Engineering Report and UIC Permit Application for a Reclaimed Water ASR Well at the Pelican Bay Wellfield

for

Collier County Government

3301 East Tamiami Trail
Naples, FL 34112

August 2002

Water Resource Solutions
428 Pine Island Road, S.W.
Cape Coral, FL 33991

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Project Number: 01-03946.A3

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1.0 INTRODUCTION

An Aquifer Storage and Recovery (ASR) project is being undertaken by Collier County to develop a Reclaimed Water ASR system. The County's goal is to improve the utilization of this resource and expand their Reclaimed Water reuse system. The permit application, engineering report, and technical specifications are being submitted for the construction of an ASR well at the Pelican Bay Wellfield site (Figure 1.1). The goals of this project are in keeping with the State of Florida's policy as presented in the Florida Administrative Code (FAC) to " encourage the use of water with the lowest acceptable quality for the purpose needed" (62-40.310(5) FAC), "protect aquifers from depletion through water conservation and preservation of the function of high recharge areas" (62-40.310(8) FAC), and "encourage nonstructural alternatives whenever structural works are proposed" (62-40.310(12) FAC). The above objectives are achieved by :

- Replacement of potable water for irrigation by Reclaimed Water ASR,
- Reduction in the demand for water from aquifers currently suppling potable water, and
- Utilization of underground brackish water aquifers for storage rather than building surface tanks or reservoirs capable of handling the required volumes of water.

An initial investigation was conducted to evaluate potential sites for the ASR system (Water Resource Solutions, 1999). The original study, which evaluated the hydrogeology, water quality, and other issues relating to the ASR system, investigated three potential sites. The sites were the Livingston Road extension, North County Regional Water Reclamation Facility (NCRWRF), and the Pelican Bay Wellfield. The initial ASR site selected was the NCRWRF. However, in an effort to cordially work with the City of Naples, the County elected to move the proposed ASR facility to the Pelican Bay Wellfield location.

The Pelican Bay Wellfield site (Figure 1.1) is located in Collier County near the northwest intersection of Interstate 75 and Immokalee Road (S.R. 846). The wellfield is located in

Section 19, Township 48 S., Range 26 E., and is aligned north to south along the east side of Livingston Road.

In preparation for selecting a suitable ASR storage interval at the Pelican Bay Wellfieldsite, an exploration/dual zone monitoring well was permitted and constructed at the site. A completion report was prepared that detailed the construction and testing of the well (Water Resource Solutions, 2002). The specific purpose of the exploration/dual zone monitoring well was to develop site specific information concerning confinement, water quality, and other aquifer properties required for the selection of an appropriate ASR storage interval. The information developed during the construction and testing of the exploration/dual zone monitoring well and data from previous studies were used to select the ASR storage interval, design the pilot ASR well, and develop this permit application for construction of the proposed ASR well.

The proposed ASR well will be completed in the Suwannee Limestone Zone II. Testing of the well will include pumping tests, geophysical logging, and analyses of drill cuttings. A description of the drilling and testing program is included in this document. The well will be completed within the selected ASR storage interval using a 16-inch to 12-inch diameter tapered casing string. Following the completion of the well, a pressure test on the final casing and a production test will be performed prior to initiating ASR cycle testing. Flow and solute transport modeling will be used to predict long term well recovery performance.

Flow and solute transport modeling has been used in this submission to develop a conservative estimate of the maximum distance of movement of the injected water assuming 10 years of injection at 100 days per year (1000 days) at an injection rate of one (1) million gallons per day. This simulation does not include recovery and therefore over estimates the location of the extended boundary for the injected water. The currently existing dual zone monitoring well, located approximately 300 feet south of the proposed

ASR well, will be used to monitor for both lateral and vertical migration. The monitor well was constructed as part of the exploration well program for this project.

2.0 AREA OF REVIEW

The proposed Aquifer Storage and Recovery (ASR) well will be located at the Pelican Bay Wellfield in Collier County, Florida. This wellfield is used to supply irrigation water for Collier County. The elongated, north-to-south aligned wellfield is located north of Immokalee Road (S.R. 846) and west of Interstate 75 along Livingston Road in Section 19, Township 48 South, Range 26 East. An area of review study had been previously conducted during the permitting phase of the exploratory/dual zone monitor well. An update of the area of review study was undertaken as part of this application. The following is a summary of the original area of review with updated information.

The injected fluid radius should not exceed 3,000 feet from the ASR well based on the conservative analysis presented in Section 7. Therefore, a one-mile radius around the site was chosen and deemed appropriate for the limits of the study. The proposed ASR system, when in operation, must not cause a deterioration of water quality or unacceptable declines in groundwater levels at off-site wells. Conversely, existing water users can potentially impact the goals of the project by withdrawing or causing displacement of water put in storage. The goal of the area of review study is to identify wells in the inventoried area to determine which, if any, wells impact or will be impacted by the proposed ASR well within a one-mile radius of the site.

The study area consists of the section containing the wellfield and the eight contiguous sections, which encompasses an area larger than 1-mile radius from the proposed well site in all direction A map showing the well location and the topographic and surface features is provided as Figure 2-1. The nine sections within north Collier County are included on portions of the U.S. Geological Survey (USGS) Bonita Springs, Florida, and the Corkscrew Southwest, Florida quadrangle maps. These sections include 17, 18, 19, 20, 29 and 30 of Township 48 South, Range 26 East and 13, 24, and 25 of Township 48 South, Range 25 East.

2.1 Source of Data

The two main considerations for the wells located within one mile of the ASR well are the potential stored water to be pulled from the ASR wells sphere of influence by withdrawal from nearby wells and the potential impact of drawdown on competing users during ASR recovery. For these reasons, it is important to identify wells in the project area completed within the storage zone or wells that may impact, or be impacted, by the ASR well.

Water Resource Solutions (WRS) updated the previous well inventory to obtain well construction and well use data for the purpose of determining current aquifer utilization. The well inventory included searches from the following sources:

- South Florida Water Management District (SFWMD), Fort Myers Service Center
- Collier County Pollution Control (CCPC) Well Permitting
- Water Resource Solutions In-house Well Records
- United States Geological Survey (USGS), Miami Branch
- Florida Department of Environmental Protection (FDEP), Oil and Gas Section

The SFWMD water-use-permitted well search consisted of reviewing the permits on file at the District's Fort Myers Service Center. These permits provide well construction, well use and water allocation data (Table 2.1). Maps or sketches contained in the permit files were used to plot the well locations on a map provided as Figure 2.2.

Well inventory information collected from CCPC's well database is listed by Section, Township, and Range (S/T/R). A search of WRS's in-house well records involved reviewing topographic maps with the plotted well locations and well schedules containing well construction details and well use data. The USGS provided a well inventory listing that indicated well location by latitude and longitude coordinates. An inquiry for well data maintained by the Oil and Gas Section of the FDEP was made. The FDEP representative

confirmed that there are no records of oil/gas exploration wells within the nine-section study area. Table 2.2 provides a summary of the well inventory data for the CCPC, WRS, and USGS wells within the area-of–review. The well locations, with the exception of those listed in the county database, are plotted on the map provided as Figure 2.3. The data from the CCPC records could not be accurately plotted on the map based on the absence of data to locate their position within the appropriate section.

2.2 Well Inventory Results

Results of the SFWMD water-use-permitted well inventory update showed no additional wells constructed or identified since the previous inventory. The previous inventory identified 52 irrigation wells (landscape and agricultural irrigation), 4 industrial wells (closed loop pool heater), and 3 public water supply wells within the nine sections reviewed. The three public supply wells, which lie outside the one mile area of review, are identified as wells 6,8, and 13 in Figure 2.2 and Table 2.1. Seven of the identified irrigation wells (Map Reference Nos. 3a-3g) are located within the Pelican Bay Wellfield. The deepest well identified in the SFWMD search is 110 feet below land surface (bls).

A search of the Collier County database within the nine-section study area identified 100 additional wells since the original inventory for a total of 945 wells. Approximately 15% of this total are nonconsumptive-use wells (monitoring and test wells) and abandoned wells. The majority of the wells listed are either irrigation wells (57%) or domestic-use wells (24%). Approximately 6% of the 945-well total recorded unknown well use. Three of the wells listed in the database are the wells constructed as part of the ASR investigation. These wells are the two shallow pad monitor wells and the exploratory/dual zone monitor well. The deepest of the wells listed in the database, with the exception of the exploratory/dual zone monitor well, is a 225-foot monitoring well.

Records of the WRS in-house well inventory identified 4 new wells. These new wells are the two pad monitor wells, the exploratory/dual zone monitor well, and the FGS core constructed at the wellfield. A total of 143 wells were identified in this data base. Approximately 51% of this total are non-consumptive-use wells (observation and test wells), abandoned, or wells of unknown use. Approximately 49% of this 143-well total are consumptive-use wells. The preponderance of the consumptive use wells are irrigation wells with a small number of production wells. The seven production wells listed in Table 2.2 comprise the Pelican Bay Wellfield are completed at approximately 100 feet bls in the Lower Tamiami Aquifer. The in-house search revealed the deepest well of the study, with the exception of the exploratory/dual zone monitor well and the FGS core well, is a 4-inch diameter, 260-foot deep observation well, completed in the Sandstone Aquifer.

The USGS well search did not identify any new wells. The previous inventory identified a total of 11 wells. Each of the USGS wells are also part of our in-house database. The deepest well identified in this search is a 214-foot deep observation well that penetrates the Sandstone Aquifer. The other ten wells are completed in either the water table or Lower Tamiami aquifers.

In summary, results of the well inventory within the area of review indicate the majority of consumptive-use wells are reportedly used for irrigation and domestic supply. Due to the variability in completeness of the well records, wells may be duplicated in the multiple searches. All wells within the inventoried area, with the exception of the observation/monitor wells completed in the Sandstone Aquifer, Collier County's new exploratory/dual zone monitoring well, and the FGS core well, are completed in either the Water Table or Lower Tamiami aquifers. No municipal public water supply wells were identified as a result of any of the well searches. There is no apparent use of the deeper aquifers within a one-mile radius of the project site. There are no wells completed in the storage zone of the proposed ASR well or in any aquifer potentially influenced by ASR injection or recovery within the area of review.

2.3 Abandoned Flowing Wells

The well inventory identified thirteen (13) new abandoned wells since the previous inventory for a total of twenty (20) abandoned wells. The wells identified in the Collier County well construction and WRS in-house records have all been properly plugged. There are no known free-flowing abandoned wells within the inventoried area.

2.4 Surface Water Bodies, Quarries, and Mines

Surface water bodies, quarries, and mines within the area of review were identified through a review of topographic maps, aerial photographs, and a site investigation. The most prominent surface water feature within the inventoried area is the Cocohatchee Canal located approximately 0.6 miles south of the proposed well location.

A number of man made lakes are present within the inventoried area. These lake were constructed principally for surface water management and to provide construction fill. The lakes are primarily associated with residential developments. These developments include Quail Creek Country Club in Section 17, Carlton Lakes in Section 19, and Quail Village and Longshore Lakes in Section 20. There are four lakes located along Interstate-75 that were used as borrow pits for highway construction. Two of these lakes are located in Section 18 and one lake is located in each of sections 19 and 30.

No quarries or mines were identified in the area of review other than the lakes constructed as sources of construction fill. There are no natural springs identified within the inventoried area. Wetland areas are present throughout the area of review. However, these wetlands are relatively small, isolated and not part of a larger surface water system.

2.5 Faults

Available literature on the subsurface geology of southwest Florida was reviewed to identify faults in the vicinity of the area of review. There are no known or suspected faults mapped within the area of review.

2.6 Class I Injection Wells

No Class I injection wells are located within the area of review. The nearest Class I injection wells are located at Collier County's North County Regional Water Treatment Plant. This facility, which has two wells that inject R.O concentrate into the "boulder zone" of the Oldsmar Formation, is located approximately 5.2 miles southeast of the proposed ASR well in Section 35, Township 48 S., Range 26 E. The "boulder zone" lies approximately 2500 feet or more below land surface at the North County Regional Water Treatment Plant.

Two Class I injection wells are permitted and will soon be constructed at the site of the County's North County Water Reclamation Facility that is located approximately 3 miles southwest of the proposed ASR well.

3.0 HYDROGEOLOGY

Reviews, evaluations, and studies of the available lithologic and aquifer hydraulic data, geophysical records, and native groundwater quality data relevant to the project have been conducted for this project (Water Resource Solutions, Inc., 1999, 2001, and 2002). Information was compiled from numerous sources including the U.S. Geological Survey (USGS), South Florida Water Management District (SFWMD), Florida Geological Survey (FGS), Florida Department of Environmental Protection (FDEP), published reports, consultant reports, in-house data and reports, and on-site testing. The data provided in this section is specific to the proposed ASR storage zone, storage zone confinement, and monitor zones. For a more detailed discussion of the regional and site hydrogeology, refer to the above referenced documents.

A generalized hydrostratigraphic column reflecting the zones intersected during the exploratory/dual zone monitor well construction is provided as Figure 3.1. Two regional hydrostratigraphic cross sections are provided on Figures 3.2 and 3.3. The locations of wells included in the cross sections and others where data were considered in this investigation are shown on Figure 3.4. Cross section A-A' is oriented north-south and extends from Marco Island into southwestern Lee County and includes the project site. Cross section B-B' is oriented west-east and extends from the Pelican Bay Development to about Everglades Boulevard, passing from two to three miles south of the NCRWRF and the Pelican Bay Wellfield.

3.1 Geology

The description of the geology and groundwater hydrology of the project site is based on previously obtained information and hydrologic tests conducted during the construction of the exploratory/dual zone monitor well. In addition, information obtained from a continuous core collected by the Florida Geological Survey (FGS) provided insight into the interpretation of

cutting samples. The FGS core was obtained approximately 2000 feet south of the ASR exploration well. The coring of the FGS well was performed at the request of Collier County to obtain additional information concerning the subsurface environment at this site. The geologist's log from the exploration/monitoring well and the description of the FGS cores are provided in Appendix 3.1 and 3.2 of this submission.

The deepest formation penetrated on-site during the exploratory/dual zone monitor well construction was the Suwannee Limestone at 1100 feet bpl. The geologic formations penetrated during well construction range in age from Holocene (Recent) to Oligocene (25-30 million years). They consist of undifferentiated Quaternary deposits, the Tamiami Formation, the Peace River and Arcadia formations of the Hawthorn Group, and the Suwannee Limestone Formation. The target ASR storage zone, which extends from 770 to 860 feet bpl at the site, occur within carbonate rocks of the Suwannee Limestone (Suwannee Zone II).

Arcadia Formation (Hawthorn Group)

The top of the Arcadia Formation is marked by the occurrence of phosphatic limestone underlying the basal Peace River Formation clay at a depth of approximately 250 feet bpl. The base of the formation is picked at approximately 730 feet bpl at the site.

The Arcadia Formation consists of interbedded sequences of phosphatic carbonate rocks, separated by clay, dolostone, and lime mud. Porosity of the limestones within the formation is variable; tending to be best developed where fossil shell has dissolved to form molds. The thickness of the Arcadia Formation is approximately 480 feet.

Suwannee Limestone Formation

The Suwannee Limestone Formation is early to middle Oligocene in age (25.5-30 million years). The top of the formation is approximately 735 feet bpl. The upper strata in the

Suwannee consist of arenitic limestones with good moldic porosity and low gamma activity that are often difficult to distinguish from the basal Arcadia Formation. Marl, clay, and dolostone interbeds are also present in the upper portion of the formation. These lower permeability sediments separate the permeable limestones within the formation. The limestone from 1010 feet to 1100 feet bpl, which was the deepest point penetrated during this project, contains variable amounts of quartz sand.

3.2 Aquifer Designations

The aquifers and confining units identified at the site are illustrated in the hydrostratigraphic column (Figure 3.1). The major aquifer systems present include the surficial aquifer system, which includes the water table and lower Tamiami aquifers; the intermediate aquifer system, which includes a series of aquifers and confining units within the Hawthorn Group; and the upper Floridan aquifer, which occurs within a thick sequence of Oligocene to Eocene age carbonate rocks.

Two principal aquifers are generally recognized in the Arcadia Formation, the Mid-Hawthorn, and Lower-Hawthorn aquifers. Each of the Arcadia Formation aquifers are subdivided into two zones. Mid-Hawthorn Zone I extends from 250 to 365 feet bpl, while Mid-Hawthorn Zone II extends from approximately 390 to 490 feet bpl. The two Lower-Hawthorn zones (I and II) are present from 525 to 545 feet and 610 to 660 feet bpl.

Two permeable intervals were identified in the upper portion of the Suwannee Limestone during the study conducted to determine potential ASR storage zones (Water Resource Solutions, 2001). These two intervals, designated Zones I and II, were penetrated during the drilling of the exploration well. Zone I, which lies at the top of the Suwannee Limestone, also includes sediments from the basal Arcadia Formation. This zone was identified from 690 to 750 feet bpl. Suwannee Limestone Zone II was penetrated from approximately 770 to 840 feet bpl. Zone II was identified as the target lower ASR zone for this project. Other permeable

sediments were encountered in the Suwannee Limestone between 840 feet and the base of the well at 1100 feet bpl. However, because of water quality concerns, and the presence of better apparent hydraulic conditions above, these sediments were not considered as potential ASR storage zones and are not further delineated in this report.

3.3 Selected Storage Interval

Two subsurface intervals were identified as potentially good ASR storage intervals. The upper zone, located between 320 and 440 feet is subdivided into two flow units. The transmissivity of this unit is approximately 60,000 gpd/ft (8000 ft^2/day).

The lower interval is located between the depths of 770 and 840 feet and shows reasonably well distributed permeability across the entire interval. This zone does not appear to be characterized by fractured flow or flow from a single, thin interval. The transmissivity of the lower interval is estimated to be approximately 80,000 gpd/ft (10,000 ft^2/day), and the zone contains native water having a chloride concentration approaching 2060 mg/l (WRS, 2002). These are considered good characteristics for continued project development.

Th lower unit has been selected as the target storage interval on the basis that this unit has a more uniform flow interval. This characteristic is anticipated to provide a higher recovery efficiency than that expected from the upper alternative storage interval. The lower interval is expected to also provide lower injection pressures than the upper interval.

One other interval was encountered that might be considered for an ASR zone between the depths of about 640 and 740 bpl. However, this zone has a lower transmissivity and therefore was not considered optimum for this project. However, this second zone may be appropriate for a project requiring smaller injected volumes and lower rates for injection and recovery in the future.

3.4 Confining Interval Description

A review of the geologist's log from the exploration well (Appendix 3.1) and the core description for the FGS core well (Appendix 3.2) indicates that several confining layers exist at the site within the strata penetrated. A thick confining unit in the uppermost section of the borehole extends from approximately 155 to 260 feet below pad level. This section is composed of approximately 100 feet of clay and low permeability materials with vertical hydraulic conductivity values ranging between $3x10^{-4}$ and $7x10^{-3}$ ft/day, as determined by testing of the FGS cores by Omni Laboratories (Appendix 3.3). This section is part of a regionally persistent confining unit that occurs in the Peace River Formation of the Hawthorn Group.

Additional confinement of substantial nature lies between the depths of 280 and 335 feet bpl. This section consists of a marly limestone material exhibiting low permeability characteristics.

Numerous additional confining beds are present in the lower sections of the borehole. Within the 330 feet of sediments that lie between 440 feet and 770 feet bls, approximately 140 feet of low-permeability clays, lime mud, and marly limestones are present. These fine grained sediments are interbedded with more permeable carbonates. Core samples in this interval had measured vertical hydraulic conductivity values that range between $1x10^{-5}$ and $1x10^{-4}$ ft/day (Appendix 3.3). Natural gamma activity is variable within this interval indicating a variety of rock types.

Minor amounts of low permeability materials including lime mud and clay were encountered below the base of the target storage interval at approximately 840 feet bpl. Based on the data obtained, the level of lower confinement appears to be adequate for the application of ASR at this site.

3.5 General Native Water Quality

Fresh water resources in the region surrounding the site are limited to the water table aquifer and the lower Tamiami aquifer. The depth to the base of the freshwater zones extends to about 150 feet. Groundwater in deeper aquifers is brackish to saline.

