter or activity is located;
(b) A statement of how and when each petitioner received notice of the Department action;
(c) A statement of how each petitioner's substantial interests are affected by the Department action;
(d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
(e) A statement of facts that the petitioner contends warrant reversal or modification of the Department action;
(f) A concise statement of the ultimate facts alleged, as well as the rules and statutes which entitle the petitioner to relief; and
(g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wants the Department to take.

A petition that does not dispute the material facts on which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under Section 120.573 of the Florida Statutes is not available for this proceeding.

This action is final and effective on the date filed with the Clerk of the Department unless a petition is filed in accordance with the above. Upon the timely filing of a petition this order will not be effective until further order of the Department.

Any party to the order has the right to seek judicial review of the order under Section 120.68 of the Florida Statutes, by the filing of a Notice Of Appeal under Rule 9.110 of the Florida Rules of Appellate Procedure with the Clerk of the Department in the Office of General Counsel, Mail Station 35, 3900 Commonwealth Boulevard, Tallahassee, Florida, 32399-3000; and by filing a copy of the Notice Of Appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The

Notice of Appeal must be filed within 30 days from the date when the final order is filed with the Clerk of the Department.

Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Christianne C. Ferraro, P.E.
Program Administrator
Water Resource Management
3319 Maguire Boulevard
Suite 232
Orlando, Florida 32803-3767
(407) 894-7555

Date: January 6, 2009

FILING AND ACKNOWLEDGMENT

FILED, on this date, pursuant to Section 120.52, F.S., with the designated Department Clerk, receipt of which is hereby acknowledged.

Clerk January 6, 2009
Date

CCF/AKD/dw

cc: George Heuler, PG, UIC, Tallahassee

CERTIFICATE OF SERVICE

This is to certify that this MODIFICATION OF CONDITIONS and all copies were e-mailed before the close of business on January 6, 2009 to the listed persons by Duane Watroba.

