JONES EDMUNDS

May 22, 2008

Mr. Duane Watroba
Environmental Specialist
Florida Department of Environmental Protection
Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

RE: Storage Zone Selection
City of Rockledge Reclaimed Water ASR
FDEP Permit Number 05-0195980-002
Jones Edmunds Project No.: 08802-034-02

Dear Mr. Watroba:

Advanced Well Drilling (the Driller) reached a total depth of 510 feet below land surface (BLS) at SZMW-2 on April 30, 2008. Since that time we have been testing and analyzing data from the pilot hole. Based on the available data, we recommend that the storage interval for the City of Rockledge Reclaimed ASR system be between 370 and 470 feet BLS. Below is a summary of lithologic, water quality, geophysical, and pump test data gathered from SZMW-2.

Geology

The top of the Upper Floridan aquifer was encountered at approximately 150 feet BLS, with the first occurrence of Ocala Limestone. The upper 80 feet of Ocala Limestone was particularly soft, resulting in clogging of the reverse-air drilling rods on several occasions. The first occurrence of *Dictyoconus cookei* was observed at 260 feet BLS, indicating the top of the Avon Park Formation. The first beds of dolomite were observed at approximately 450 feet BLS, with low permeability zones observed from 468 to 478 and 500 to 510 feet BLS. A full lithologic description is included in Attachment 1.

Water Quality

After the top of the Upper Floridan aquifer was reached, the Driller collected water quality samples from the reverse air drilling system at 10-foot intervals. These samples were analyzed for field parameters: temperature, pH, conductivity, and turbidity. At 30-foot intervals the Driller collected water quality samples for laboratory analysis of total dissolved solids (TDS) and chlorides. Water quality samples were also collected during pump tests and analyzed for a wider range of parameters. Tables of field and laboratory water quality results are included in Attachment 2. The primary water quality indicators, TDS and chlorides, remained relatively consistent from the top of the Ocala to 510 feet BLS. TDS remained between 1870 and 2330 mg/L and chlorides remained between 850 and 1040 mg/L.

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Geophysics

Geophysical logs were collected on March 28, 2008 to a total depth of 170 feet BLS; on April 18, 2008 to a total depth of 308 feet BLS; and on May 2, 2008 to a total depth of 510 feet BLS. Copies of the geophysical logs were submitted as a part of weekly progress summaries. The static and dynamic flow logs indicate that the majority of flow is entering the borehole between 160 feet BLS and approximately 250 feet BLS. The video log confirms that this zone is highly fractured with large conduit flow zones. Caliper logs indicate a large-diameter borehole throughout much of the pilot hole, despite the Driller using an 11 7/8-inch drill bit. This may be because the Driller performed a significant amount of dredging and because much of the formation was soft. The size of the borehole begins to decrease below approximately 390 feet BLS. Sonic porosity logs indicate highly variable porosity throughout the borehole with a slight decrease below 450 feet.

Pump Tests

The Driller performed five pump tests on SZMW-2. Two pump tests were performed on the open borehole, one after the Driller had reached 308 feet BLS and the second after the Driller had reached 510 feet BLS. Three off-bottom packer pump tests were then performed with a single packer set at 402, 285, and 370 feet BLS, respectively. Transmissivities from the various intervals were then calculated based on drawdowns in the aquifer during pumping. A summary of transmissivities is included in Attachment 3.

Potential Storage Intervals

As part of the FDEP Construction Permit application, we submitted a construction plan that included two alternatives for potential storage intervals: a shallow interval from 150 to 300 feet BLS and a deep interval from 400 through 510 feet BLS. Based on data gathered from the exploratory well, the aquifer matrix of the shallow interval is too transmissive to serve as an ASR storage interval. The fracture and conduit flow that appears to predominate in this interval would likely result in poor recovery efficiency if the ASR were located in this zone. Alternatively, the deep zone appears to be of limited transmissivity. The appearance of dolomitic beds at approximately 460 feet BLS, in particular, indicates a zone of low permeability.

Operational Considerations

The design of this ASR system was based on a storage volume of up to 180 million gallons and a peak recovery flow rate of 2 million gallons per day. The demand for reuse water in the City of Rockledge is as strong now as it was when the system was designed. Therefore, the ideal storage interval would allow for the maximum recovery flow rate (2 MGD). The ultimate operational flow rate of ASR-1 cannot be determined until cycle testing. However, the last packer test that was performed, which isolated the interval between 370 feet and 510 feet BLS, appears to identify a zone that will allow for high rates of recovery (up to 2 MGD) but has low enough transmissivity to allow for sufficient recovery efficiency.

Recovery efficiency of the system cannot be determined until cycle testing. The primary operational constraint of the ASR during recovery may be the TDS concentration that can enter the reuse distribution system. The native TDS concentration in the aquifer (approximately 2000 mg/L) is significantly higher than the TDS concentration of the City's reuse water (approximately 600 mg/L). However, during operation water recovered from the ASR well will be directed to the above-ground storage tanks where mixing with reclaimed water from the WWTF could reduce TDS concentrations thus increasing recovery efficiency.

Well Construction

Jones Edmunds will advise the Driller to plug back SZMW-2 from 510 feet BLS to a total depth of 470 feet BLS and set the 6-inch final casing to 370 feet BLS. In accordance with plans and specifications an 8 to 10-hour specific capacity test will be conducted on SZMW-2 following casing installation, geophysical logging, pressure testing, and development. SZMW-1 and ASR-1 will then be constructed with similar total depths and casing depths. SMW-1 will be constructed with a total depth of 230 feet and casing to 200 feet BLS. This will allow for monitoring above the storage zone.

We appreciate your quick review of these results. If you have any questions concerning the project status, please feel free to contact me at (352) 377-5821.

Sincerely,

Allan H. Biddlecomb, P.G.
Senior Project Scientist

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Enclosure

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