Formation water samples were collected every 30 feet during reverse-air drilling of the open hole and at the completion of development during drilling and testing of the exploration well. the samples were analyzed for dissolved chloride and conductivity (Table 3.1). Analyses show changes in salinity over the subsurface interval between 343 and 1100 feet bpl, where chloride concentrations ranged between 1660 mg/l near the top to 3940 mg/l at the base of the lowest zone penetrated. Data collected following the completion of the well indicate the composite chloride level in the selected ASR zone is approximately 2050 mg/l. TDS in the selected storage unit as reported in the Primary and Secondary Drinking Water Standard analyses is 4900 mg/l.

Formation water samples were also collected during pumping and packer testing from the approximate depth intervals between 322 and 500, 322 and 566, 624 and 770, 777.5 and 860 feet bpl. The samples were also analyzed for chloride and conductivity, as indicated in Table 3.2.

The base of the underground source of drinking water (USDW), defined in applicable state and federal regulations as 10,000 mg/l total dissolved solids, was not penetrated at the project site. The USDW is estimated to lie at a depth of approximately 1250 feet at this site based on regional data. Native groundwater in the storage interval and overlying aquifers is most appropriately classified as G-II groundwater. G-II groundwater is defined as having a TDS content between 3,000 and 10,000 mg/l (F.A.C. 62-520.410).

3.6 Florida Geological Survey Core

Local geology is best evaluated based on the data obtained from the FGS core well and the exploration/dual zone monitoring well. Therefore, in order to provide a comparison of the geology between the two boreholes at this site, a gamma-ray log was run in the borehole of the FGS core well. This gamma-ray log was compared with the gamma-ray log from the ASR exploration well. A very close correlation was found to exist between the two logs indicating similar depositional environments. The comparison of the two gamma-ray logs is provided in Figure 3.5. The subsurface lithology determined from the FGS core is very similar to the lithology encountered in the exploration/monitoring well.

Data from the ASR exploration well and the FGS core correlates closely with the originally cross section prepared from more regional data as referenced in Section 3.0. These new data provide additional evidence for the continuity of the confining units and permeable units within the region.

4.0 WATER QUALITY

4.1 Native Storage Interval Water Quality

Water samples from the interval between 770 and 833 feet were collected after the well was completed. These samples were sent to Severn Trent Laboratories for determination of water quality with respect to Primary and Secondary Drinking Water Standards, and minimum criteria for sewage effluent requirements. As indicated by the laboratory analyses summarized in Tables 4.1 through 4.4, all water quality standards are met with the exception of TDS, chlorides, sulfate, sodium, odor, and gross alpha as expected from this brackish water aquifer. The ground water from this unit has a chloride content of 2060 mg/l and a TDS of 4900 mg/l.

4.2 Quality of the Reclaimed Water ASR

Approximately 3 years of analyses for the Reclaimed Water ASR produced at the NCWRF are summarized in Tables 4.1, 4.1A, 4.2, 4.3, and 4.4. These data form the basis of the discussion concerning Reclaimed Water ASR quality.

4.2.1 Primary Drinking Water Standards

The data in Table 4.1 identify the chemical constituents and groups of chemical constituents that comprise the primary drinking water standards. With the exception of an analysis from one sampling event, which indicates 2 fecal coliforms in effluent from the South County Water Reclamation facility, no other constituent was observed to exceed the maximum contamination level for drinking water. In fact, most listed chemicals were found to have concentrations below detection limits (BDL). An examination of Table 4.1 shows that the term BMCL in the columns representing volatile organics and pesticides. BMCL indicates that one or two of the constituents in these groups had measured concentrations that were above detection limits but below MCL values on the specified dates. Table 4.1A lists the chemicals identified above

detection limits, the MCL values for these chemicals, the concentrations that were detected, and the dates and locations when these chemicals were identified.

4.2.2 Secondary Drinking Water Standards

A review of the data provided in Table 4.2 shows that all secondary drinking water standards are regularly met by effluent from the NCWRF with the exceptions of color, odor, and TDS. Since the aquifers into which this water will be injected contains hydrogen sulfide at low levels, and TDS levels in excess of 4000 mg/l, the only parameter of concern from a regulatory perspective is color. Based on the data provided in Table 4.2, an exemption to inject colored water will be required for this project. The request for a color exemption will be submitted under separate cover.

It is relevant to point out that the color requirement is an aesthetic issue and does not indicate the true quality of the water. Data collected from regionally similar ASR well sites indicates that the color level in the water recovered from ASR wells is reduced from the injected values after storage in the subsurface.

4.2.3 Cryptosporidium and Giardia Lamblia

The data provided in Table 4.3 show test results obtained from analyses performed to detect Cryptosporidium and Giardia lamblia. The data indicate that no Cryptosporidium were identified in the samples and that cysts from Giardia lamblia with identifiable, internal structures were not identified.

4.2.4 Minimum Criteria for Sewage Effluent

The data provided in Table 4.4 summarizes the minimum criteria sewage effluent analyses required for this submission. The data in Table 4.4 show that for most of the chemicals

listed, the constituent concentrations were below detection levels. None of the constituents were found to exceed established maximum contamination levels for drinking water.

5.0 POTENTIAL USE OF THE PROPOSED ASR STORAGE INTERVAL BY OTHERS

The water quality in the target storage zone and in the aquifers 300 feet or more below land surface is brackish water containing over 1600 mg/l chlorides and 4000 mg/l TDS. The water in these aquifers is not suitable for irrigation and cannot be used as a potable water resource without applying sophisticated water treatment processes such as reverse osmosis. These water treatment technologies are considered too costly for the development of an irrigation water supply.

Collier County does use reverse osmosis to treat water from these deeper aquifers for potable use. However, the closest plant site, as indicated in Section 2, lies over 5.2 miles to the southeast of the ASR site. Well expansion for this plant is currently moving further to the east to take advantage of the better water quality in that direction. Therefore, since Collier County already supplies water to the local area, and since expansion of the current wellfield is to the east, it is extremely unlikely that there will be other users attempting to draw water from the target storage unit. Withdrawals from the ASR site is not anticipated to significantly impact the R.O. wellfield and withdrawal from the R.O. wellfield is not anticipated to impact the ASR wellfield. Based on the above information, it is unlikely that water from the current ASR storage interval will likely be used by others for potable or irrigation within the region influenced by the ASR wells.

In the future, if a new user were identified, the target zone would likely be the aquifer previously identified between the depths of 320 and 450 feet, since this interval is shallower, would be less costly to develop, and has sufficient capacity to provide a good flow of water. As indicated in Section 7, there would be little influence between wells operating in the subsurface region between 300 and 450 feet and the proposed ASR storage zone. Thus, use of this upper interval, if necessary, would have little impact on water stored at this site and in the Suwannee Zone II.

6.0 HYDRAULIC PARAMETER EVALUATIONS FOR MODELING

The data presented in this section are based on geophysical logging data, core analyses, and flow test information obtained during the construction of the exploration/dual zone monitoring well. The data descriptions provided in this section are provided to indicate how individual model parameters were selected. One of the guiding factors in the selection of modeling parameters is to provide a worst case estimate for the movement of injected constituents within the subsurface.

6.1 ASR Storage Interval Parameters

6.1.1 ASR Interval Thickness

The ASR zone is estimated to be approximately 60 feet thick and extends from 800 to 860 feet below land surface(WRS,2002). Zone thickness for modeling is set at 60 feet.

6.1.2 Transmissivity

The transmissivity measured for the interval between 800 and 860 feet was estimated to be 10,000 ft^2/day (WRS, 2002).

6.1.3 Horizontal Hydraulic Conductivity

The horizontal hydraulic conductivity (k_h) is assigned a value of 167 ft/day based on the measured transmissivity and interval thickness.

6.1.4 Storage Zone Vertical Hydraulic Conductivity

The vertical hydraulic conductivity of the storage zone was set equal to 56 ft/day or 33 percent of the horizontal hydraulic conductivity. This value was selected since it represents a higher vertical hydraulic conductivity then is likely to be present. The selected vertical conductivity will provide a conservative estimate of plume movement since it allows a more rapid rise of the injected water within the storage interval than would otherwise occur under more restricted flow conditions.

6.1.5 Porosity

The porosity of the storage unit and in the other modeled permeable units has been assigned a value of 0.15 based on resistivity log analyses. Schmoker and Halley (1982) indicated that a porosity of 0.35 may be more appropriate for this depth, but this selection would be less conservative with respect to injected fluid movement. The use of this porosity (0.15) extends the horizontal movement of the plume by 133 percent, which results in 700 feet of additional distance over the less conservative value of 0.35.

6.1.6 Compressibility

Formation compressibility is set at 0.000003/psi. Water compressibility is set at 0.000004/psi. These values are similar to those found in the literature (Mathews and Russell, 1967).

6.1.7 Storativity

No specific storativity value is used, since the basic physical factors, porosity and compressibility, are entered directly. A storativity value of 0.00003 is estimated based on the input parameters.

6.1.8 Dispersivity

For maximizing constituent movement through the subsurface, a dispersivity value of 75 feet is used. This is the largest value required for solute transport model calibration used by Water Resource Solutions in evaluating actual conditions at operating ASR sites in South Florida. The actual value for this site is likely to fall within the range of 30 and 55 feet. The use of 75 feet is a more conservative approach.

6.2 ASR Confining Unit Parameters

The confining unit parameters discussed in this section include interval thickness, hydraulic conductivity, and porosity. Factors such as dispersivity and compressibility are set equal to those of the storage interval.

6.2.1 Interval Thickness

Upper Confining Unit

The upper confining unit for the purposes of this document is composed of clays, marls, dolomite, and limestone between the depths of 125 and 800 feet bpl. This unit includes both transmissive and low permeability units. The transmissive units will retard the upward movement of injected water by dispersing pressure. Likewise, the transmissive unit will also allow lateral spread of the water more easily than will occur in the overlying confining beds.

The interval immediately above the storage zone (layer 6) is approximately 50 feet thick and is considered to be a confining unit (Figure 6.1).

The first transmissive interval (layer 5) that lies above the storage interval and lies within the confining unit occurs from approximately 635 to 730 feet bpl (Figure 6.1).

The second confining unit (layer 4), which is approximately 160 feet thick, lies between 475 and 635 feet bpl.

The second transmissive interval (layer 3) above the storage unit lies between 325 and 475 feet bpl, and is approximately 148 feet thick.

Finally, the upper interval between 125 feet and 325 feet bpl (layer 2) is considered to be a confining unit based on the high amount of confining material identified within this unit.

Lower Confining Unit

The lower confining unit, layer 8, extends between 860 and 1000 feet based on the flow log obtained between 322 and 1100 feet bpl in the exploration well. However, the major confinement is believed to exist between 840 to 885 feet. This unit, based on core and cuttings analyses, contains clay and lime mud and is described as mudstone. The thickness of the lower confining unit is assigned a value of 45 feet (Figure 6.1).

Upper Confining Unit Vertical Hydraulic Conductivity

Layer 6 is conservatively assigned a vertical hydraulic conductivity of 2×10^{-3} feet/day based on measured core samples with hydraulic conductivity values of 1×10^{-4} and 4×10^{-5} feet/day from this depth interval.

Layer 5 is assigned a vertical hydraulic conductivity of 9 ft/day, which is 33% of the horizontal transmissivity measured for this interval.

Layer 4 is conservatively assigned a vertical hydraulic conductivity of 1×10^{-4} ft/day based on core hydraulic conductivity values of 3×10^{-5} and 1×10^{-5} feet/day from this depth range and the significant portion of this region comprised of clay and marl (geologists logs, Appendix 3.1 and 3.2).

Layer 3 is assigned a vertical hydraulic conductivity of 18 ft/day, which is 33% of the horizontal transmissivity measured for this interval.

Layer 2 is conservatively assigned a vertical hydraulic conductivity of 8×10^{-3} ft/day based on core hydraulic conductivity values ranging between 7×10^{-3} and 3.3×10^{-4} feet/day from this depth range and the significant portion of this region (>80%) comprised of low permeability clay and marl (geologists logs, Appendices 3.1 and 3.2).

Lower Confining Unit Vertical Hydraulic Conductivity

The vertical hydraulic conductivity of the lower confining unit is assigned a value of 8×10^{-3} ft/day based on the presence of clay and marl materials similar to those encountered uphole.

6.3 Injected Volume

The current model is used to estimate injected fluid boundaries based on injecting one billion gallons which approximates ten years of injecting 100 MG/year without recovery. The purpose of this exercise is to provide a very conservative estimate of the region within which the stored water might reside after 10 years of injection without recovery. As, designed, the model over-predicts the location of the stored water.

7.0 SOLUTE TRANSPORT MODELING

The computer model, as developed for this document, is designed to provide a conservative estimate of the location of the boundary of the injected water. The boundary of the stored water plume is defined as the point where the mixture of water contains 99% native water and 1% injected water. In order to provide a conservative estimate, the modeling is based on injecting a volume which represents 10 years of injection without recovery. This volume extends the location of the injected water boundary beyond the boundary that will be in place after 5 years of well operation and the time when the operating permit for this well will need to be renewed.

7.1 Solute Transport Modeling

The computer simulator used to estimate the boundary location for the movement of injected water is called the Sandia Waste Isolation Flow and Transport (SWIFT) simulator. SWIFT was developed by the Nuclear Regulatory Commission and by the U.S. Geological Society (named SWIP, Survey Waste Injection Program) for assessing injection of nuclear and other aqueous wastes into saline aquifers. The model has undergone rigorous testing, verification, and improvement since its inception over 35 years ago. This model, after review, was the preferred model of the U.S. Environmental Protection Agency to be used to demonstrate underground plume movement for hazardous waste injection well "No Migration" Petitions. This model is readily available to the public.

The SWIFT computer code is a full three dimensional solute transport simulator capable of dealing with fluid density differences, complex flow patterns including flow through fractures, diffuse sources and sinks, and the more standard groundwater flow and transport problems.

7.2 Parameter Selection

All aquifer selection criteria have been provided (Section 6). The solute transport model is a nine layer, radial model extending from the uppermost permeable unit to the base of the Suwannee formation. The radial grid model extends over 8500 feet from the ASR well. Injection into the well occurs over a 1000 day time period at a rate of 1 MGD.

7.3 Model Results

Figure 7.1 provides a schematic representation of the output data provided by the model. The contour lines representing the location of the injected water as a fraction of the water in place show the edge of the injected water plume. The outermost point is represented by the 0.01 concentration contour (1% injected water, 99% native water). Vertically, the 1% contour line lies less than 250 feet above the top of the ASR storage interval and lies more than 400 feet below the base of the Tamiami aquifer which is the aquifer that contains fresh water and the only aquifer tapped by water users in the area. At the uppermost depth of the defined position of the 1 percent concentration, the water has not yet approached the bottom of the primary confining layer in the region. The horizontal extent lies approximately 2750 feet from the ASR well. This conservation model clearly shows that vertical migration of stored water will be extremely limited at this site. Horizontal movement of the injected water also remains well within the area of review established for this well. Model input and output data are provided in Appendix 7.1.

8.0 WELL DESIGN

The proposed ASR well is designed to handle injection and production rates approaching 1.5 MGD at injection pressures that do not exceed 70 psi.

8.1 ASR Well Construction Summary

The target ASR storage interval is located within the Suwannee formation and is currently identified as the Suwannee Zone II. This zone is located between approximately 770 feet and 870 feet below land surface within the exploration well. The ASR well will be constructed for both injection and recovery. The basic subsurface well construction is provided in Figure 8.1 and is briefly discussed below:

- Steel, 32-inch O.D. pit casing will be installed to an appropriate depth as selected by the drilling contractor. Setting depth of the pit casing is currently anticipated to be approximately 40 feet below land surface. The pit casing will be cemented in place.

- A 32-inch borehole will be drilled to a depth of 320 feet below land surface, and a 26-inch diameter steel surface casing will be set to a depth of 320 feet below land surface.

- A 22-inch bore hole will be reamed using the reverse air method to an approximate depth of 800 feet. A tapered, fiberglass casing string will then be run into the borehole. The top 220 feet of the fiberglass casing will be 16-inch I.D., 0.5-inch special heavy wall Burgess fiberglass pipe or equivalent. The bottom 580 feet of the fiberglass casing will be 12-inch I.D., 0.5 wall standard Burgess fiberglass casing or equivalent. The maximum O.D. of the 16-inch pipe is 19.5-inches.

- The final open hole diameter will be nominally 12-inches.

Detailed construction procedures and well design are provided in the attached technical specifications.

8.2 ASR Wellhead Construction

The basic design for the ASR wellhead after well construction is pictured in Figure 8.2

8.3 Plugging and Abandonment

If, for some unforeseen reason, the ASR well and/or the monitoring well cannot be used for ASR storage and recovery, permits will be obtained from the FDEP and Collier County to plug and abandon the wells. Each well will be backfilled with cement by pumping from the base of the well to land surface according to the appropriate regulations. A mixture of cement with 4 percent bentonite will be used in the back plugging process and pumped through a tremmie pipe placed at the base of the well. If a highly cavernous zone is encountered in the borehole, that portion of the well will be backfilled with gravel. The cement and bentonite mixture will then be placed above the gravel layer.

9.0 TEST PLAN

A detailed plan for the testing of the ASR well during and immediately after construction is set forth in the technical specifications included with this submission. The well construction test plans are also summarized in this section.

9.1 Testing During Drilling

9.1.1 Lithologic Log

During the drilling of the ASR well, an on site geologist will be involved in the collection and analysis of drill cuttings to identify the strata being penetrated and to correlate the lithology of the ASR well with that of the exploration/dual zone monitoring well. These data will be used to help identify specific zones of interest and correlate lithology with log interpretations.

9.1.2 Water Samples While Drilling

During reverse air drilling, water samples will be collected every rod change or at a minimum of every 30 feet. These samples will be analyzed for conductance and chlorides.

9.1.3 Specific Capacity Testing During Drilling

Data for estimating specific capacity with depth will be obtained at every rod change during reverse air drilling.

9.1.4 Geophysical Logging

The following geophysical logging will be conducted:

Pilot Hole (12.25-inch) between land surface and 320 feet bls.

Gamma-ray, dual inductance, and borehole sonic logs

Reamed hole between land surface and 320 feet bls

Caliper Log, Gamma-ray

Surface Casing Installation

Temperature logs during cementing

Pilot hole between 320 feet and 860 feet bls

Caliper, Gamma- ray, dual inductance, borehole sonic, resistivity on flowing well, flow survey, video survey

Reamed hole between 320 and 790 feet bls

Caliper and gamma-ray

Final Borehole

Gamma-ray, flow survey, and resistivity

Final Casing after installation

Temperature logs during cementing

Pressure test on casing

Video Survey

9.2 Flow Testing 9

Flow Test on Open Hole

Once total depth is reached, a 4-hour flow test will be performed followed by a 4-hour shut-in period. This test and associated logging will be performed to identify the final casing setting depth and final hole depth.

Specific Capacity Testing

Once the longstring casing is set, a four stage specific capacity test will be performed. Flow rates will be performed between 100 and 900 gpm.

Aquifer Performance Test

A 72-hour aquifer performance test followed by a 72-hour shut-in period will be initiated the next day following the specific capacity test. The results of these tests will be used to establish aquifer properties and the need for well stimulation.

Casing Pressure Test

A casing pressure test will be performed at a minimum of 110 psi to establish the mechanical integrity of the well. A positive test at this pressure will allow the well to be operated at an injection pressure of 70 psi.

Storage Interval Water Quality

Near the completion of the final aquifer performance test, samples of the native water will be collected. These water samples will be analyzed for compliance with primary and secondary drinking water standards and for minimum sewage effluent criteria in accordance with UIC requirements.

10.0 PROPOSED ASR SYSTEM MONITORING PROGRAM

The following monitoring plan is proposed for the ASR well and associated monitoring wells during periods of recharge and recovery.