Table 2
Proposed Monitoring Schedule for City of Sanford, Florida

Parameter	Units	Frequency		Pre-Cycle Testing #of Samples			Cycle 1 # of Samples						Cycle 2 # of Samples						Cycle 3 # of Samples						Cycle 4 # of Samples					
				60 days	Background Sampling[2]		Injection (7-12 days)		Storage (10-30 days)		Recovery (7-12 days)		Injection (7-12 days)		Storage (10-30 days)		Recovery (7-12 days)		Injection (32-64 days)		Storage (30-60 days)		Recovery (32-64 days)		Injection (32-64 days)		Storage (30-60 days)		Recovery (32-64 days)	
		ASR	MWs	Source Water[1]	ASR	MWs	ASR	MWs	ASR	MWs	ASR	MWs	ASR	MWs	ASR	MWs	ASR	MWs	ASR	MWs	ASR	MWs	ASR	MWs	ASR	MWs	ASR	MWs	ASR	MWs
Arsenic	µg/L	W2	W2	---	---	---	---	4	8	8	4	4	---	4	8	8	4	4	---	18	16	16	18	18	---	18†	16	16†	18	18†
Chloride	mg/L	W	W	---	---	---	---	2	4	4	2	2	---	2	4	4	2	2	---	9	8	8	9	9	---	9	8	8	9	9
Dissolved Oxygen (field)	mg/L	W	W	---	---	---	---	2	4	4	2	2	---	2	4	4	2	2	---	9	8	8	9	9	---	9	8	8	9	9
Iron, total	mg/L	W	W	---	---	---	---	2	4	4	2	2	---	2	4	4	2	2	---	9	8	8	9	9	---	9	8	8	9	9
Sodium	mg/L	W	W	---	---	---	---	2	4	4	2	2	---	2	4	4	2	2	---	9	8	8	9	9	---	9	8	8	9	9
pH	std. units	W	W	---	---	---	---	2	4	4	2	2	---	2	4	4	2	2	---	9	8	8	9	9	---	9	8	8	9	9
Specific Conductance (field)	µmhos/cm	W	W	---	---	---	---	2	4	4	2	2	---	2	4	4	2	2	---	9	8	8	9	9	---	9	8	8	9	9
Sulfate	mg/L	W	W	---	---	---	---	2	4	4	2	2	---	2	4	4	2	2	---	9	8	8	9	9	---	9	8	8	9	9
Temperature (field)	°C	W	W++	---	---	---	---	2	4	1	2	2	---	2	4	1	2	2	---	9	8	2	9	9	---	9	2	2	9	9
Total Dissolved Solids	mg/L	W	W	---	---	---	---	2	4	4	2	2	---	2	4	4	2	2	---	9	8	8	9	9	---	9	8	8	9	9
Bicarbonate	mg/L	W	M	---	---	---	---	---	4	1	2	---	---	1	4	---	2	1	---	2	8	2	9	2	---	2	4	2	9	2
Magnesium	mg/L	W	M	---	---	---	---	---	4	1	2	---	---	1	4	---	2	1	---	2	8	2	9	2	---	2	4	2	9	2
Manganese	mg/L	W	M	---	---	---	---	---	4	1	2	---	---	1	4	---	2	1	---	2	8	2	9	2	---	2	4	2	9	2
ORP (field)	mV	W	M	---	---	---	---	---	4	1	2	---	---	1	4	---	2	1	---	2	8	2	9	2	---	2	4	2	9	2
Potassium	mg/L	W	M	---	---	---	---	---	4	1	2	---	---	1	4	---	2	1	---	2	8	2	9	2	---	2	4	2	9	2
Total Alkalinity	mg/L	W	M	---	---	---	---	---	4	1	2	---	---	1	4	---	2	1	---	2	8	2	9	2	---	2	4	2	9	2
Total Trihalomethane	ug/L	W	M	---	---	---	---	---	4	1	2	---	---	1	4	---	2	1	---	2	8	2	9	2	---	2	4	2	9	2
Total Coliform	#/100 ml	W+	M	---	---	---	---	---	4	1	2	---	---	1	4	---	2	1	---	2	8	2	9	2	---	2	4	2	4	2
Fecal Coliform	#/100/ml	W+	M	---	---	---	---	---	4	1	2	---	---	1	4	---	2	1	---	2	8	2	9	2	---	2	4	2	4	2
Gross Alpha	pCi/L	M	M	---	---	---	---	---	1	1	---	---	---	1	1	---	---	1	---	2	2	2	2	2	---	2	2	2	2	2
Uranium	pCi/L	M	M	---	---	---	---	---	1	1	---	---	---	1	1	---	---	1	---	2	2	2	2	2	---	2	2	2	2	2
^{226}Ra / ^{228}Ra	pCi/L	O	---	---	---	---	---	---	---	---	2	---	---	---	---	---	2	---	---	---	---	---	2	---	---	---	---	---	2	---
Primary and Secondary DW Parameters		A	---	1	1	1	---	---	---	---	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	---	---	---	---

MWs - SZMW-1, SZMW-2, and CZMW-1

W – Weekly

W2 – Twice/week

O – Only required when gross alpha exceeds 5 pCi/L, sampled beginning and end of recovery cycle.

A – Annually

+ – Weekly through Cycle Test 3, then twice monthly thereafter with Department written approval

++ – Weekly during recharge and recovery, monthly during storage

[1] Source water sampled within 60 days prior to starting cycle testing for Primary and Secondary Drinking Water Parameters established in 62-550, Part III excluding asbestos acrylamide, epichlorohydrin, and dioxin and including giardia lamblia, cryptosporidium, dissolved oxygen, E.coli, enteroccoci, and fecal and total coliform.

[2] Completed prior to any pump tests.

[3] During extended storage periods (greater than 30 days), the water quality parameters listed above may be sampled and analyzed monthly.

†FDEP may decrease the number of samples required for arsenic during Cycle 4 based on information obtained during Cycles 1-3.