10.1 ASR Well

Parameters	Recording Frequency	Reporting Frequency
Injection Pressure (p.si.)		
Monthly Maximum Injection Pressure	Monthly during recharge	Monthly during recharge
Monthly Minimum Injection Pressure	Monthly during recharge	Monthly during recharge
Monthly Average Injection Pressure	Monthly during recharge	Monthly during recharge
Daily Maximum Injection Pressure	Daily during recharge	Monthly during recharge
Daily Minimum Injection Pressure	Daily during recharge	Monthly during recharge
Daily Average Injection Pressure	Daily during recharge	Monthly during recharge
Flow Rate (g.p.m.)		
Monthly Maximum Flow Rate	Monthly during recharge/recovery	Monthly during recharge/recovery
Monthly Minimum Flow Rate	Monthly during recharge/recovery	Monthly during recharge/recovery
Monthly Average Flow Rate	Monthly during recharge/recovery	Monthly during recharge/recovery
Daily Maximum Flow Rate	Daily during recharge/recovery	Monthly during recharge/recovery
Daily Average Flow Rate	Daily during recharge/recovery	Monthly during recharge/recovery
Total Volume Injected (gallons)	Daily/Monthly during recharge/ recovery	Monthly during recharge
Total Volume Recovered (gallons)	Daily/Monthly during recharge/ recovery	Monthly during recharge

Parameters	Recording Frequency	Reporting Frequency
Injection Fluid Parameters		
Specific Conductance (umhos/cm)	Weekly during recharge/recovery	Monthly during recharge/recovery
pH (std units)	Weekly during recharge/recovery	Monthly during recharge/recovery
Total Dissolved Solids (TDS) (mg/l)	Weekly during recharge/recovery	Monthly during recharge/recovery
Chloride (mg/l)	Weekly during recharge/recovery	Monthly during recharge/recovery
Sodium (mg/l)	Weekly during recharge/recovery	Monthly during recharge/recovery
Sulfate (mg/l	Weekly during recharge/recovery	Monthly during recharge/recovery
Field Temperature (°C)	Weekly during recharge/recovery	Monthly during recharge/recovery
Color (color units)	Weekly during recharge/recovery	Monthly during recharge/recovery
Total Coliform (colonies/100 ml)	Weekly during recharge/recovery	Monthly during recharge/recovery
Fecal Coliform (colonies/100 ml)	Weekly during recharge/recovery	Monthly during recharge/recovery
Arsenic (mg/l)	Weekly during recharge/recovery	Monthly during recharge/recovery
Dissolved Oxygen (mg/l)	Weekly during recharge/recovery	Monthly during recharge/recovery
Total Trihalomethanes (mg/l)	Weekly during recharge/recovery	Monthly during recharge/recovery
Total Iron (mg/l)	Weekly during recharge/recovery	Monthly during recharge/recovery
Gross Alpha (pCi/l)	Monthly during recharge/recovery	
Primary and Secondary Water Standards	Annually during recharge	Annually during recharge
Cryptosporidium	Annually during recharge	Annually during recharge
Giardia Lamblia	Annually during recharge	Annually during recharge

10.2 DUAL ZONE MONITORING WELL

The dual zone monitoring well, as indicated in Figure 1.1 lies approximately 300 feet south of the proposed ASR site. This well will be used to monitor for both vertical and horizontal movement of the injected water. The upper zone monitoring well will be designated as DZS-1 and the lower zone monitoring well is designated DZD-1.

Parameters to be monitored for this well are present below:

Parameters	Measuring Frequency	Reporting Frequency
Maximum Water Level/Pressure	Daily/.Monthly during recharge/recovery	Monthly during recharge/recovery
Minimum Water Level/Pressure	Daily/Monthly during recharge/recovery	Monthly during recharge/recovery
Average Water Level/Pressure	Daily/Monthly during recharge/recovery	Monthly during recharge/recovery
Water Quality		
Specific Conductance (umhos/cm)	Weekly during recharge/recovery	Monthly during recharge/recovery
pH (std units)	Weekly during recharge/recovery	Monthly during recharge/recovery
Total Dissolved Solids (TDS) (mg/l)	Weekly during recharge/recovery	Monthly during recharge/recovery
Chloride (mg/l)	Weekly during recharge/recovery	Monthly during recharge/recovery
Sodium (mg/l)	Weekly during recharge/recovery	Monthly during recharge/recovery
Sulfate (mg/l	Weekly during recharge/recovery	Monthly during recharge/recovery
Field Temperature (°C)	Weekly during recharge/recovery	Monthly during recharge/recovery
Color (color units)	Weekly during recharge/recovery	Monthly during recharge/recovery
Total Coliform (colonies/100 ml)	Weekly during recharge/recovery	Monthly during recharge/recovery
Fecal Coliform (colonies/100 ml)	Weekly during recharge/recovery	Monthly during recharge/recovery
Arsenic (mg/l)	Weekly during recharge/recovery	Monthly during recharge/recovery
Dissolved Oxygen (mg/l)	Weekly during recharge/recovery	Monthly during recharge/recovery
Total Trihalomethanes (mg/l)	Weekly during recharge/recovery	Monthly during recharge/recovery
Total Iron (mg/l)	Weekly during recharge/recovery	Monthly during recharge/recovery
Gross Alpha (pCi/l)	Monthly during recharge/recovery	Monthly during recharge/recovery
Cryptosporidium	Annually	Annually
Giardia Lamblia	Annually	Annually

11.0 REFERENCES

Geraghty & Miller, 1977, Evaluation of the Ground-Water Resources of the Pelican Bay Development Project, Naples, Collier County, Florida: Rept. to Gee & Jenson, 46 p.

Knapp, M.S., Burns, W.S., Sharp, T.S., 1986, Preliminary Assessment of the Groundwater Resources of Western Collier County, Florida, Parts 1 and 2, SFWMD Tech. Pub. 86-1, 142 p.

Mathews, C.S., and Russel, D.G., 1967, Pressure Buildup and Flow Test in Wells, Monograph Vol. 1, Henry L. Doherty series SPE of AIME, Dallas, TX.

McCoy, H.J., 1962, Ground-water Resources of Collier County, Florida: Florida Geol. Survey R.I. 31, 82 p.

Missimer & Associates, Inc., 1983, Hydrologic Investigation for Development of Irrigation Water at Pelican's Nest Lee County, Florida: Rept. to Westinghouse Communities of Naples, Inc., 49 p.

Missimer & Associates, Inc., 1989, Hydrogeologic Information Supporting a Groundwater Monitoring Plan Application for Spray Irrigation of Reclaimed Wastewater at Selected Sites in Northwestern Collier County: Rept. to Consoer, Townsend & Assoc., Inc., 214 p.

Missimer & Associates, Inc., 1991, Phase I - Deep Aquifer Hydrogeologic Study, Collier County, Florida: Rept. to Collier County Utilities Division, 61 p.

Peacock, R., 1983, The Post Eocene Stratigraphy of Southern Collier County, Florida: SFWMD Tech. Pub. 83-5, 42 p.

ViroGroup, Inc., 1995, UIC Class V Aquifer Storage and Recovery Application and Documentation for the Marco Lakes Site, Collier County, Florida: Rept. to Southern States Utilities, Inc. 68 p.

Ward, David S., et al., 1993, Data Input Guide for SWIFT, The Sandia Waste Isolation Flow and transport Model for Fractured Media, Release 2.54, GeoTrans, Inc. Sterling, Va.

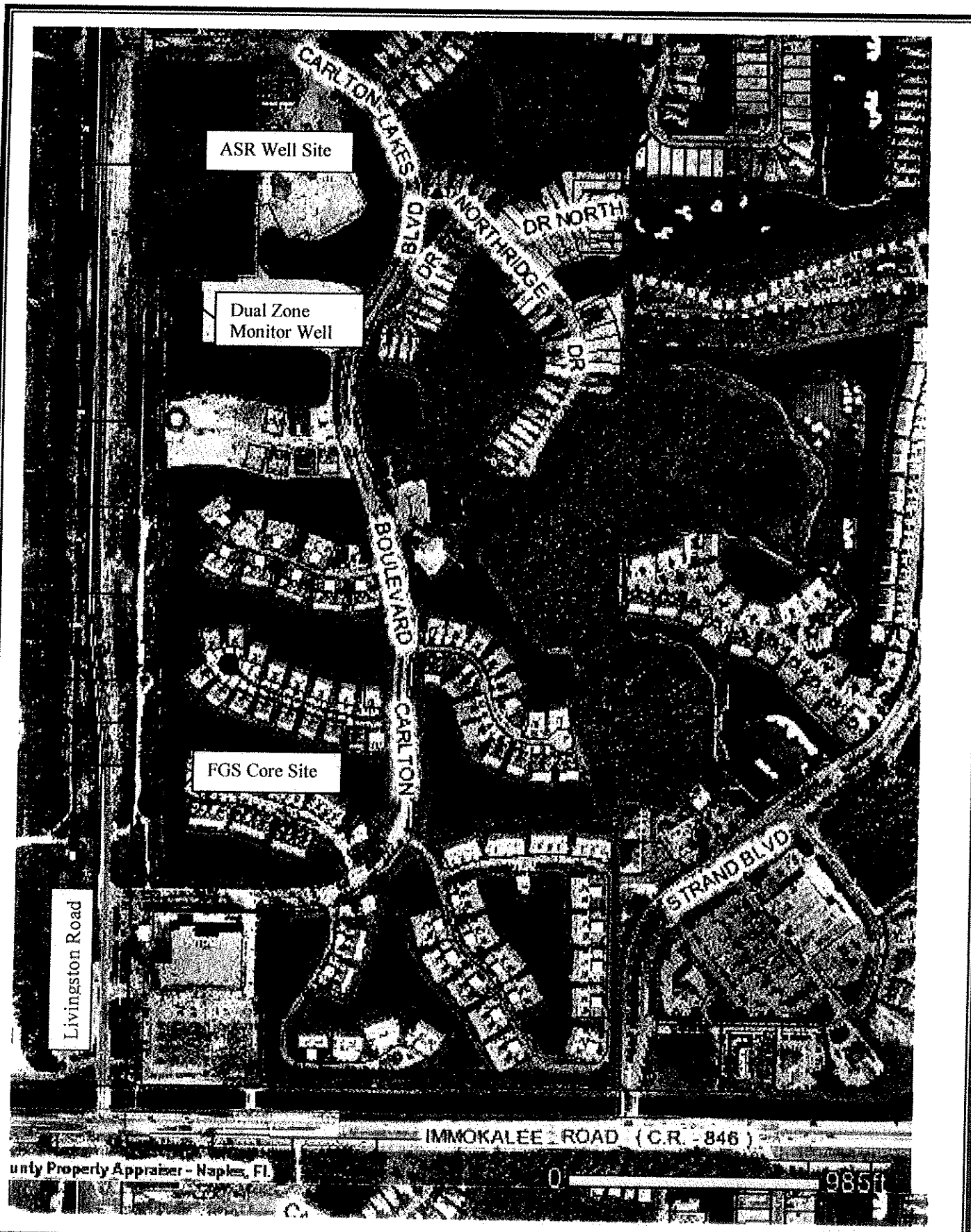
Water Resource Solutions, Inc., 1998, Marco Lakes ASR Project UIC Class V Injection Well Construction Permit Application and Supporting Documentation: Rept. to Florida Water Services, 53 p.

Water Resource Solutions, Inc., 1999, Design Report for Reclaimed Water Aquifer Storage and Recovery: Rept. to Collier County Government, 69 p.

Water Resource Solutions, Inc., 2001, UIC Class V Aquifer Storage and Recovery Application and Documentation for the Pelican Bay Wellfield: Report to Collier County Government.

Water Resource Solutions, Inc., 2002, Well Completion Report, ASR Exploration Well Dual Zone at Pelican Bay Wellfield: Rept. to Collier County Government.

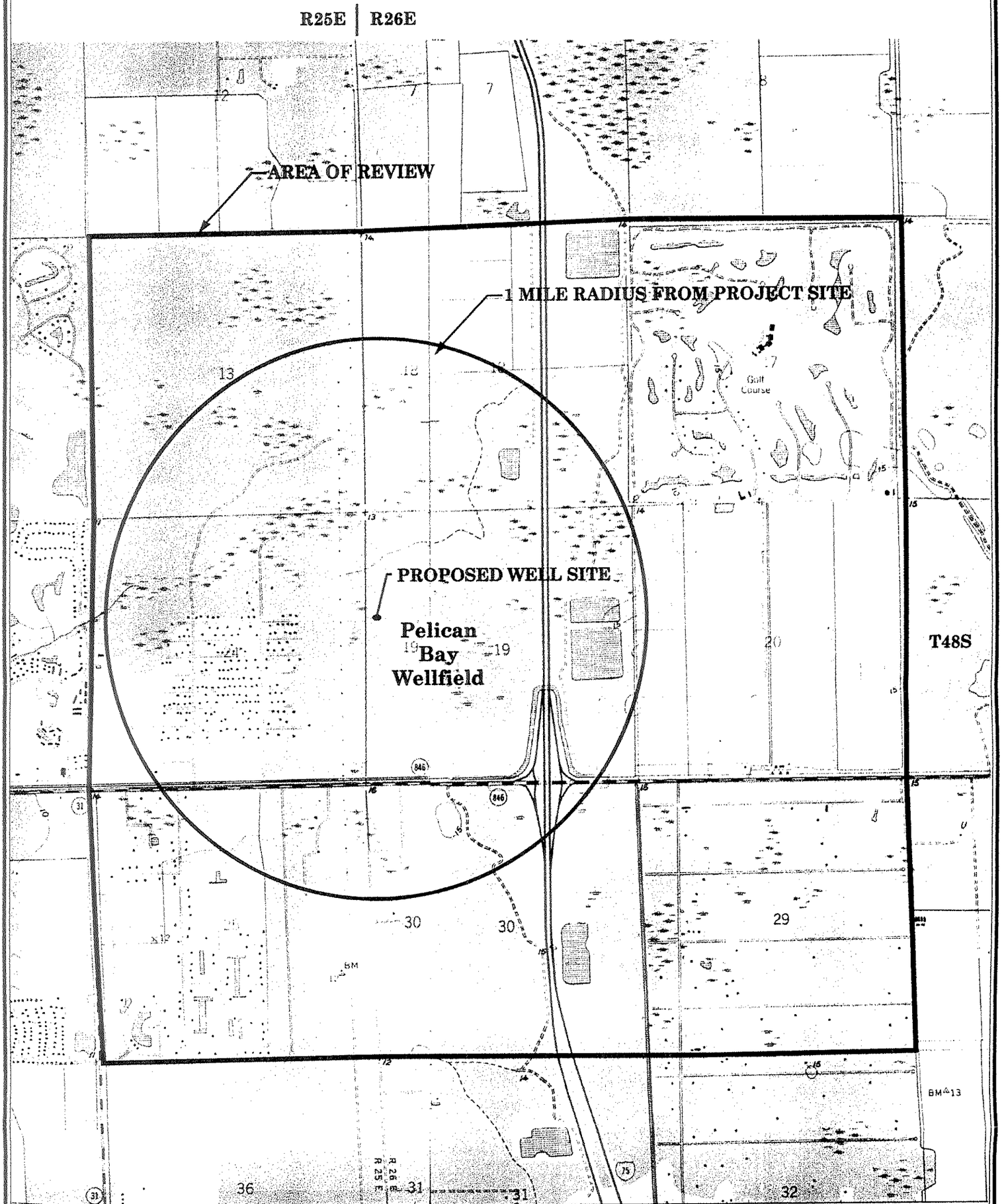
FIGURES



Water Resource Solutions

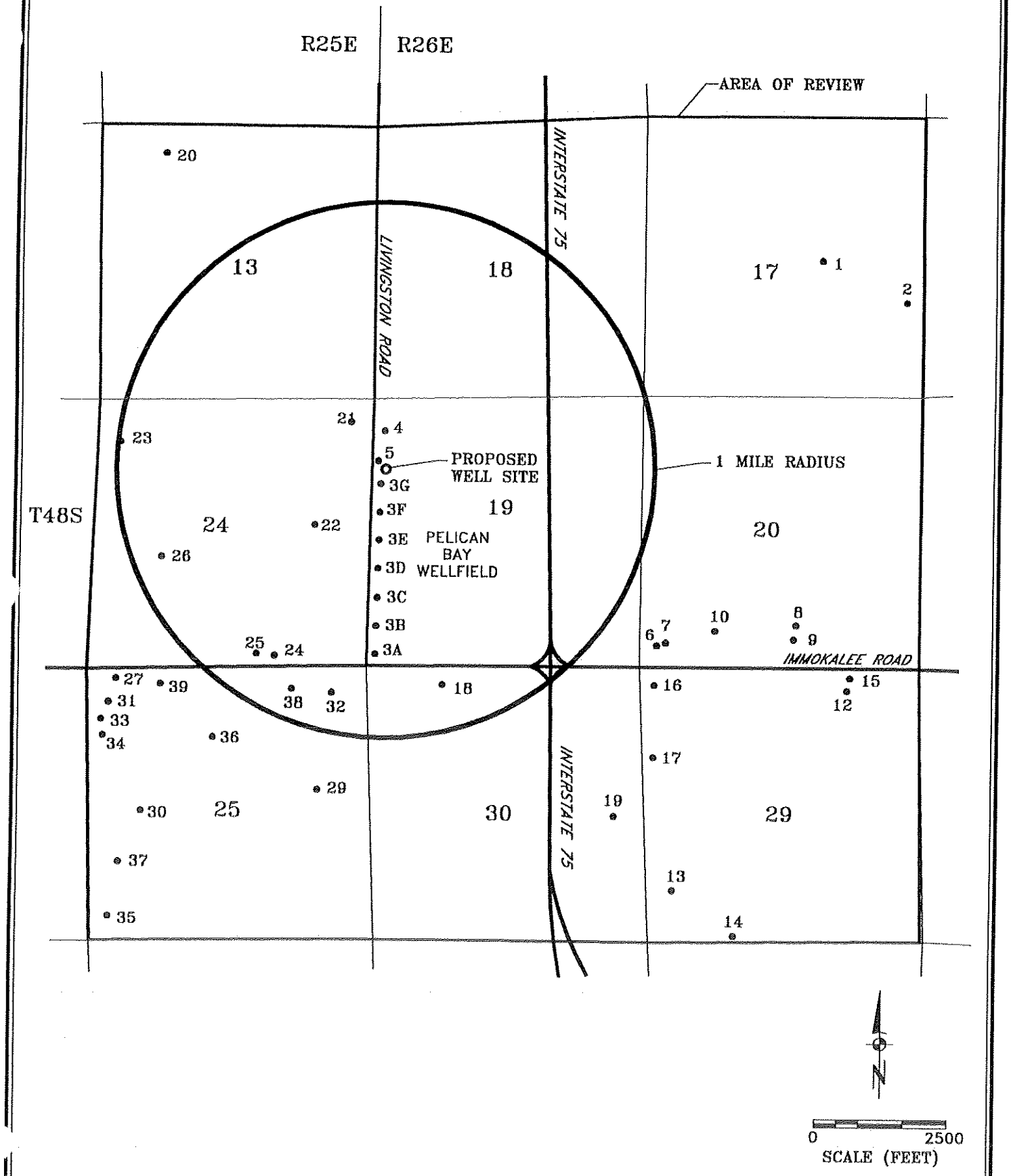
Project Collier County– ASR
Project Number: 01-0.02 Date: 8-11-02

FIGURE 1.1 Location of Sites for the Collier County Reclaimed Water ASR Test Wells



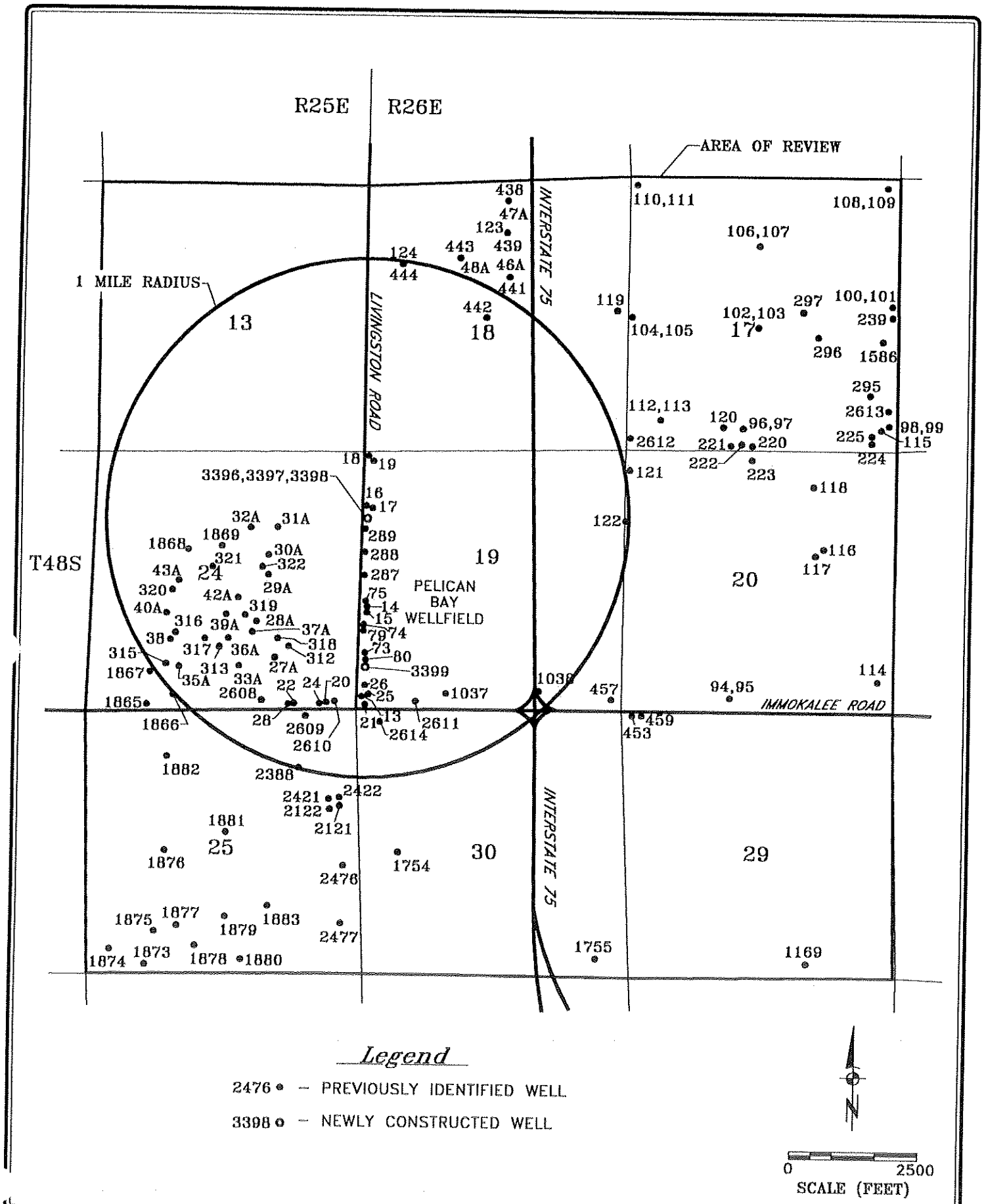
Water Resource Solutions	PROJECT NAME: COLLIER COUNTY ASR	DWG. NUMBER: B-013946TOPO-2
	PROJECT NUMBER: 01-03946.HO	DATE: 8/7/02

FIGURE 2.1 TOPOGRAPHIC MAP SHOWING THE AREA OF REVIEW AND PROPOSED WELL SITE.