Table 1

Matrix Volume Between ASR well and the Closest and Distant Storage Zone Monitoring Wells (SZMW)

Condition	r	H	ϕ	Volume		Approx Time to reach SZMW[1]
Volume Between	(feet)	(feet)	(dim)	(ft3)	(mgal)	(days)
ASR-1 to SZMW-1	122	100	0.3	1,402,783	10.5	10.5
ASR-1 to SZMW-2	319	100	0.3	9,590,740	71.7	71.7

[1] Assuming an injection and recovery rate of 1 mgd

Florida Department of Environmental Protection

Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767
Phone: (407) 894-7555

BEFORE THE STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Responsible Authority:

Paul R. Moore, P.E., Director of Utilities
City of Sanford
300 N. Park Avenue
Sanford, FL 32771-0000

DEP Permit No. 59-0259876-001-UC
Order No. AO-08-0015
City of Sanford Potable Water ASR Project

DRAFT ADMINSTRATIVE ORDER

I. STATUTORY AUTHORITY

The Department of Environmental Protection (Department) issues this Administrative Order under the authority of Section 403.088(2)(f) of the Florida Statutes (F.S.). The Secretary of the Department has delegated this authority to the Director of the Central District, who issues this Order and makes the following findings of fact.

II. FINDINGS OF FACT

1. The Permittee, Paul R. Moore, P.E., is a person under Section 403.031, F. S.

2. The Facility is located at 3100 South Orlando Drive, Sanford, Seminole County, Florida. This aquifer storage and recovery (ASR) operation is subject to the requirements contained in Rules 62-4, 62-520, 62-528 and 62-550 of the Florida Administrative Code (F.A.C.), which includes underground injection control, permitting and ground water monitoring requirements.

3. The Facility applied for a permit on January 10, 2006, under Section 403 .0876, F.S., to construct an aquifer storage and recovery (ASR) system. Permit No. 50-0259876-001-UC (Permit) constitutes Department approval for the construction of the approved ASR Facility. Operational (cycle) testing approval will require Department authorization per Specific Condition 5.a of Permit No. 59-0259876-001-UC.

4. The Department acknowledges that the site at which this Facility operates has never been used for ASR activities that may potentially affect ground water quality.

5. The availability of ground water monitoring data in the ASR aquifer is limited or does not exist for this facility.

6. The Facility has provided reasonable assurance that the water injected will meet all primary drinking water standards prior to injection.

7. The Facility has not provided reasonable assurance that the ASR activity will result in arsenic concentrations that will meet the 10 µg/L standard in the ground water. Most ASR facilities in Florida have experienced exceedances of the 10 µg/L standard either in the recovered water or the storage zone monitor wells, or both, although the injectate meets the standard. The Facility can not provide data to demonstrate this ASR project will result in compliance with the arsenic standard.

III. ORDER

Based on the foregoing findings of fact, IT IS ORDERED,

8. The Facility shall comply with all conditions of Permit No. 59-0259876-001-UC and applicable water quality standards, except as otherwise authorized under this Administrative Order.

9. If arsenic levels during operational (cycle) testing conducted under Permit No. 59-0259876-001-UC or subsequent permit modifications or renewals, or future construction permits for ASR wells, or monitor wells not covered under Permit No. 59-0259876-001-UC, are found to exceed 10 µg/L in the recovered water or any associated monitor well, the permittee shall submit a report addressing the operational (cycle) testing results of the collected ground water monitoring data including a determination after every two cycles if there is an indication that arsenic levels are decreasing. The report shall be submitted to the Department no later than 90 days following the end of the recovery period for the second cycle. The report shall include a discussion of the changes in water quality parameters exceeding maximum contaminant levels, including arsenic, during the injection, storage, and recovery periods. The discussion of the arsenic results shall address the possibility that continued cycles may allow the facility to come into compliance without pretreatment and shall include a projected time until compliance will be achieved.

10. If the arsenic standard is exceeded in recovered water or ground water as a result of ASR operations, any future ASR permits for this facility can only be issued with an associated Consent Order.

11. In addition, the Department may require certain enhancements to the ASR facility, which may include, but not be limited to, additional monitoring parameters; a greater monitoring frequency; additional monitoring wells particularly if ground water not meeting the arsenic standard may be migrating off Facility property; and a pretreatment program to reduce arsenic leaching in the storage zone.