Water Resource Solutions	PROJECT NAME: COLLIER COUNTY ASR	DWG. NUMBER: A-013946WI-2
	PROJECT NUMBER: 01-03946.A9	DATE: 8/7/02

FIGURE 2.2 MAP SHOWING AREA OF REVIEW, PROPOSED WELL SITE, AND SFWMD WATER USE



Legend

2476 ● – PREVIOUSLY IDENTIFIED WELL

3398 ● – NEWLY CONSTRUCTED WELL

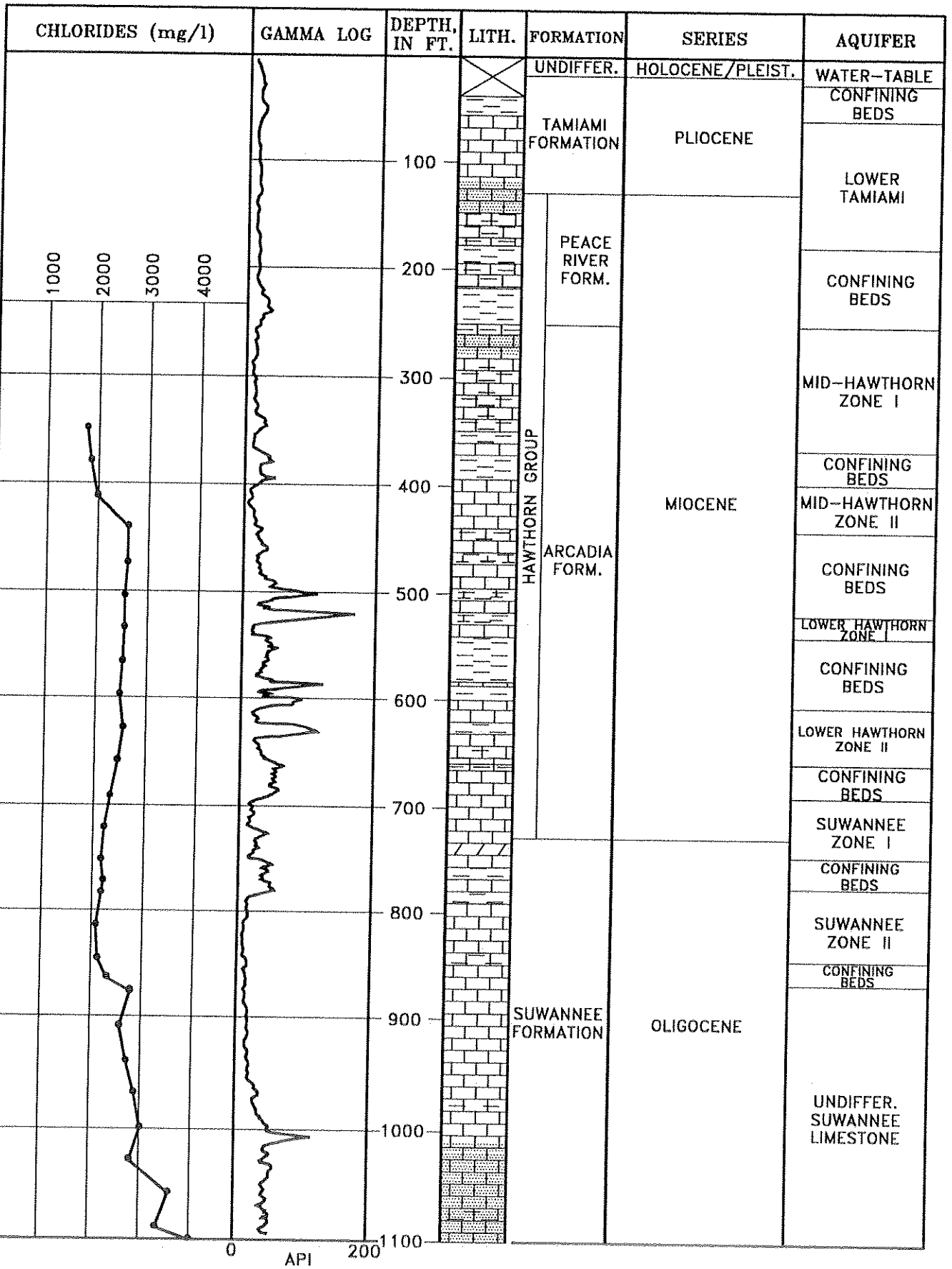
N

0 2500

SCALE (FEET)

Water Resource Solutions	PROJECT NAME: COLLIER COUNTY ASR	DWG. NUMBER: A-013946WI3-3
	PROJECT NUMBER: 01-03946.A9	DATE: 8/7/02

FIGURE 2.3 MAP SHOWING AREA OF REVIEW, USGS WELLS, WATER RESOURCE SOLUTIONS' WELLS, AND COLLIER COUNTY WELLS (REVISED).



Water Resource Solutions	PROJECT NAME: COLLIER CTY PELICAN BAY ASR	DWG. NUMBER: A-013946A1-2
	PROJECT NUMBER: 01-03946.A8	DATE: 6/27/02

FIGURE 3.1. HYDROSTRATIGRAPHIC COLUMN PELICAN BAY WELLFIELD ASR WELL MW-1.

A
NORTH

A'
SOUTH

L-605 L-645 L-600 LEE CTY. IW-1 MC-5000 CO-2081 W-14534 W-2420 CO-2427 CO-2080 W-14921 CO-2433

WATER TABLE

BONITA SPRINGS MARL

LOWER TAMIAMI AND SANDSTONE AQUIFERS

PEACE RIVER (HAWTHORN) CLAY

MID-HAWTHORN ZONE I

CONFINING BEDS

MID HAWTHORN ZONE II

CONFINING BEDS

LOWER HAWTHORN ZONE I

CONFINING BEDS

LOWER HAWTHORN ZONE II

CONFINING BEDS

SUWANNEE ZONE I

CONFINING BEDS

SUWANNEE ZONE II

UNDIFFERENTIATED SUWANNEE

TDS=10,000 mg/L (USDW)

DEPTH, IN FEET

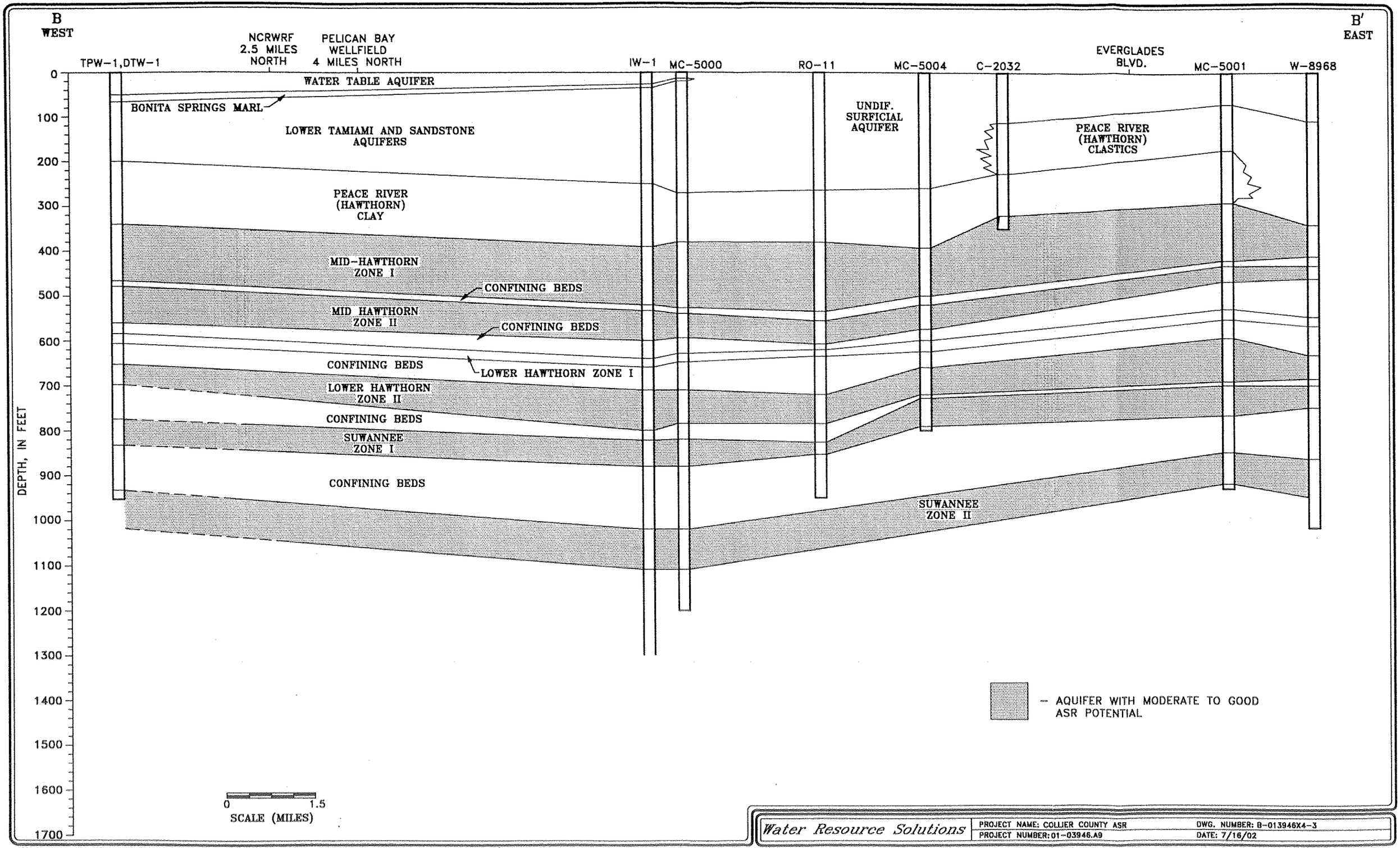
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700

0 2.75
SCALE (MILES)

– AQUIFER WITH MODERATE TO GOOD ASR POTENTIAL

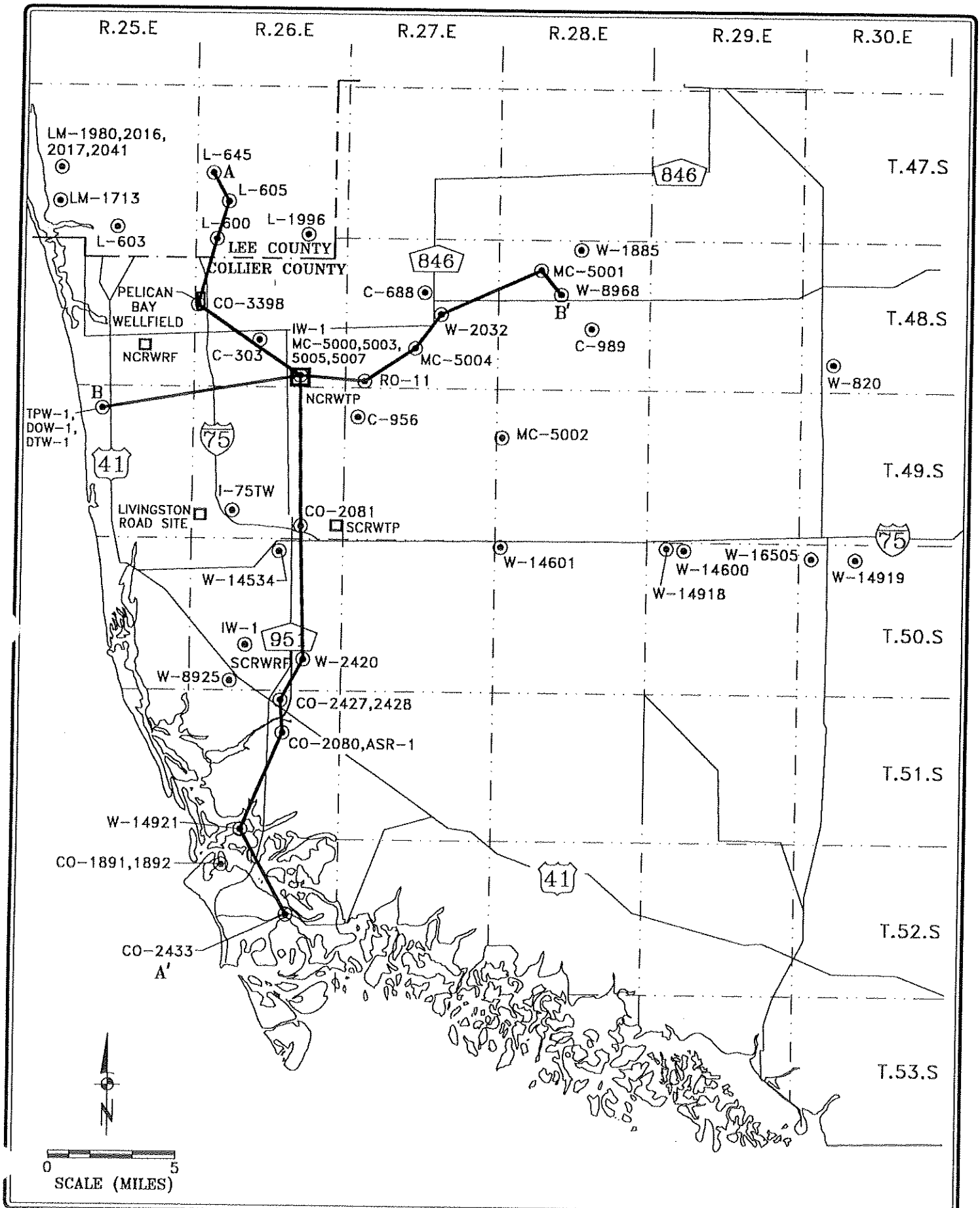
Water Resource Solutions	PROJECT NAME: COLLIER COUNTY ASR	DWG. NUMBER: B-013946X3-1
	PROJECT NUMBER: 01-03946.A9	DATE: 7/15/02

FIGURE 3-2. NORTH-SOUTH HYDROSTRATIGRAPHIC CROSS SECTION A-A'.



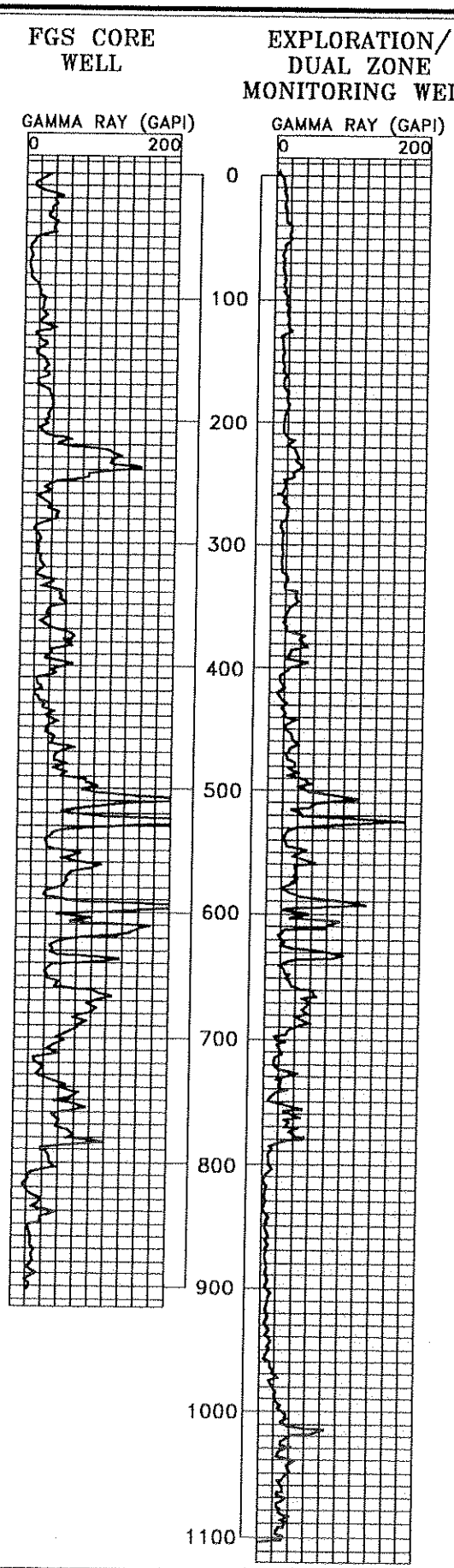
Water Resource Solutions	PROJECT NAME: COLLIER COUNTY ASR	DWG. NUMBER: B-013946X4-3
	PROJECT NUMBER: 01-03946.A9	DATE: 7/16/02

FIGURE 3-3. WEST-EAST HYDROSTRATIGRAPHIC CROSS SECTION B-B'.



Water Resource Solutions	PROJECT NAME: COLLIER COUNTY ASR	DWG. NUMBER: A-013946G2-2
	PROJECT NUMBER: 01-03946.A9	DATE: 7/30/02

FIGURE 3.4 WELL AND CROSS SECTION LOCATION MAP.