12. If monitoring indicates the potential that arsenic exceeding 10 µg/L is occurring off-site because of the ASR activity, the Department may require the following within the area of review which includes the lateral extent into which the injected fluids are calculated to migrate plus a 50 percent buffer zone; or a one-mile radius, whichever is larger:

a) A field-verified inventory of all wells used to withdraw water from the ASR storage zone or any zone into which the stored water may migrate; or

b) Institutional controls that prohibit the construction of new wells and use of existing wells for drinking water supply which withdraw from the storage zone aquifer or any zone into which the injected fluid may migrate.

13. Reports or other information required by this Administrative Order shall be sent to the Department of Environmental Protection, Underground Injection Control Program, Central District, 3319 Maguire Boulevard, Suite 232, Orlando, Florida 32803-3767, and to the Department of Environmental Protection, Underground Injection Control Program, 2600 Blair Stone Road, MS 3530, Tallahassee, Florida 32399-2400.

14. This Administrative Order does not operate as a permit under Section 403.088 of the Florida Statutes. This Administrative Order shall be incorporated by reference into Permit No. 59-0259876-001-UC.

15. Failure to comply with the requirements of this Administrative Order shall constitute a violation of this Administrative Order and Permit No. 59-0259876-001-UC, and may subject the Facility to penalties as provided in Section 403.161, F.S.

16. If any event, excluding administrative or judicial challenges by third parties unrelated to the Facility, occurs which causes delay or the reasonable likelihood of delay, in complying with the requirements of this Administrative Order, the Facility shall have the burden of demonstrating that the delay was or will be caused by circumstances beyond the reasonable control of the Facility and could not have been or cannot be overcome by the Facility's due diligence. Economic circumstances shall not be considered circumstances beyond the reasonable control of Facility, nor shall the failure of a contractor, subcontractor, materialman or other agent (collectively referred to as "contractor") to whom responsibility for performance is delegated to meet contractually imposed deadlines be a cause beyond the control of Facility, unless the cause of the contractor's late performance was also beyond the contractor's control. Upon occurrence of an event causing delay, or upon becoming aware of a potential for delay, the Facility shall notify the Central District of the Department orally at (407) 894-7555 within 24 hours or by the next working day and shall, within seven calendar days of oral notification to the Department, notify the Department in writing at: Department of Environmental Protection, Underground Injection Control Program, Central District, 3319 Maguire Boulevard, Suite 232, Orlando, Florida 32803-3767 of the anticipated length and cause of the delay, the measures taken or to be taken to prevent or minimize the delay and the timetable by which Facility intends to implement these measures. If the parties can agree that the delay or anticipated delay has been or will be caused by circumstances beyond the reasonable control of the Facility, the time for performance hereunder shall be extended for a period equal to the agreed delay resulting from such circumstances.

IV. NOTICE OF RIGHTS

17. A person whose substantial interests are affected by this Order may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received by the clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail

Station 35, Tallahassee, Florida 32399-3000.

Under Rule 62-110.106(4), Florida Administrative Code, a person may request enlargement of the time for filing a petition for an administrative hearing. The request must be filed (received by the clerk) in the Office of General Counsel before the end of the time period for filing a petition for an administrative hearing.

Petitions by the applicant or any of the persons listed below must be filed within fourteen days of receipt of this written notice. Petitions filed by any persons other than those entitled to written notice under Section 120.60(3), Florida Statutes, must be filed within fourteen days of publication of the notice or within fourteen days of receipt of the written notice, whichever occurs first. Under Section 120.60(3), Florida Statutes, however, any person who has asked the Department for notice of agency action may file a petition within fourteen days of receipt of such notice, regardless of the date of publication.

The petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition within fourteen days of receipt of notice shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57, Florida Statutes. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205, Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information:

(a) The name, address, and telephone number of each petitioner; the name, address, and telephone number of the petitioner's representative, if any; the Department permit identification number and the county in which the subject matter or activity is located;
(b) A statement of how and when each petitioner received notice of the Department action;
(c) A statement of how each petitioner's substantial interests are affected by the Department action;
(d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
(e) A statement of facts that the petitioner contends warrant reversal or modification of the Department action;
(f) A concise statement of the ultimate facts alleged, as well as the rules and statutes which entitle the petitioner to relief and
(g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wants the Department to take.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under Section 120.573, Florida Statutes, is not available for this proceeding.