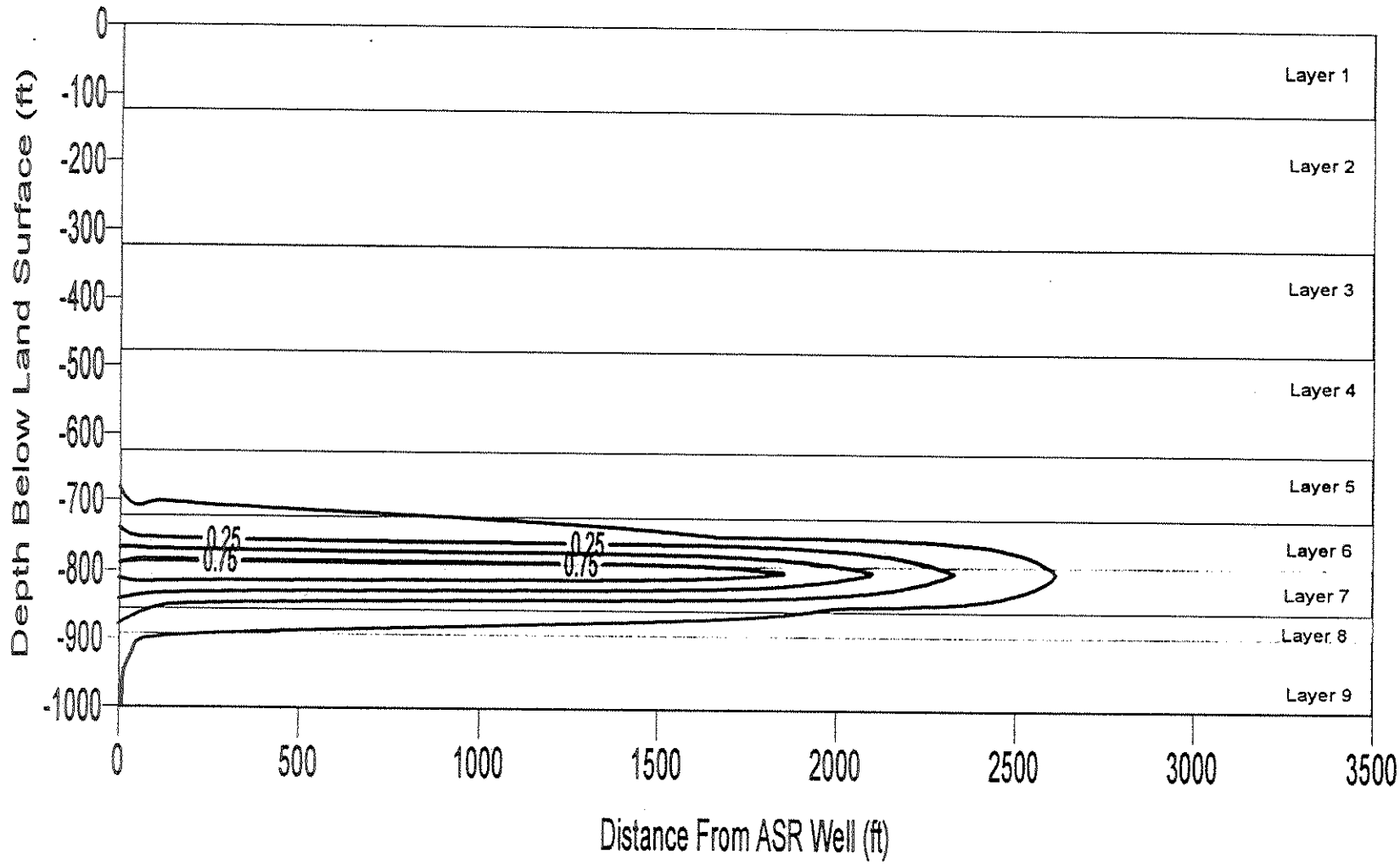


Water Resource Solutions	PROJECT NAME: COLLIER CTY ASR	DWG. NUMBER: A-013946GR-1
	PROJECT NUMBER: 01-03946.A8	DATE: 8/7/02

FIGURE 3.5 GAMMA RAY LOG CORRELATION BETWEEN EXPLORATION/DUAL ZONE MONITORING WELL AND FGS CORE WELL.

Layer 1	Depth below land surface=0	Layer thickness = 125 ft Kh = 36.6 ft/day	Kv = 13.2 ft/day
Layer 2	Depth below land surface = 125 ft	Layer thickness = 200 ft Kh = 0.024 ft/day	Kv = 0.008 ft/day
Layer 3	Depth below land surface = 325 ft	Layer thickness = 150 ft Kh = 54 ft/day	Kv = 18 ft/day
Layer 4	Depth below land surface = 475 ft	Layer thickness = 160 ft Kh = 0.003 ft/day	Kv = 0.001 ft/day
Layer 5	Depth below land surface = 635 ft	Layer thickness = 95 ft Kh = 27 ft/day	Kv = 9 ft/day
Layer 6	Depth below land surface = 730 ft	Layer thickness = 50 ft Kh = 0.06 ft/day	Kv = 0.002 ft/day
Layer 7	Depth below land surface = 780 ft	Layer thickness = 60 ft Kh = 166 ft/day	Kv = 156 ft/day
Layer 8	Depth below land surface = 840 ft	Layer thickness = 45 ft Kh = 0.024 ft/day	Kv = 0.008 ft/day
Layer 9	Depth below and surface = 895 ft	Layer thickness = 50 ft Kh = 10 ft/day	Kv = 3 ft/day

FIGURE 6.1 Summary of model input parameters for interval thickness, vertical hydraulic conductivity, and horizontal hydraulic conductivity by layer and depth.

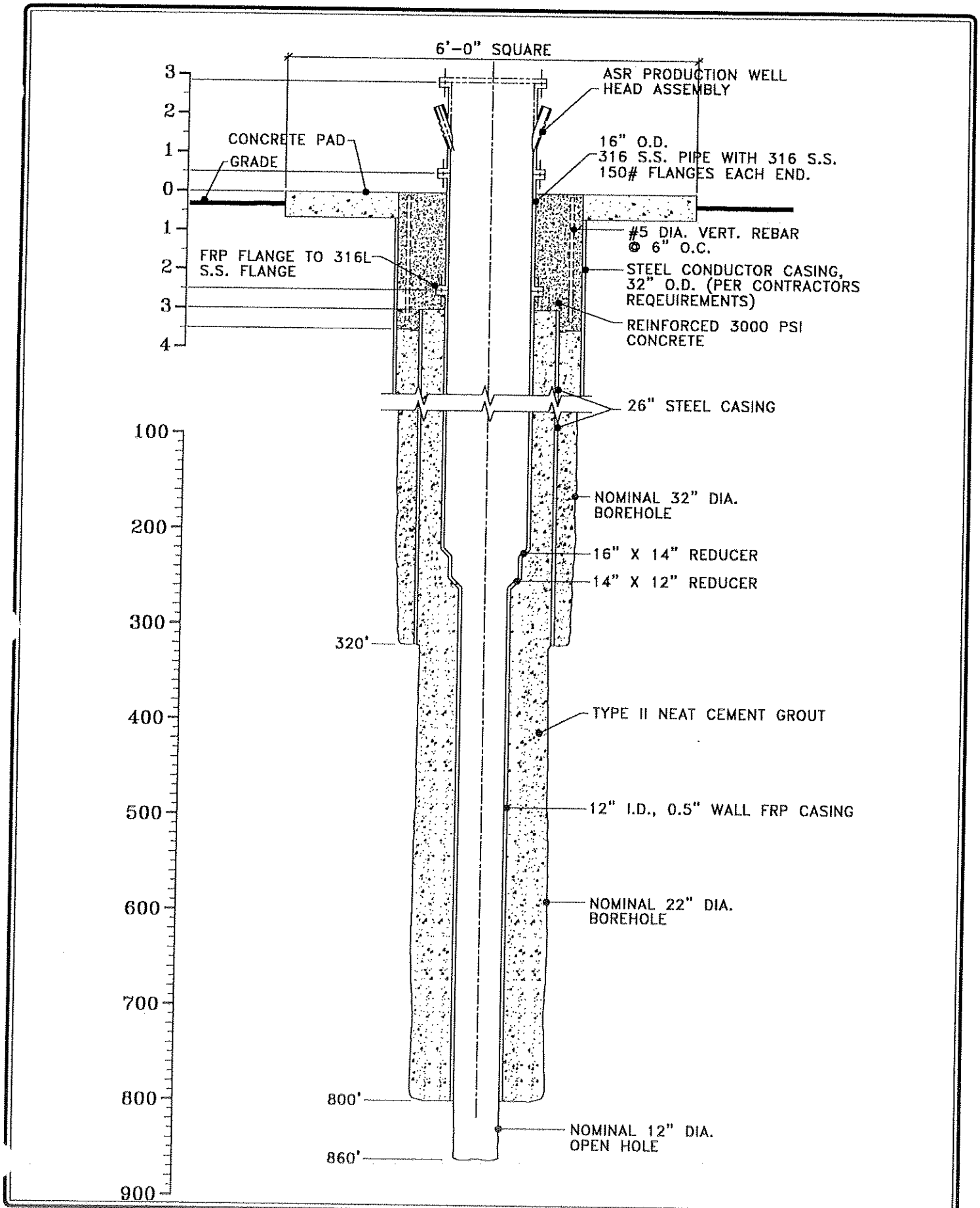


Water Resource Solutions

Project : Collier County ASR
Project Number: 01-03946

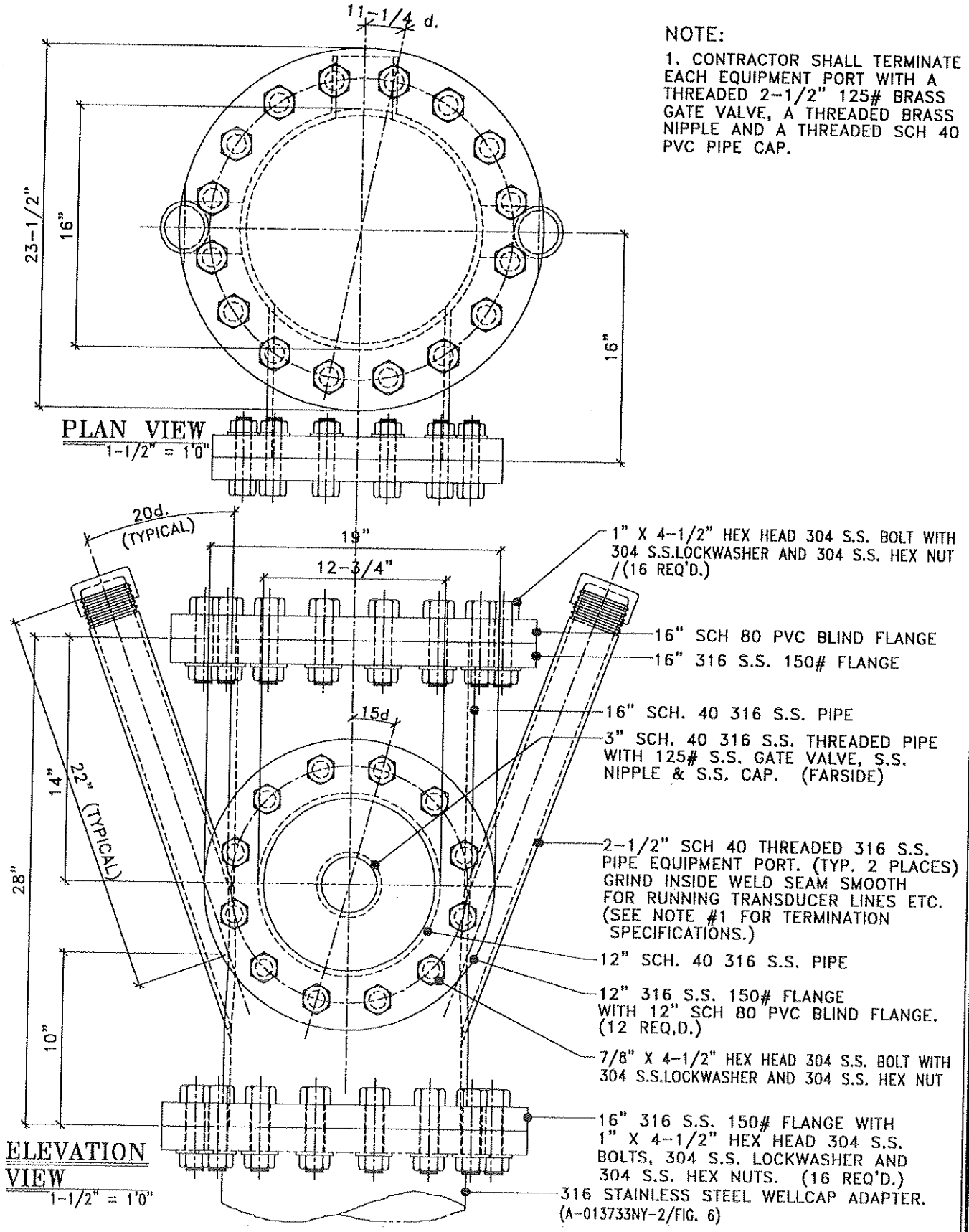
Date: 8-05 -02

FIGURE 7.1. Modeling results for injected water distribution after injecting one billion gallons (10 years of injection) without recovery.



Water Resource Solutions	PROJECT NAME: COLLIER CTY ASR	DWG. NUMBER: A-013946WX-2
	PROJECT NUMBER: 01-03946.02	DATE: 8/14/02

FIGURE 8.1 ASR PRODUCTION WELL CROSS SECTION.



NOTE:

1. CONTRACTOR SHALL TERMINATE EACH EQUIPMENT PORT WITH A THREADED 2-1/2" 125# BRASS GATE VALVE, A THREADED BRASS NIPPLE AND A THREADED SCH 40 PVC PIPE CAP.

Water Resource Solutions	PROJECT NAME: COLLIER CTY ASR	DWG. NUMBER: A-013946WH1-1
	PROJECT NUMBER: 01-03946.03	DATE: 8/7/02

FIGURE 8.2 ASR PRODUCTION WELLHEAD DIAGRAM.

TABLES

TABLE 2.1
COLLIER COUNTY ASR
PELICAN BAY WELLFIELD
WATER USE PERMIT INVENTORY

No additional water use permit wells were identified during the updated area of review. The following is a list of the previously identified wells.

Map Reference No.	SFWMD Permit No.	Location (S-T-R)	Number of Wells	Total Depth (ft)	Cased Depth (ft)	Casing Diameter (in)	Use	Source	Annual Allocation (MG)	Max. Monthly Allocation (MG)	Owner Name
1	11-00192-W	17-48-26	2	105	75 and 80	10	Landscape Irrigation	Lower Tamiami Aquifer	591.10		Manchester Investments, Inc.
2	11-01386-W	17-48-26	1 (primary)	34	20	10	Landscape Irrigation	Water Table Aquifer	46.55	6.18	Quail Creek Property Owner's Assoc.
			1 (backup)	38	18	10					
3a - 3g	11-00052-W	19-48-26	7	100	50	10	Landscape/ Golf Course Irrigation	Lower Tamiami Aquifer	603	111.9	Collier County Water Sewer District
4	11-01547-W	19-48-26	NA	NA	NA	NA	Dewatering Use	Water Table Aquifer	2.736		NTC Development LTD
5	11-01566-W (include surface water source)	19-48-26	4	15 to 20	5 to 10	4	Landscape Irrigation	Water Table Aquifer	114.0		NTC Development LTD
6	86-00026-W	20-48-26	1	60	40	4	Public Water Supply	Lower Tamiami Aquifer	0.547		United Telephone of Florida
7	86-00026-W	20-48-26	1	22	16	4	Irrigation	Water Table Aquifer	0.547		United Telephone of Florida
8	87-00109-W	20-48-26	1	40	20	2	Commercial Public	Water Table Aquifer	0.0365		Robert S. Hardy

TABLE 2.1
COLLIER COUNTY ASR
PELICAN BAY WELLFIELD
WATER USE PERMIT INVENTORY

Map Reference No.	SFWMD Permit No.	Location (S-T-R)	Number of Wells	Total Depth (ft)	Cased Depth (ft)	Casing Diameter (in)	Use	Source	Annual Allocation (MG)	Max. Monthly Allocation (MG)	Owner Name
9	11-01587-W	20-48-26	1	40	25	4	Landscape Irrigation	Water Table Aquifer	0.876		Mobil Oil Corporation
10	11-01643-W	20-48-26	1	65	50	4	Landscape Irrigation	Lower Tamiami Aquifer	2.33		Quail Plaza, Inc.
11	11-00559-W	29-48-26	2	68	64	2	Industrial (closed loop pool heater)	Lower Tamiami Aquifer	3.65		Bayshore II
12	11-00607-W	29-48-26	1	40	32	2	Landscape Irrigation	Water Table Aquifer	2.19		North Naples Fire District
13	11-00725-W	29-48-26	1	90	80	4	Public Water Supply (non-community)	Lower Tamiami Aquifer	0.73		North Naples Baptist Church
14	11-00735-W	29-48-26	2	30	30	6	Industrial (closed loop pool heater)	Water Table Aquifer	3.65		James Mantor
15	11-01258-W	29-48-26	1	40	30	4	Landscape Irrigation	Water Table Aquifer	4.78		St. Monica's Episcopal Church
16	11-01310-W	29-48-26	1	110	100	4	Landscape Irrigation	Lower Tamiami Aquifer	5.36		Faith Bible Church of Naples
17	11-01817-W	29-48-26	2	80	60	4	Landscape Irrigation	Lower Tamiami Aquifer	2.51		Faith Community Church of the Nazarene, Inc.

TABLE 2.1
COLLIER COUNTY ASR
PELICAN BAY WELLFIELD
WATER USE PERMIT INVENTORY

Map Reference No.	SFWMD Permit No.	Location (S-T-R)	Number of Wells	Total Depth (ft)	Cased Depth (ft)	Casing Diameter (in)	Use	Source	Annual Allocation (MG)	Max. Monthly Allocation (MG)	Owner Name
18	11-01189-W	30-48-26	1	25	20	4	Landscape Irrigation	Water Table Aquifer	5.0	0.6	April Circle LTD (Windsong Club Apts.)
19	11-01859-W	30-48-26	2	80	50	4	Landscape Irrigation	Lower Tamiami Aquifer	42.0	5.5	PR VI LLC
20	11-01887-W	13-48-25	1	40	20	4	Landscape Irrigation	Water Table Aquifer	4.28	0.569	Sorrento Asset Management, Inc.
21	86-00359-W	24-48-25	1	50	45	2	Landscape Irrigation	Water Table Aquifer	1.20		Sun-Op/Green Tree
22	88-00120-W	24-48-25	1	60	50	4	Landscape Irrigation	Lower Tamiami Aquifer	3.61		The Bunkers Condo Assoc.
23	11-00617-W	24-48-25	1	25	20	4	Landscape Irrigation	Water Table Aquifer	3.39		Badgett-Williams Corp.
24	11-00791-W	24-48-25	1	80	70	4	Landscape Irrigation	Lower Tamiami Aquifer	1.55		Dominic LaGrasta
25	11-01300-W	24-48-25	1	30	20	4	Landscape Irrigation	Water Table Aquifer	9.0	1.2	Willoughby Gardens, Inc.
26	11-01624-W	24-48-25	1	35	25	4	Landscape Irrigation	Water Table Aquifer	3.24		McCullough Construction, Inc.
27	87-00349-W	25-48-25	2	110	104	4	Irrigation	Lower Tamiami Aquifer	3.21		Quail Woods Estates

TABLE 2.1
COLLIER COUNTY ASR
PELICAN BAY WELLFIELD
WATER USE PERMIT INVENTORY

Map Reference No.	SFWMD Permit No.	Location (S-T-R)	Number of Wells	Total Depth (ft)	Cased Depth (ft)	Casing Diameter (in)	Use	Source	Annual Allocation (MG)	Max. Monthly Allocation (MG)	Owner Name
28	88-00074-W	25-48-25	1	72	63	2	Irrigation	Lower Tamiami Aquifer	0.18		Quail Woods Estates
29	11-00070-W	25-48-25	1			8	Well Not Used	Well Not Used	Well Not Used	Well Not Used	Manatee Fruit Co.
			1			8	Agricultural Irrigation	Water Table Aquifer		20.8	Manatee Fruit Co.
30	11-00157-W	25,35,36-48-25	5			6 and 8	Agricultural Irrigation	Water Table Aquifer		164	Manatee Fruit Co. (D.T. Farms, Inc.)
31	11-00603-W	25-48-25	1	50	40	4	Landscape Irrigation	Water Table Aquifer	2.6		Naples Keep Condo Assoc., Inc.
32	11-00697-W	25-48-25	1	65	60	2	Landscape Irrigation	Lower Tamiami Aquifer	2.62		Florida Realty and Investment
33	11-00948-W	25-48-25	1	70	60	4	Landscape Irrigation	Lower Tamiami Aquifer	3.57		Wal-Mart Stores, Inc.
34	11-01090-W	25-48-25	1	60	50	4	Landscape Irrigation	Lower Tamiami Aquifer	3.90		Our Savior Lutheran Church
35	11-01100-W	25-48-25	1	65	55	6	Landscape Irrigation	Lower Tamiami Aquifer			Eurofund Crescent Lake LTD
36	11-01390-W	25-48-25	1	65	52	4	Landscape Irrigation	Lower Tamiami Aquifer	3.79		Crescent Gardens Condo Assoc.

TABLE 2.1
COLLIER COUNTY ASR
PELICAN BAY WELLFIELD
WATER USE PERMIT INVENTORY

Map Reference No.	SFWMD Permit No.	Location (S-T-R)	Number of Wells	Total Depth (ft)	Cased Depth (ft)	Casing Diameter (in)	Use	Source	Annual Allocation (MG)	Max. Monthly Allocation (MG)	Owner Name
37	11-01618-W	25-48-25	1	35	25	4	Landscape Irrigation	Water Table Aquifer	1.42		Boca Palms Homeowners Assoc.
38	11-01760-W	25-48-25	1	35	25	8	Landscape Irrigation	Water Table Aquifer	11.0	1.4	St. Croix Apts at Pelican Marsh LTD
39	11-01805-W	25-48-25	1	40	30	4	Landscape Irrigation	Water Table Aquifer	1.49		Winter View Court Development Inc.

TABLE 2.2
COLLIER COUNTY ASR
AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (inches)	Casing Depth (feet)	Total Depth (feet)
CC12100-FF			13	48	25	Irrigation	2	91	
CC02221-F			13	48	25	Irrigation	2	82	
CC02081-F			13	48	25	Irrigation	4	87	
CC05091-B			13	48	25	Irrigation	2	100	
CC04021-D			13	48	25	Irrigation	4	80	
CC07031-B			13	48	25	Irrigation	1	90	
CC08191-A			13	48	25	Irrigation	4	80	
CC12051-C			13	48	25	Irrigation	4	80	
CC01022-B			13	48	25	Irrigation	2	60	
CC06242-A			13	48	25	Irrigation		80	
CC10012-A			13	48	25	Irrigation	4	60	
CC03083-C			13	48	25	Irrigation	4	110	
CC05183-A			13	48	25	Irrigation	4	80	
CC05183-C			13	48	25	Irrigation	4	85	
CC06293-A			13	48	25	Irrigation	4	60	
CC07223-D			13	48	25	Irrigation	4	70	
CC06116-A			13	48	25	Irrigation	4	102	
CC08016-B			13	48	25	Irrigation	4	60	
CC02275K			13	48	25	Irrigation			
CC10143-K			13	48	25	Irrigation	4		
CC01226-E			13	48	25	Irrigation	4	70	
CC05136-A			13	48	25	Irrigation	4	80	
CC05017-B			13	48	25	Irrigation		80	
CC05137-H			13	48	25	Irrigation	4		
CC03145-J			13	48	25	Irrigation	4		
CC03285-C			13	48	25	Irrigation	4	80	
CC05185-F			13	48	25	Irrigation	4		
CC07105-E			13	48	25	Irrigation	4	70	
CC08155-A			13	48	25	Irrigation	4	55	
CC10255-G			13	48	25	Irrigation	4	80	
CC11075-G			13	48	25	Irrigation	4	90	
CC11075-H			13	48	25	Irrigation	4	85	
CC11075-I			13	48	25	Irrigation	4	90	
CC12015-A			13	48	25	Irrigation	4	100	
CC07167-K			13	48	25	Irrigation	4	80	
CC01244-C			13	48	25	Irrigation	4	86	
CC01068-F			13	48	25	Irrigation	4	60	
CC05054-H			13	48	25	Irrigation	4	55	
CC05164-A			13	48	25	Irrigation	4	80	
CC02058-T			13	48	25	Irrigation			
CC03118-B			13	48	25	Irrigation			
CC03138-D			13	48	25	Irrigation	4	80	
CC03138-E			13	48	25	Irrigation	4	80	
CC04218-M			13	48	25	Irrigation			
CC07228-Q			13	48	25	Irrigation			
CC08118-G			13	48	25	Irrigation			
CC08198-A			13	48	25	Irrigation	4	60	
CC08198-C			13	48	25	Irrigation	4	80	
CC08218-B			13	48	25	Irrigation	4	70	
CC09088-A			13	48	25	Irrigation	4		
CC012099-C			13	48	25	Irrigation			
CC020199-A			13	48	25	Irrigation			
CC01071-A			13	48	25	Soil			
CC02221-C			13	48	25	Domestic	2	95	95
CC01022-A			13	48	25				65
CC03112-C			13	48	25	Domestic	4	80	100
CC09186-E			13	48	25	Domestic	4	80	110
CC10086-I			13	48	25	Domestic	4	80	100
CC01266-C			13	48	25	Domestic	4	80	100
CC04167-E			13	48	25	Domestic	4	60	100
CC01068-M			13	48	25	Domestic	4	80	100
CC020199A			13	48	25	Domestic	14	110	120
CC012099C			13	48	25	Irrigation	4	110	120
CC030399A			13	48	25	Irrigation	4	65	75
CC030499C			13	48	25	Domestic	4	50	60

Note: Entries shown in bold italics indicate wells identified or constructed after the previous inventory.

TABLE 2.2
COLLIER COUNTY ASR
AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (inches)	Casing Depth (feet)	Total Depth (feet)
CC032299A			13	48	25	Irrigation	4	80	90
CC090299B			13	48	25	Irrigation	4	80	80
CC100599A			13	48	25	Irrigation			90
CC020200A			13	48	25	Irrigation	4	80	90
CC042800J			13	48	25	Irrigation	4	70	90
CC060100B			13	48	25				20
CC060500F			13	48	25	Irrigation	4	100	110
CC040902N			***13***	***48***	***25***	***Soil***			***25***
CC031302J			***13***	***48***	***25***	***Irrigation***	***4***	***70***	***80***
CC110700J			***13***	***48***	***25***	***Irrigation***	***4***	***80***	***90***
CC082200K			***13***	***48***	***25***	***Domestic***	***4***	***80***	***92***
CC082200K			***13***	***48***	***25***	***Domestic***	***4***	***80***	***92***
CC011201B			***13***	***48***	***25***	***Irrigation***	***4***	***30***	***32***
CC020201I			***13***	***48***	***25***	***Irrigation***	***4***	***80***	***95***
CC011502A			***13***	***48***	***25***	***Irrigation***	***4***	***80***	***90***
CC021402A			***13***	***48***	***25***	***Domestic***	***4***	***80***	***90***
CC032002DD			***13***	***48***	***25***	***Irrigation***	***4***	***50***	***60***
	20		24	48	25	Observation	4	55	82
	22		24	48	25	Observation	4	61	65
	23		24	48	25	Observation	2	21	25
	24		24	48	25	Observation	2	15	15
	311		24	48	25	Irrigation	2	60	
	312		24	48	25	Irrigation	2	60	
	313		24	48	25	Irrigation			
	314		24	48	25	Irrigation			
	316		24	48	25	Irrigation			
	317		24	48	25	Irrigation			
	318		24	48	25	Irrigation			
	319		24	48	25	Irrigation			40-50
	320		24	48	25	Irrigation			
	321		24	48	25	Irrigation			
	322		24	48	25	Irrigation			
	1865		24	48	25	Irrigation			
	1866		24	48	25	Irrigation			
	1867		24	48	25	Irrigation			
	1868		24	48	25	Irrigation			
	1869		24	48	25	Irrigation			
	27A		24	48	25	Irrigation	2	40	40
	28A		24	48	25				
	29A		24	48	25		2		
	30A		24	48	25	Irrigation	2	60	
	31A		24	48	25	Irrigation	2		
	32A		24	48	25		2	25	30
	33A		24	48	25	Irrigation	2	65	
	35A		24	48	25	Irrigation	2		
	36A		24	48	25	Irrigation	2	60	
	37A		24	48	25	Irrigation	2		
	38A		24	48	25	Irrigation	2	65	
	39A		24	48	25		2	60	
	40A		24	48	25	Irrigation	2		
	41A		24	48	25		2		
	42A		24	48	25	Irrigation	2		
	43A		24	48	25	Irrigation	2	72	
	2608	1189	24	48	25	Unused		61	75
	2610	1187	24	48	25	Unused		55	90
CC021699T			24	48	25	Irrigation	4	60	
CC02229-C			24	48	25	Irrigation			64
CC03029-B			24	48	25	Irrigation			68
CC04180-F			24	48	25	Irrigation	4	55	60
CC03219-C			24	48	25	Irrigation	4	52	58
CC04109-C			24	48	25	Irrigation	2	52	63
CC04120-D			24	48	25	Irrigation	6	85	85
CC04189-E			24	48	25	Irrigation	2	63	65
CC04189-F			24	48	25	Irrigation	2	63	65
CC04189-I			24	48	25	Irrigation	2	52	63

Note: Entries shown in bold italics indicate wells identified or constructed after the previous inventory.

TABLE 2.2
COLLIER COUNTY ASR
AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (inches)	Casing Depth (feet)	Total Depth (feet)
CC05019-A			24	48	25	Irrigation			
CC05029-P			24	48	25	Irrigation Soil	2	63	65
CC05059-B			24	48	25	Irrigation	2	63	65
CC03120-L			24	48	25	Irrigation	2	70	70
CC03270-P			24	48	25	Irrigation	4	77	77
CC08189-B			24	48	25	Irrigation	2	63	65
CC10309-D			24	48	25	Irrigation	2	68	68
CC11139-A			24	48	25	Irrigation	2	63	65
CC11219-H			24	48	25	Irrigation	2	63	66
CC12149-C			24	48	25	Irrigation	2	67	67
CC01300-A			24	48	25	Irrigation	20	21	25
CC02200-N			24	48	25	Irrigation	2	105	105
CC10160-E			24	48	25	Irrigation			80
CC10160-F			24	48	25	Irrigation			90
CC11270-C			24	48	25	Irrigation	2	73	73
CC12100-Z			24	48	25	Irrigation		70	70
CC02141-B			24	48	25	Irrigation	2	65	65
CC02141-C			24	48	25	Irrigation	4	76	76
CC05311-A			24	48	25	Irrigation	2	70	88
CC07181-C			24	48	25	Irrigation	2	60	80
CC07181-D			24	48	25	Irrigation	2	60	80
CC12061-D			24	48	25	Irrigation	2	63	70
CC01312-D			24	48	25	Irrigation	2	70	75
CC02032-L			24	48	25	Irrigation	4	62	75
CC02072-D			24	48	25	Irrigation	2	70	80
CC04152-C			24	48	25	Irrigation	4	60	80
CC03232-E			24	48	25	Irrigation	4	80	80
CC03232-F			24	48	25	Irrigation	4	60	80
CC05212-M			24	48	25	Irrigation	2	63	67
CC07022-A			24	48	25	Irrigation	4	65	70
CC08272-J			24	48	25	Irrigation	4	60	65
CC11162-G			24	48	25	Irrigation	4	70	80
CC01043-F			24	48	25	Irrigation	4	95	95
CC01043-G			24	48	25	Irrigation	4	65	65
CC02053-B			24	48	25	Irrigation	4	68	80
CC02053-C			24	48	25	Irrigation	4	68	80
CC03253-G			24	48	25	Irrigation	4	75	85
CC04133-A			24	48	25	Irrigation	4	65	75
CC05253-L			24	48	25	Irrigation	4	80	80
CC08203-E			24	48	25	Irrigation	4	60	65
CC08233-B			24	48	25	Irrigation	4	60	65
CC06106-I			24	48	25	Irrigation	4	50	60
CC09023-G			24	48	25	Irrigation	4	57	70
CC09023-L			24	48	25	Irrigation	4		65
CC09203-C			24	48	25	Irrigation	4	55	70
CC09233-C			24	48	25	Irrigation	4	55	80
CC02065A			24	48	25	Irrigation			75
CC10076-C			24	48	25	Irrigation	4	60	70
CC02275E			24	48	25	Irrigation			60
CC11046-J			24	48	25	Irrigation	4	50	60
CC11226-D			24	48	25	Irrigation	4	50	65
CC12056-B			24	48	25	Irrigation	4	60	70
CC12196-D			24	48	25	Irrigation	4	50	60
CC11043-A			24	48	25	Irrigation	4	60	70
CC11043-B			24	48	25	Irrigation	4	60	70
CC01176-M			24	48	25	Irrigation	4	55	70
CC01306-B			24	48	25	Irrigation	4	65	80
CC02016-B			24	48	25	Irrigation	4	60	80
CC02016-M			24	48	25	Irrigation	4	55	60
CC02086-G			24	48	25	Irrigation	4	55	60
CC04106-F			24	48	25	Irrigation	4	65	80
CC04106-G			24	48	25	Irrigation	4	65	80
CC05136-E			24	48	25	Irrigation	4	20	30
CC03145-H			24	48	25	Irrigation	4		
CC04055-I			24	48	25	Irrigation	4	60	80

Note: Entries shown in bold italics indicate wells identified or constructed after the previous inventory.

TABLE 2.2
COLLIER COUNTY ASR
AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (inches)	Casing Depth (feet)	Total Depth (feet)
CC04145-A			24	48	25	Irrigation	4		
CC05185-D			24	48	25	Irrigation	4	42	55
CC06075-B			24	48	25	Irrigation	4		
CC06075-G			24	48	25	Irrigation	4		
CC12275-A			24	48	25	Irrigation	4	70	
CC06187-B			24	48	25	Irrigation			70
CC06267-G			24	48	25	Irrigation			60
CC07177-E			24	48	25	Irrigation	4	50	60
CC07177-H			24	48	25	Irrigation	4	50	60
CC09187-E			24	48	25	Irrigation	4	60	70
CC11127-F			24	48	25	Irrigation	4	65	75
CC01078-C			24	48	25	Irrigation	4		
CC02224-C			24	48	25	Irrigation	4	70	85
CC04264-F			24	48	25	Irrigation	4	55	75
CC04284-A			24	48	25	Irrigation	4	69	80
CC06014-K			24	48	25	Irrigation	4	50	60
CC06074-I			24	48	25	Irrigation			
CC08264-D			24	48	25	Irrigation	4	55	75
CC08264-E			24	48	25	Irrigation	4	55	75
CC09124-L			24	48	25	Irrigation	4	55	75
CC03098-D			24	48	25	Irrigation			
CC03098-E			24	48	25	Irrigation			
CC04078-S			24	48	25	Irrigation	4	50	70
CC05218-D			24	48	25	Irrigation			70
CC06158-M			24	48	25	Irrigation			65
CC08108-E			24	48	25	Irrigation	4	60	70
CC09218-H			24	48	25	Irrigation			
CC12048-C			24	48	25	Irrigation Soil			70
CC021699-T			24	48	25	Irrigation			
CC01050-A			24	48	25	Soil			
CC06250-C			24	48	25	Domestic	4	58	75
CC12190-A			24	48	25	Soil			
CC08301-A			24	48	25	Soil			
CC12131-B			24	48	25	Domestic	4	60	75
CC02272-C			24	48	25	Domestic	2	70	80
CC04302-J			24	48	25	Soil			
CC03202-A			24	48	25	Monitor	2	2	12
CC06222-J			24	48	25	Monitor	2	20	30
CC06222-K			24	48	25	Monitor	2		13
CC07162-G			24	48	25	Domestic	2	60	65
CC08182-G			24	48	25	Domestic	4	50	60
CC10162-D			24	48	25	Soil			80
CC10292-C			24	48	25	Domestic	4	51	60
CC11122-Q			24	48	25	Domestic	4	60	68
CC01113-B			24	48	25	Domestic			82
CC08133-C			24	48	25	Domestic	4	55	70
CC09023-F			24	48	25	Domestic	4	70	70
CC10116-C			24	48	25	Domestic	4	60	
CC10073-I			24	48	25	Monitor	4	5	15
CC11023-B			24	48	25	Domestic	4	60	70
CC11183-B			24	48	25	Domestic	4	60	80
CC03116-G			24	48	25	Domestic	4	120	135
CC03267-F			24	48	25	Domestic	4	65	81
CC05087-B			24	48	25	Domestic	4	60	70
CC05015-E			24	48	25	Domestic	4	60	70
CC12055-E			24	48	25	Domestic	4	60	80
CC09187-D			24	48	25	Domestic	2		50
CC03224-A			24	48	25	Soil			
CC09264-E			24	48	25	Soil			
CC031299A			24	48	25	Domestic			
CC031299DD			24	48	25	Irrigation			70
CC041499A			24	48	25	Irrigation	4	55	65
CC062499B			24	48	25	Irrigation	4	60	60
CC051799F			24	48	25	Irrigation			70
CC051999L			24	48	25	Irrigation			80

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TABLE 2.2
COLLIER COUNTY ASR
AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (Inches)	Casing Depth (feet)	Total Depth (feet)
CC051199C			24	48	25	Irrigation	4	80	90
CC070199E			24	48	25	Irrigation	4	60	80
CC070199O			24	48	25	Irrigation			100
CC070899E			24	48	25	Domestic			70
CC071299H			24	48	25	Irrigation			70
CC071599H			24	48	25	Irrigation	4	65	
CC080999E			24	48	25	Irrigation	4	70	75
CC111299A			24	48	25	Irrigation	4	55	65
CC030200A			24	48	25	Irrigation	4	80	80
CC110999D			24	48	25	Irrigation			70
CC110999E			24	48	25	Domestic			20
CC120299P			24	48	25	Domestic			70
CC030700N			24	48	25	Irrigation			70
CC032800D			24	48	25	Irrigation	4	60	70
CC041900I			24	48	25	Irrigation		-	70
CC042600C			24	48	25	Irrigation	4	70	80
CC042600D			24	48	25	Irrigation	4	70	70
CC052300L			24	48	25	Irrigation			90
CC052300Q			24	48	25	Irrigation	4	70	80
CC080100B			24	48	25	Irrigation			90
CC081501D			***24***	***48***	***25***	***Domestic***	***4***	***80***	***90***
CC082701H			***24***	***48***	***25***	***Domestic***	***4***	***40***	***50***
CC040102M			***24***	***48***	***25***	***Domestic***	***4***	***60***	***70***
CC040102L			***24***	***48***	***25***		***2***	***63***	***68***
CC111500H			***24***	***48***	***25***	***Domestic***	***4***	***60***	***70***
CC120400C			***24***	***48***	***25***	***Domestic***	***4***	***80***	***90***
CC010801C			***24***	***48***	***25***	***Test***			***20***
CC011001A			***24***	***48***	***25***	***Test***			***80***
CC120500C			***24***	***48***	***25***	***Domestic***	***4***	***60***	***70***
CC101501F			***24***	***48***	***25***	***Domestic***	***4***	***60***	***70***
CC020802E			***24***	***48***	***25***	***Irrigation***	***4***	***80***	***80***
CC041702J			***24***	***48***	***25***	***Irrigation***	***4***	***80***	***90***
CC040102L			***24***	***48***	***25***		***2***	***63***	***68***
CC040102M			***24***	***48***	***25***	***Irrigation***	***4***	***60***	***70***
	1873		25	48	25	Irrigation			
	1874		25	48	25	Irrigation			
	1875		25	48	25	Irrigation			
	1876		25	48	25	Irrigation			
	1877		25	48	25	Irrigation			
	1878		25	48	25	Irrigation			
	1879		25	48	25	Irrigation			
	1880		25	48	25	Irrigation			
	1881		25	48	25	Irrigation			
	1882		25	48	25				
	1883		25	48	25	Irrigation			
	2121		25	48	25	Irrigation	8		
	2122		25	48	25	Irrigation	8		
	2421		25	48	25		10	48	75
	2422		25	48	25		10	46	75
	2476		25	48	25				
	2477		25	48	25				
	2388		25	48	25	Abandoned			
	2609	177	25	48	25				58
CC02239-F			25	48	25	Irrigation			58
CC05159-C			25	48	25	Irrigation	2	63	65
CC04090-B			25	48	25	Irrigation	2	63	63
CC06079-C			25	48	25	Irrigation	2	60	70
CC07069-B			25	48	25	Irrigation			60
CC07109-B			25	48	25	Irrigation			70
CC08029-C			25	48	25	Irrigation			60
CC08049-C			25	48	25	Irrigation	4	60	75
CC03260-A			25	48	25	Irrigation		68	73
CC08299-A			25	48	25	Irrigation			70
CC08189-F			25	48	25	Irrigation	4	45	60
CC09199-A			25	48	25	Irrigation	2	63	70