This Order is final and effective on the date filed with the clerk of the Department unless a petition is filed in accordance with the above. Upon the timely filing of a petition this Order will not be effective until further order of the Department.

Any party to the permit has the right to seek judicial review of the Order under Section 120.68, Florida Statutes, by the filing of a notice of appeal under Rules 9.110 and 9.190, Florida Rules of Appellate Procedure, with the clerk of the Department in the Office of General Counsel, Mail Station 35**,** 3900 Commonwealth Boulevard, Tallahassee, Florida, 32399-3000; and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice of appeal must be filed within 30 days from the date when this Order is filed with the clerk of the Department.

DONE AND ORDERED on this 6th day of January 2009 in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

for Vivian F. Garfein, Director
Central District

FILED AND ACKNOWLEDGED on this date, under Section 120.52(11) of the Florida Statutes, with the designated Department Clerk, receipt of which is acknowledged.

Clerk _____ Date January 6, 2009

Appendix E

Substantial Completion Certificates

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT City of Sanford Auxiliary WTP ASR Project

DATE OF ISSUANCE

December 18, 2008

OWNER: St. Johns River Water Management District (ownership to be transferred to City of Sanford)

OWNER's Contract No.: SJRWMD SF409RA (and City of Sanford MOU SH335AA)

CDM Project No.: 57316

CONTRACTOR: CDM Constructors Inc. **ENGINEER:** Camp Dresser & McKee Inc.

This Certificate of Substantial Completion applies to all Work under the Contract Documents or to the following specified parts thereof:

Task 7 – Construction of ASR Well, Monitor Wells, Surface Facilities, and appurtenant work, in accordance with approved Plans and Specifications dated June 2006.

To: St. Johns River Water Management District and City of Sanford
OWNER

And To CDM Constructors Inc.
CONTRACTOR

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and ENGINEER, and that Work is hereby declared to be substantially complete in accordance with the contract Documents on

December 12, 2008
DATE OF SUBSTANTIAL COMPLETION

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the contract Documents.

From the date of Substantial Completion, the responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties and guarantees shall be as follows:

RESPONSIBILITIES:

OWNER: City of Sanford: Security, operation, safety, maintenance, utilities, insurance and compliance with active project permits.

CONTRACTORS: Complete punch list. Provide warranties and guarantees per contract. Fencing and final surfacing of access road to be completed during future phase of ASR pretreatment work.

The following documents are attached to and made a part of this Certificate:

Punch list dated December 12, 2008

[For items to be attached see definition of Substantial Completion as supplemented and other specifically noted conditions precedent to achieving Substantial Completion as required by Contract Documents.]

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of CONTRACTOR's obligation to complete the Work in accordance with the Contract Documents.

Executed by ENGINEER on 12/18, 2008

Camp Dresser & McKee Inc.

ENGINEER

By: _____

(Authorized Signature)

CONTRACTOR accepts this Certificate of Substantial Completion on 12/19, 2008

CDM Constructors Inc.

CONTRACTOR

By: _____

(Authorized Signature)

OWNER accepts this Certificate of Substantial Completion on _____, 2008

St. John's River Water Management District

OWNER

By: _____

(Authorized Signature)

City of Sanford

OWNER

By: _____

(Authorized Signature)