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TABLE 2.2
COLLIER COUNTY ASR
AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (Inches)	Casing Depth (feet)	Total Depth (feet)
CC11069-F			25	48	25	Irrigation			60
CC11069-E			25	48	25	Irrigation			60
CC11159-B			25	48	25	Irrigation		55	68
CC12189-D			25	48	25	Irrigation			58
CC01310-G			25	48	25	Irrigation	2	67	67
CC01230-A			25	48	25	Irrigation		75	75
CC02090-F			25	48	25	Irrigation			
CC02210-L			25	48	25	Irrigation	4	64	64
CC02260-C			25	48	25	Irrigation	2	67	67
CC04250-F			25	48	25	Irrigation	2	63	65
CC07020-J			25	48	25	Irrigation	4	75	75
CC07100-C			25	48	25	Irrigation	2	63	65
CC07200-B			25	48	25	Irrigation		75	75
CC07270-B			25	48	25	Irrigation			60
CC08130-A			25	48	25	Irrigation	4	47	65
CC09140-J			25	48	25	Irrigation	4	70	70
CC11280-D			25	48	25	Irrigation	2	73	73
CC12140-A			25	48	25	Irrigation	2	70	70
CC01071-B			25	48	25	Irrigation	2	65	65
CC02211-Y			25	48	25	Irrigation			69
CC05231-H			25	48	25	Irrigation	4	70	70
CC08151-E			25	48	25	Irrigation	2	42	50
CC10171-F			25	48	25	Irrigation	2	63	70
CC12181-B			25	48	25	Irrigation	4	50	60
CC01142-A			25	48	25	Irrigation	4	75	75
CC03092-F			25	48	25	Irrigation	4	51	60
CC03092-G			25	48	25	Irrigation	4	52	60
CC04272-H			25	48	25	Irrigation			80
CC05012-I			25	48	25	Irrigation	4	45	60
CC03192-A			25	48	25	Irrigation	4	58	70
CC05112-B			25	48	25	Irrigation	4	60	70
CC05282-B			25	48	25	Irrigation	4	50	60
CC06102-A			25	48	25	Irrigation	4	60	70
CC06232-C			25	48	25	Irrigation	4	80	90
CC08042-G			25	48	25	Irrigation	4	48	60
CC08062-B			25	48	25	Irrigation	2	70	80
CC08062-C			25	48	25	Irrigation	2	70	80
CC09292-D			25	48	25	Irrigation	4	60	70
CC11062-B			25	48	25	Irrigation	4	60	70
CC12112-B			25	48	25	Irrigation	4	50	60
CC12182-H			25	48	25	Irrigation	4	50	60
CC12182-I			25	48	25	Irrigation	4	50	60
CC12282-A			25	48	25	Irrigation	4	60	80
CC12282-C			25	48	25	Irrigation		50	60
CC12282-B			25	48	25	Irrigation	4	50	60
CC01043-E			25	48	25	Irrigation	4	60	70
CC01113-A			25	48	25	Irrigation	4	50	60
CC02093-B			25	48	25	Irrigation	4	60	70
CC03103-B			25	48	25	Irrigation	4	55	60
CC04163-A			25	48	25	Irrigation	4	50	60
CC05043-A			25	48	25	Irrigation	4	50	60
CC05253-A			25	48	25	Irrigation	4	50	55
CC07073-E			25	48	25	Irrigation	4	70	80
CC07203-A			25	48	25	Irrigation	4	65	75
CC07223-C			25	48	25	Irrigation	4		
CC08103-L			25	48	25	Irrigation	4	50	60
CC08113-B			25	48	25	Irrigation	4	60	70
CC08193-A			25	48	25	Irrigation	4	50	65
CC06246-A			25	48	25	Irrigation	4	50	60
CC06246-C			25	48	25	Irrigation	4	80	70
CC07156-A			25	48	25	Irrigation	4	48	60
CC07316-C			25	48	25	Irrigation	4	60	70
CC08226-D			25	48	25	Irrigation	4	50	60
CC10146-B			25	48	25	Irrigation	4	65	70
CC02275G			25	48	25	Irrigation			60

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AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (inches)	Casing Depth (feet)	Total Depth (feet)
CC10263-E			25	48	25	Irrigation	4	50	65
CC11043-F			25	48	25	Irrigation	4	50	60
CC11083-B			25	48	25	Irrigation	4	60	70
CC12173-B			25	48	25	Irrigation	4	50	60
CC12173-C			25	48	25	Irrigation	4	50	60
CC04116-D			25	48	25	Irrigation	4	50	60
CC04116-E			25	48	25	Irrigation	4	50	60
CC04116-F			25	48	25	Irrigation	4	50	60
CC04116-G			25	48	25	Irrigation	4	50	60
CC04156-C			25	48	25	Irrigation	4	50	60
CC03037-D			25	48	25	Irrigation	4	50	60
CC04017-B			25	48	25	Irrigation	4	50	60
CC03075-A			25	48	25	Irrigation	4	50	60
CC03145-I			25	48	25	Irrigation	4	40	60
CC05235-E			25	48	25	Irrigation	4		
CC05235-F			25	48	25	Irrigation	4		
CC06075-F			25	48	25	Irrigation	4		
CC06235-K			25	48	25	Irrigation	4	50	60
CC06235-L			25	48	25	Irrigation	8		60
CC08215-C			25	48	25	Irrigation	8		60
CC08047-A			25	48	25	Irrigation	4	50	60
CC08047-B			25	48	25	Irrigation	4	65	70
CC09117-A			25	48	25	Irrigation	4	48	52
CC10287-F			25	48	25	Irrigation		50	60
CC12297-O			25	48	25	Irrigation	4	50	60
CC12297-P			25	48	25	Irrigation	10	46	70
CC12297-Q			25	48	25	Irrigation	10	46	70
CC12297-R			25	48	25	Irrigation	10	46	70
CC01184-K			25	48	25	Irrigation	10	46	70
CC01088-D			25	48	25	Irrigation	4		
CC01288-A			25	48	25	Irrigation	4	50	60
CC02094-B			25	48	25	Irrigation	4	45	55
CC02244-C			25	48	25	Irrigation	4	45	55
CC02244-D			25	48	25	Irrigation	4	50	60
CC04044-B			25	48	25	Irrigation	4	50	60
CC04264-L			25	48	25	Irrigation	4	60	75
CC04264-M			25	48	25	Irrigation	4	45	55
CC05104-J			25	48	25	Irrigation	4	45	55
CC06084-A			25	48	25	Irrigation	4	45	60
CC02058-N			25	48	25	Irrigation	4	60	75
CC08104-T			25	48	25	Irrigation	4	50	60
CC08194-D			25	48	25	Irrigation	4	60	70
CC08234-B			25	48	25	Irrigation	4	57	70
CC11024-B			25	48	25	Irrigation	4	35	60
CC11044-B			25	48	25	Irrigation	4	47	55
CC03268-E			25	48	25	Irrigation	4	49	60
CC04238-F			25	48	25	Irrigation	4	53	60
CC05208-C			25	48	25	Irrigation	4	50	60
CC06028-H			25	48	25	Irrigation			70
CC06198-I			25	48	25	Irrigation			90
CC08188-B			25	48	25	Irrigation			125
CC08288-A			25	48	25	Irrigation	4	60	70
CC09308-A			25	48	25	Irrigation	4	60	80
CC10028-G			25	48	25	Irrigation	4	60	80
CC10028-H			25	48	25	Irrigation			
CC10078-E			25	48	25	Irrigation			
CC10288-A			25	48	25	Irrigation			
CC11208-A			25	48	25	Irrigation	4	60	70
CC11238-A			25	48	25	Irrigation	4	50	60
CC12158-A			25	48	25	Irrigation			60
CC08189-E			25	48	25	Irrigation			80
CC12219-A			25	48	25	Domestic			
CC02260-A			25	48	25				10
CC02281-A			25	48	25	Domestic	2	67	67
CC05281-B			25	48	25	Soil			
						Soil			

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COLLIER COUNTY ASR
AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (inches)	Casing Depth (feet)	Total Depth (feet)
CC01222-F			25	48	25	Soil			10
CC11192-D			25	48	25	Domestic	4	60	70
CC06066-D			25	48	25	Domestic	4		
CC09213-A			25	48	25	Monitor			
CC11196-K			25	48	25	Soil			
CC12036-N			25	48	25	Test	4	10	15
CC02267-A			25	48	25	Soil			
CC10283-G			25	48	25				
CC12083-G			25	48	25	Domestic	4	45	55
CC01026-A			25	48	25	Domestic	4	40	55
CC01026-B			25	48	25	Domestic	4	40	55
CC01296-B			25	48	25	Domestic	4	50	65
CC04065-A			25	48	25	Soil			
CC08155-I			25	48	25	Domestic	4	40	55
CC07317-A			25	48	25	Soil			
CC12317-C			25	48	25	Soil			
CC01058-C			25	48	25	Monitor	4		15
CC04124-E			25	48	25	Test	6	8	18
CC04124-F			25	48	25	Monitor	4	1	18
CC02038-G			25	48	25	Monitor	4	5	15
CC05118-D			25	48	25	Domestic			60
CC041499B			25	48	25	Irrigation	4	50	60
CC032999C			25	48	25	Irrigation	4	50	60
CC042799D			25	48	25	Irrigation	4	80	90
CC040299C			25	48	25	Irrigation			70
CC060499C			25	48	25	Domestic	4	80	80
CC042799C			25	48	25	Irrigation	4	80	90
CC051399T			25	48	25	Domestic	4	80	90
CC051499L			25	48	25	Irrigation	4		65
CC052899D			25	48	25	Irrigation	4	50	60
CC060199L			25	48	25	Irrigation	4	70	80
CC070899D			25	48	25	Domestic			70
CC091399N			25	48	25	Irrigation			70
CC092499F			25	48	25	Irrigation	4	55	65
CC100599B			25	48	25	Irrigation			70
CC100599C			25	48	25	Irrigation			70
CC102699J			25	48	25	Irrigation	4	55	65
CC110599M			25	48	25	Test			
CC010400G			25	48	25	Domestic	4	80	90
CC011100C			25	48	25	Irrigation			70
CC011100E			25	48	25	Irrigation	4	80	90
CC011100F			25	48	25	Irrigation	4	80	90
CC021700M			25	48	25	Irrigation			70
CC033000B			25	48	25	Irrigation	4	80	90
CC041000F			25	48	25	Irrigation	4	30	40
CC041300B			25	48	25	Irrigation	4	80	90
CC050900C			25	48	25	Irrigation			70
CC052300S			25	48	25	Irrigation	4	50	70
CC052300U			25	48	25				
CC052400E			25	48	25	Irrigation			70
CC080800G			***25***	***48***	***25***	***Domestic***	***4***	***60***	***70***
CC090700E			***25***	***48***	***25***	***Domestic***	***4***	***80***	***90***
CC101700B			***25***	***48***	***25***	***Irrigation***	***4***	***70***	***80***
CC110600K			***25***	***48***	***25***	***Domestic***	***4***	***80***	***90***
CC110600C			***25***	***48***	***25***	***Domestic***	***4***	***60***	***70***
CC121600I			***25***	***48***	***25***	***Domestic***	***4***	***60***	***70***
CC020801G			***25***	***48***	***25***	***Domestic***	***4***	***80***	***90***
CC042701O			***25***	***48***	***25***	***Domestic***			***90***
CC050901B			***25***	***48***	***25***	***Monitor***	***4***	***63***	***69***
CC042601H			***25***	***48***	***25***	***Abandoned***			
CC042601G			***25***	***48***	***25***	***Domestic***			***90***
CC031301F			***25***	***48***	***25***	***Irrigation***	***4***	***80***	***90***
CC050901A			***25***	***48***	***25***	***Domestic***	***4***	***65***	***70***
CC062101C			***25***	***48***	***25***	***Irrigation***	***4***	***80***	***90***
CC062901A			***25***	***48***	***25***	***Test***			***30***

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COLLIER COUNTY ASR
AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (inches)	Casing Depth (feet)	Total Depth (feet)
CC012902F			***25***	***48***	***25***	***Irrigation***	***4***	***80***	***90***
CC031302C			***25***	***48***	***25***	***Irrigation***	***4***	***90***	***80***
CC032102K			***25***	***48***	***25***	***Irrigation***	***4***	***60***	***70***
CC031802D			***25***	***48***	***25***		***2***	***60***	***70***
	96		17	48	26	Observation	2	80	86
	97		17	48	26	Observation	2	10	50
	98		17	48	26	Observation	2	90	95
	99		17	48	26	Observation	1¼	12.5	15
	100		17	48	26		2	90	95
	101		17	48	26	Observation	1¼	12.5	15
	102		17	48	26	Observation	2	92.5	95
	103		17	48	26	Observation	1¼	12.5	
	104		17	48	26	Observation	2	65	65
	105		17	48	26	Observation	1¼	12.5	15
	106		17	48	26	Observation	2	93	93
	107		17	48	26	Observation	1¼	12.5	
	108		17	48	26	Observation	2	87.5	95
	109		17	48	26	Observation	1¼	12.5	
	110		17	48	26	Observation	2	65	80
	111		17	48	26	Observation	1¼	12.5	15
	112		17	48	26	Observation	2	80	95
	113		17	48	26	Observation	1¼	7.5	
	115		17	48	26	Irrigation	6		57
	120		17	48	26	Irrigation	10	103	148
	220		17	48	26	Irrigation	10	65	99
	221		17	48	26	Observation	4	250	260
	222		17	48	26	Observation	4	65	100
	224		17	48	26		10	20	34
	225		17	48	26	Observation	2	25	35
	239		17	48	26	Observation	2	20	30
	295		17	48	26		10	18	41
	296		17	48	26	Irrigation	10	78	105
	297		17	48	26	Irrigation	10	80	103
	1586		17	48	26	Observation	2	2	
	2612	1197	17	48	26	Unused	2	80	85
	2613	1198	17	48	26	Unused	2	85	90
CC02139-D			17	48	26	Irrigation	2	70	80
CC02279-D			17	48	26	Irrigation	4	80	100
CC04180-D			17	48	26	Irrigation			100
CC03229-C			17	48	26	Irrigation	4	70	90
CC03219-E			17	48	26	Irrigation	4	70	80
CC04139-A			17	48	26	Irrigation	4	58	68
CC04160-G			17	48	26	Irrigation	4	74	74
CC04199-C			17	48	26	Irrigation	4	67	82
CC05039-B			17	48	26	Irrigation	4	60	100
CC05039-C			17	48	26	Irrigation	4	60	100
CC05109-G			17	48	26	Irrigation	4	70	77
CC05049-C			17	48	26	Irrigation			77
CC05239-H			17	48	26	Irrigation			80
CC05249-B			17	48	26	Irrigation			79
CC05309-I			17	48	26	Irrigation			60
CC06199-M			17	48	26	Irrigation	4	95	95
CC06139-J			17	48	26	Irrigation			98
CC06239-B			17	48	26	Irrigation			100
CC06029D			17	48	26	Irrigation			77
CC06139J			17	48	26	Irrigation			98
CC06029-D			17	48	26	Irrigation			77
CC08159-F			17	48	26	Irrigation			
CC08159-D			17	48	26	Irrigation			80
CC08219-I			17	48	26	Irrigation			80
CC08109-G			17	48	26	Irrigation	4	70	70
CC08109-F			17	48	26	Irrigation		70	70
CC03190-S			17	48	26	Irrigation	4	115	115
CC09089-C			17	48	26	Irrigation	4	60	70
CC03280-F			17	48	26	Irrigation			80

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TABLE 2.2
COLLIER COUNTY ASR
AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (Inches)	Casing Depth (feet)	Total Depth (feet)
CC09119-G			17	48	26	Irrigation	4	60	70
CC10049-C			17	48	26	Irrigation			100
CC10199-D			17	48	26	Irrigation			100
CC11069-G			17	48	26	Irrigation			80
CC11079-D			17	48	26	Irrigation			90
CC11099-B			17	48	26	Irrigation	4	85	100
CC11289-G			17	48	26	Irrigation			80
CC12189-G			17	48	26	Irrigation	4	80	95
CC12229-F			17	48	26	Irrigation			90
CC01150-E			17	48	26	Irrigation			90
CC01170-I			17	48	26	Irrigation	4	90	90
CC01230-C			17	48	26	Irrigation	4	90	90
CC02280-I			17	48	26	Irrigation	10	80	100
CC04250-K			17	48	26	Irrigation			100
CC08170-G			17	48	26	Irrigation			90
CC09070-G			17	48	26	Irrigation			80
CC11010-F			17	48	26	Irrigation			80
CC11200-D			17	48	26	Irrigation			90
CC11200-B			17	48	26	Irrigation			70
CC11270-D			17	48	26	Irrigation			100
CC11280-E			17	48	26	Irrigation			100
CC11290-D			17	48	26	Irrigation			80
CC12120-C			17	48	26	Irrigation	4	80	87
CC12120-E			17	48	26	Irrigation	4	73	73
CC12120-D			17	48	26	Irrigation	4	93	93
CC01041-K			17	48	26	Irrigation	4		100
CC03041-B			17	48	26	Irrigation	2	97	97
CC03131-A			17	48	26	Irrigation	4	85	85
CC05081-H			17	48	26	Irrigation			60
CC11251-A			17	48	26	Irrigation	4	65	75
CC12301-E			17	48	26	Irrigation	4	50	70
CC01072-H			17	48	26	Irrigation	4	73	80
CC01272-C			17	48	26	Irrigation	4	80	87
CC02072-B			17	48	26	Irrigation			90
CC03182-C			17	48	26	Irrigation	4	60	85
CC07232-D			17	48	26	Irrigation	4	60	60
CC09012-A			17	48	26	Irrigation		60	80
CC12182-E			17	48	26	Irrigation	4	70	80
CC07163-C			17	48	26	Irrigation	4	90	100
CC07223-A			17	48	26	Irrigation	4		
CC07223-B			17	48	26	Irrigation	4		
CC08243-E			17	48	26	Irrigation	4	55	70
CC06196-N			17	48	26	Irrigation	4	65	75
CC01055-I			17	48	26	Irrigation			55
CC09083-G			17	48	26	Irrigation	4	60	80
CC09083-H			17	48	26	Irrigation	4	60	80
CC09153-H			17	48	26	Irrigation	4	70	80
CC10096-A			17	48	26	Irrigation	4	80	90
CC02165A			17	48	26	Irrigation			85
CC02275-H			17	48	26	Irrigation			
CC11186-B			17	48	26	Irrigation	4	60	75
CC11226-G			17	48	26	Irrigation	4	60	70
CC01147-C			17	48	26	Irrigation	4	58	70
CC01157-D			17	48	26	Irrigation	4	78	90
CC01166-E			17	48	26	Irrigation	4	60	75
CC01176-B			17	48	26	Irrigation	4	50	60
CC05096-V			17	48	26	Irrigation	4	50	60
CC05017-A			17	48	26	Irrigation		60	80
CC03285-B			17	48	26	Irrigation	4	50	60
CC04275-M			17	48	26	Irrigation	4	60	80
CC05315-G			17	48	26	Irrigation	4	60	80
CC10105-A			17	48	26	Irrigation	4	80	90
CC06237-C			17	48	26	Irrigation	4	60	80
CC07307-B			17	48	26	Irrigation	4	80	90
CC10207-J			17	48	26	Irrigation	4	80	100