City of Sanford

Sanford Auxiliary Water Treatment Plant ASR Project

Punch List - December 12, 2008

1. Paint air release valves and touch up paint around turbidity probe.
2. Check operation of photo cell switch on outdoor light.
3. Power cable to pump needs to be shortened and run through conduit.
4. Provide City with 1 liter of conductivity calibration solution (1000 uS/cm).
5. Provide nuts on interior doors inside of control panel.
6. Level and grade around concrete valve marker and operator pads.
7. Repair cracked asphalt near entrance.
8. Remove old survey stakes and location markers.
9. Clean up miscellaneous concrete and debris.
10. Adjust valve seat on 10" electronic supply valve on ASR Well pad, and confirm through field test that no flow occurs when valve is 100% closed.
11. Remove temporary jumper connection on potable water line and blow off at raw water line tie-in.
12. Provide high temperature alarm for pump.
13. Show clearance and depth of existing raw water line and new ASR supply line crossing on Record Drawings.
14. Show location of corporation stops at supply and recovery tapping valve locations on Record Drawings.
15. Show locations of the three sections directionally drilled 10"HDPE supply and recovery piping in front of Plant.
16. Reconnect water line to picnic shelter hose bib*.

*To be performed during soil cement/cement access road construction during next phase of work (Dechlor/Degas)

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT City of Sanford Auxiliary WTP Pretreatment System Project

DATE OF ISSUANCE

September 22, 2010

OWNER: St. Johns River Water Management District (ownership to be transferred to City of Sanford)

OWNER's Contract No.: SJRWMD SF409RA (and City of Sanford MOU SH335AA)

CDM Project No.: 69430

CONTRACTOR: CDM Constructors Inc. **ENGINEER:** Camp Dresser & McKee Inc.

This Certificate of Substantial Completion applies to all Work under the Contract Documents or to the following specified parts thereof:

Task 7 – Construction of Pretreatment System for dechlorination and degasification of potable water prior to injection into ASR Well in accordance with approved Plans and Specifications dated April 2009. The dechlorination system generally consists of a chemical storage tank, chemical metering pumps and associated piping, instrumentation and electrical work. The degasification system generally consists of a Membrana LiquiCel system with air compressor, nitrogen generator system, vacuum pump system and associated piping, instrumentation and electrical work. This certificate of substantial completion does not include the Degasification system equipment and components. When the Degasification system is able to consistently meet acceptable performance standards for dissolved oxygen removal an additional Certificate of Substantial Completion will be completed for that work. Attached is an equipment and component list that specifies the equipment, applicable warranty period and warranty start date.

To: St. Johns River Water Management District and City of Sanford

OWNER

And To CDM Constructors Inc.

CONTRACTOR

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and ENGINEER, and that Work is hereby declared to be substantially complete in accordance with the contract Documents on

January 25, 2010

DATE OF SUBSTANTIAL COMPLETION

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the contract Documents.

From the date of Substantial Completion, the responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties and guarantees shall be as follows:

RESPONSIBILITIES:

OWNER: City of Sanford: Security, operation, safety, maintenance, utilities, insurance

CONTRACTORS: Complete punch lists. Provide warranties and guarantees per contract.

The following documents are attached to and made a part of this Certificate:

Punch list dated September 22, 2010

[For items to be attached see definition of Substantial Completion as supplemented and other specifically noted conditions precedent to achieving Substantial Completion as required by Contract Documents.]

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of CONTRACTOR's obligation to complete the Work in accordance with the Contract Documents.

Executed by ENGINEER on Sept 23, 2010

Camp Dresser & McKee Inc.

ENGINEER

By: _____

(Authorized Signature)

CONTRACTOR accepts this Certificate of Substantial Completion on Sept 23, 2010

CDM Constructors Inc.

CONTRACTOR

By: _____

(Authorized Signature)

OWNER accepts this Certificate of Substantial Completion on _____, 2010

St. John's River Water Management District

OWNER

By: _____

(Authorized Signature)

City of Sanford

Cooperator/Owner

By: _____

(Authorized Signature)

City of Sanford

Sanford Auxiliary Water Treatment Plant

Pretreatment System Construction Project

Punch List – September 22, 2010

1. Install drain piping and pump to discharge seal water from Vacuum Pump into raw water line for Plant or ASR supply line.
2. Secure Instrument water tubing to sunshade supports and at edge of concrete slab
3. Remove small vacuum pump and permanently install larger vacuum pump as is recommended by Pretreatment System supplier.
4. Repair erosion areas at edge of road at drainage swale caused by vacuum pump discharge.
5. Minimize fumes from bisulfite tank.

Appendix F

Supplemental DVDs