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COLLIER COUNTY ASR
AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (inches)	Casing Depth (feet)	Total Depth (feet)
CC12127-A			17	48	26	Irrigation			
CC01124-D			17	48	26	Irrigation	4	64	75
CC02224-E			17	48	26	Irrigation	4	50	70
CC02244-H			17	48	26	Irrigation	4	60	80
CC02254-A			17	48	26	Irrigation	4	80	95
CC03224-D			17	48	26	Irrigation	4	95	105
CC03224-E			17	48	26	Irrigation	4		
CC05204-H			17	48	26	Irrigation	4		
CC06304-G			17	48	26	Irrigation	4	61	70
CC07194-A			17	48	26	Irrigation	4	80	90
CC07254-E			17	48	26	Irrigation	4	58	73
CC08084-A			17	48	26	Irrigation	4	80	90
CC10244-A			17	48	26	Irrigation			
CC11014-C			17	48	26	Irrigation	4	75	95
CC11144-B			17	48	26	Irrigation	4	55	75
CC03318-C			17	48	26	Irrigation			
CC04078-R			17	48	26	Irrigation	4	60	80
CC04078-T			17	48	26	Irrigation	4	60	80
CC04218-N			17	48	26	Irrigation			
CC04278-A			17	48	26	Irrigation	4	70	80
CC04288-Q			17	48	26	Irrigation	4		90
CC04288-R			17	48	26	Irrigation	4		30
CC05198-F			17	48	26	Irrigation			90
CC06038-B			17	48	26	Irrigation			100
CC06158-N			17	48	26	Irrigation			75
CC06238-B			17	48	26	Irrigation			70
CC08178-D			17	48	26	Irrigation			
CC010799-A			17	48	26	Irrigation			90
CC03260-C			17	48	26	Domestic	4	60	80
CC08239-B			17	48	26	Domestic	4	80	100
CC03280-E			17	48	26				
CC09119-J			17	48	26				
CC03190-V			17	48	26				
CC10199-E			17	48	26				
CC01050-K			17	48	26	Domestic			100
CC01050-F			17	48	26	Domestic			80
CC05020-J			17	48	26				
CC06270-I			17	48	26	Domestic Fire			90
CC09070-A			17	48	26	Fire			90
CC09050-T			17	48	26	Domestic	2	63	31
CC09050-U			17	48	26	Domestic	2	63	80
CC10040-B			17	48	26	Monitor	2	15	15
CC11130-G			17	48	26		2	30	35
CC11130-H			17	48	26	Domestic	2	30	35
CC11010-G			17	48	26				60
CC12030-E			17	48	26	Domestic			90
CC12100-F			17	48	26	Domestic	2	95	95
CC12100-G			17	48	26	Domestic	4	105	105
CC01081-C			17	48	26	Domestic			60
CC02271-E			17	48	26	Domestic	4	94	94
CC02271-D			17	48	26	Domestic	2	90	90
CC08051-M			17	48	26	Domestic	4	95	95
CC10181-A			17	48	26	Domestic			
CC10181-B			17	48	26	Domestic			
CC10211-A			17	48	26	Domestic	4	80	115
CC03112-D			17	48	26	Monitor	2	8	18
CC03252-B			17	48	26	Domestic Monitor	4	60	
CC01063-A			17	48	26	Domestic	4	80	90
CC03253-A			17	48	26	Domestic	4	60	75
CC03293-A			17	48	26	Domestic	4	67	78
CC04133-F			17	48	26	Soil			25
CC06213-F			17	48	26		4	3	23
CC06213-G			17	48	26		4	63	70
CC06076-E			17	48	26	Domestic	4	85	95
CC01087-E			17	48	26	Domestic	4	60	80

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COLLIER COUNTY ASR
AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (inches)	Casing Depth (feet)	Total Depth (feet)
CC02047-D			17	48	26	Domestic	4	50	65
CC02047-E			17	48	26	Domestic	4	50	60
CC10193-A			17	48	26	Soil			
CC11163-J			17	48	26	Domestic	4	60	70
CC11163-K			17	48	26	Domestic	4	60	70
CC05216-B			17	48	26	Domestic	4	75	90
CC05216-A			17	48	26	Domestic	4	75	90
CC03234-A			17	48	26	Domestic Soil			
CC05204-F			17	48	26	Domestic	4		
CC05204-G			17	48	26	Domestic	4		
CC11044-F			17	48	26	Domestic			
CC11044-G			17	48	26	Domestic			
CC03068-L			17	48	26	Domestic	4	60	80
CC012599-O			17	48	26	Domestic			
CC012599-P			17	48	26	Domestic			90
CC010799A			17	48	26	Irrigation			70
CC012599O			17	48	26	Irrigation	4	90	100
CC012599P			17	48	26	Irrigation			90
CC031799B			17	48	26	Irrigation	4	70	80
CC091799J			17	48	26	Domestic			70
CC092299D			17	48	26	Irrigation	4	60	70
CC102899G			17	48	26	Irrigation	4	80	90
CC013100A			17	48	26	Irrigation	4	80	
CC013100B			17	48	26	Irrigation	4	80	90
CC040600K			17	48	26	Irrigation	4	90	100
CC051900A			17	48	26	Irrigation	4	70	80
CC060700C			17	48	26	Irrigation	4	80	90
CC070400G			17	48	26	Irrigation			70
CC121600N			***17***	***48***	***26***	***Domestic***	***4***	***60***	***70***
CC121600O			***17***	***48***	***26***	***Domestic***	***2***	***60***	***70***
CC091900M			***17***	***48***	***26***	***Domestic***	***4***	***60***	***70***
CC091500B			***17***	***48***	***26***	***Domestic***	***4***	***60***	***70***
CC091500C			***17***	***48***	***26***	***Abandoned***	***4***		***40***
CC110600J			***17***	***48***	***26***	***Domestic***	***4***	***80***	***90***
CC111500E			***17***	***48***	***26***	***Irrigation***	***4***	***80***	***90***
CC111500D			***17***	***48***	***26***		***4***	***60***	***70***
CC112900H			***17***	***48***	***26***	***Domestic***	***4***	***80***	***90***
CC112900I			***17***	***48***	***26***	***Domestic***	***4***	***80***	***90***
CC010501A			***17***	***48***	***26***	***Abandoned***	***4***	***80***	***90***
CC010501B			***17***	***48***	***26***	***Domestic***	***4***	***80***	***90***
CC010901M			***17***	***48***	***26***	***Domestic***	***4***	***70***	***80***
CC020801H			***17***	***48***	***26***	***Irrigation***	***4***	***60***	***70***
CC020801I			***17***	***48***	***26***	***Domestic***			***90***
CC032701G			***17***	***48***	***26***	***Test***			***30***
CC051601G			***17***	***48***	***26***	***Domestic***			***90***
CC112500A			***17***	***48***	***26***	***Domestic***	***4***	***80***	***90***
	119		18	48	26	Irrigation	6		24
	123		18	48	26	Irrigation	8		20-30
	124		18	48	26	Irrigation	6		20-30
	438		18	48	26	Irrigation	10		138
	439		18	48	26	Irrigation	8		99
	441		18	48	26	Irrigation	8		134
	442		18	48	26	Irrigation	8		98
	443		18	48	26	Irrigation	10		94
	444		18	48	26	Irrigation	6		55
	46A		18	48	26	Irrigation	8	68	88
	47A		18	48	26	Irrigation	8	68	88
	48A		18	48	26	Irrigation	10	68	88
CC02200-E			18	48	26	Domestic			72
CC06176-B			18	48	26	Soil			
CC03267-A			18	48	26	Elevator	10	16	21
CC03267-B			18	48	26	Elevator	10	16	21
CC04027-B			18	48	26	Monitor			25
CC08068-D			18	48	26	Soil			20
	13		19	48	26	Observation	4	43	92

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COLLIER COUNTY ASR
AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (inches)	Casing Depth (feet)	Total Depth (feet)
	14		19	48	26	Observation	4	53	82
	15		19	48	26	Observation	2	10	15
	16		19	48	26	Observation	4	50	90
	17		19	48	26	Observation	2	14	21
	18	1216	19	48	26	Observation	4	51	90
	19		19	48	26	Observation	2	14	19
	21	1188	19	48	26	Observation	4	170	214
	25		19	48	26	Observation	4	10	16
	26		19	48	26	Observation	4	55	80
	73		19	48	26	Production	8	68	100
	74	1190	19	48	26	Production	8	68	100
	75		19	48	26	Production	8	70	99
	79		19	48	26	Production	8	69	100
	80		19	48	26	Production	8	69	100
	287		19	48	26	Production	10	49	98
	288		19	48	26	Production	10	52	
	289	1191	19	48	26	Production	10	53	102
	457		19	48	26	Test Well	8	50	64
	1037		19	48	26	Observation	8	50	64
	1038		19	48	26	Observation	8	47	63
	2611	998	19	48	26		4	52	62
	3399		***19***	***48***	***26***	***Monitor***	***4***	***250***	***300***
CC03053-C			19	48	26	Irrigation	8	60	90
CC08226-L			19	48	26				15
CC10046-F			19	48	26	Domestic	4	80	100
CC01147-A			19	48	26	Soil			
CC02126-C			19	48	26	Soil			
CC03077-A			19	48	26	Soil			
CC03217-A			19	48	26	Soil			
CC06277-B			19	48	26	Soil			
CC08227-A			19	48	26	Monitor	4	7	17
CC08227-AA			19	48	26	Monitor	4	5	15
CC09177-A			19	48	26	Soil			
CC10017-A			19	48	26	Soil			
CC12157-B			19	48	26	Soil			
CC01264-C			19	48	26	Soil			
CC12024-A			19	48	26	Soil			
CC020899-H			19	48	26	Soil			
CC021299-B			19	48	26	Monitor			20
CC020899H			19	48	26	Test	10	20	35
CC021299B			19	48	26		10	10	20
CC042199D			19	48	26	Test			
CC052699A			19	48	26	Elevator	12	20	26
CC052699B			19	48	26	Elevator	12	20	26
CC081299A			19	48	26	Monitor	4	10	16
CC081299D			19	48	26	Monitor	4	170	225
CC081299E			19	48	26	Monitor	4	55	90
CC110899H			19	48	26				
CC122999A			19	48	26	Test			
CC030900G			19	48	26	Test			
CC061200G			19	48	26				20
CC072500J			19	48	26	Domestic	4	80	90
CC100400B			19	48	26	Irrigation	11	50	100
CC100600F			19	48	26	Irrigation	11	50	100
CC101000K			19	48	26		4		25
CC101000L			19	48	26	Monitor	4	50	90
CC101000M			19	48	26	Abandoned	4	21	25
CC101000N			19	48	26	Abandoned	4		16
CC101000O			19	48	26	Abandoned	4		90
CC101000Q			19	48	26	Abandoned	10	50	100
CC101000R			19	48	26	Abandoned	10		100
CC101000S			19	48	26	Abandoned	10		100
CC101000T			19	48	26	Irrigation	11	50	100
CC101200A			19	48	26	Test			20
CC122700B			19	48	26	Test			

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AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (inches)	Casing Depth (feet)	Total Depth (feet)
CC021202Q	***3396***		***19***	***48***	***26***	***Pad Monitor***	***4***	***10***	***20***
CC021202R	***3397***		***19***	***48***	***26***	***Pad Monitor***	***4***	***10***	***20***
CC013002B	***3398***		***19***	***48***	***26***	***ASR Test/***	***16***	***322***	***432***
						DZ Monitor	***6***	***772***	***833***
CC100400B			***19***	***48***	***26***	***Irrigation***	***11***	***50***	***100***
CC101000Q			***19***	***48***	***26***	***Abandoned***	***10***	***50***	***100***
CC101200A			***19***	***48***	***26***	***Test***			***20***
CC100600F			***19***	***48***	***26***	***Irrigation***	***11***	***50***	***100***
CC101000R			***19***	***48***	***26***	***Abandoned***	***10***		***100***
CC101000S			***19***	***48***	***26***	***Abandoned***	***10***		***100***
CC101000L			***19***	***48***	***26***	***Monitor***	***4***	***50***	***90***
CC101000O			***19***	***48***	***26***	***Abandoned***	***4***		***90***
CC101000T			***19***	***48***	***26***	***Irrigation***	***11***	***50***	***100***
CC101000M			***19***	***48***	***26***	***Abandoned***	***4***	***21***	***25***
CC101000K			***19***	***48***	***26***		***4***		***25***
CC101000N			***19***	***48***	***26***	***Abandoned***	***4***	***16***	***25***
CC122700B			***19***	***48***	***26***	***Test***			***15***
	94		20	48	26	Observation	2	80	98
	95		20	48	26	Observation	2	10	50
	114		20	48	26	Irrigation	8		30-40
	116		20	48	26	Irrigation	6		
	117		20	48	26	Irrigation	6		
	118		20	48	26	Irrigation	6		
	121		20	48	26	Irrigation	8		
	122		20	48	26	Irrigation	8		48
	223		20	48	26	Observation	2	65	100
CC05059-A			20	48	26	Irrigation	4	85	90
CC01092-B			20	48	26	Irrigation			69
CC01092-C			20	48	26	Irrigation	4	80	100
CC11046-A			20	48	26	Irrigation	4	70	80
CC01054-G			20	48	26	Irrigation	4	55	75
CC02208-C			20	48	26	Irrigation	4	50	60
CC08304-H			20	48	26	Irrigation	4	20	35
CC04178-A			20	48	26	Irrigation			
CC11178-F			20	48	26	Irrigation	4	60	80
CC08229-B			20	48	26	Monitor			12
CC05210-F			20	48	26	Test			13
CC03191-B			20	48	26	Domestic	2	60	60
CC05311-B			20	48	26	Soil			
CC07161-B			20	48	26	Soil			
CC08183-F			20	48	26	Soil			30
CC07176-A			20	48	26	Soil			
CC12306-A			20	48	26	Soil			
CC04107-C			20	48	26	Domestic	4	80	100
CC03165-C			20	48	26	Monitor	4	1	16
CC04055-B			20	48	26		8		
CC04055-D			20	48	26		8		
CC12097-A			20	48	26	Domestic	4	80	90
CC01238-B			20	48	26	Soil			
CC09294-B			20	48	26	Soil			
CC09294-C			20	48	26	Monitor	4	3	13
CC01199-MM			20	48	26	Monitor			
CC01199-NN			20	48	26	Monitor			
CC01199-OO			20	48	26	Monitor			
CC01199-PP			20	48	26	Monitor			
CC01199-QQ			20	48	26	Monitor			
CC01199-RR			20	48	26	Monitor			
CC01199-SS			20	48	26	Monitor			
CC01199-TT			20	48	26	Monitor			
CC011999PP			20	48	26				
CC011999QQ			20	48	26				
CC011999RR			20	48	26				
CC011999SS			20	48	26				
CC011999TT			20	48	26				
CC011999VV			20	48	26				

Note: Entries shown in bold italics indicate wells identified or constructed after the previous inventory.

TABLE 2.2
COLLIER COUNTY ASR
AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (inches)	Casing Depth (feet)	Total Depth (feet)
CC011999WW			20	48	26				
CC011999XX			20	48	26				
CC011999YY			20	48	26				
CC011999ZZ			20	48	26				
CC011999AAA			20	48	26				
CC011999AAA			20	48	26				
CC011999BBB			20	48	26				
CC011999CCC			20	48	26				
CC011999DDD			20	48	26				
CC011999EEE			20	48	26				
CC011999FFF			20	48	26				
CC011999GGG			20	48	26				
CC011999HHH			20	48	26				
CC011999III			20	48	26				
CC011999JJJ			20	48	26				
CC011999MM			20	48	26				
CC011999NN			20	48	26				
CC011999OO			20	48	26				
CC032100I			20	48	26	Test			25
CC110501A			***20***	***48***	***26***	***Soil***			
	453		29	48	26	Observation	2	90	180
	459	384	29	48	26	Test Well	6	8	58
	1169		29	48	26				56
CC11179-B			29	48	26	Irrigation			28
CC11229-A			29	48	26	Irrigation			
CC09201-H			29	48	26	Irrigation			75
CC11132-II			29	48	26	Irrigation	4	60	70
CC05063-A			29	48	26	Irrigation	4	60	70
CC03046-S			29	48	26	Irrigation	4	60	75
CC05096-T			29	48	26	Irrigation	4	50	60
CC05096-U			29	48	26	Irrigation	4	60	70
CC03147-C			29	48	26	Irrigation	4	65	80
CC06235-J			29	48	26	Irrigation	4	60	70
CC03118-A			29	48	26	Irrigation			
CC05309-H			29	48	26	Domestic			70
CC06199-K			29	48	26	Domestic			67
CC07109-F			29	48	26	Domestic	2	22	28
CC08219-E			29	48	26	Domestic			65
CC08219-D			29	48	26	Domestic			68
CC09119-H			29	48	26	Domestic	2	63	65
CC09289-F			29	48	26	Domestic	4	60	60
CC12129-C			29	48	26	Domestic	2	60	75
CC01050-L			29	48	26	Domestic			80
CC01150-C			29	48	26	Domestic			78
CC01150-D			29	48	26	Domestic			90
CC05070-J			29	48	26	Domestic	2	62	62
CC05240-C			29	48	26	Domestic	2	66	66
CC06010-O			29	48	26	Domestic	2	50	50
CC06250-B			29	48	26	Test Soil			10
CC07060-L			29	48	26	Domestic	2	60	75
CC07310-A			29	48	26	Fire	4	60	100
CC09050-Z			29	48	26	Domestic	2		90
CC10030-I			29	48	26	Domestic	2	3	35
CC10030-H			29	48	26		2	30	35
CC10120-D			29	48	26	Domestic	4	72	72
CC10160-G			29	48	26	Domestic			100
CC11010-C			29	48	26		2	20	30
CC10300-L			29	48	26	Domestic			
CC12100-CC			29	48	26	Domestic	4	60	70
CC12100-BB			29	48	26	Domestic			80
CC12140-H			29	48	26	Domestic			60
CC01101-C			29	48	26				70
CC06131-D			29	48	26	Domestic		80	80
CC08231-D			29	48	26	Domestic			80
CC11071-F			29	48	26	Domestic			80

Note: Entries shown in bold italics indicate wells identified or constructed after the previous inventory.

TABLE 2.2
COLLIER COUNTY ASR
AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (inches)	Casing Depth (feet)	Total Depth (feet)
CC01092-D			29	48	26	Domestic	4	60	80
CC02132-E			29	48	26	Domestic	4	50	60
CC11052-E			29	48	26	Domestic	4	60	75
CC12102-A			29	48	26	Domestic	4	59	72
CC05123-D			29	48	26	Domestic	4	60	75
CC06033-J			29	48	26	Domestic	4	50	70
CC07213-C			29	48	26	Domestic	4	80	
CC07213-D			29	48	26	Domestic	2		
CC09153-E			29	48	26	Domestic	4	60	70
CC07186-A			29	48	26	Domestic	4	55	70
CC08056-C			29	48	26	Domestic	4	50	60
CC08226-C			29	48	26	Domestic	4	60	70
CC12106-A			29	48	26	Domestic	4	50	60
CC12106-B			29	48	26	Domestic	4	50	60
CC12196-P			29	48	26	Domestic	4	80	100
CC01167-A			29	48	26	Domestic	4	60	70
CC01167-I			29	48	26	Domestic	4	55	70
CC02147-F			29	48	26		4	50	60
CC10153-A			29	48	26	Domestic	4	75	81
CC03116-E			29	48	26	Domestic	4	50	70
CC05036-I			29	48	26	Domestic	4	50	70
CC05216-E			29	48	26	Domestic	4	50	60
CC03077-B			29	48	26	Domestic	4	60	65
CC03177-F			29	48	26	Domestic	4	50	60
CC03257-B			29	48	26	Domestic	4	65	85
CC05025-E			29	48	26	Domestic	4		
CC06265-H			29	48	26	Domestic	4	60	70
CC08015-B			29	48	26	Domestic	4	50	60
CC11085-E			29	48	26	Domestic	4	55	80
CC11145-A			29	48	26	Domestic	4	50	60
CC09257-H			29	48	26	Domestic	4	60	80
CC11137-B			29	48	26	Domestic	4	52	68
CC12197-A			29	48	26	Domestic	4	56	73
CC04134-A			29	48	26	Domestic	4	60	75
CC07014-A			29	48	26	Domestic	4	58	70
CC12054-B			29	48	26	Domestic	4	61	70
CC04238-B			29	48	26	Domestic	4	50	60
CC05068-K			29	48	26	Domestic			70
CC06198-E			29	48	26	Domestic			80
CC061998-G			29	48	26	Domestic			80
CC08118-D			29	48	26	Domestic			80
CC08118-E			29	48	26	Domestic			90
CC08178-E			29	48	26	Domestic	4	50	60
CC11108-E			29	48	26	Domestic	4	60	80
CC010899-A			29	48	26	Domestic			80
CC010899-E			29	48	26	Domestic			80
CC010899A			29	48	26	Domestic	4	60	80
CC010899E			29	48	26	Domestic	4	50	70
CC031599C			29	48	26	Domestic	4	80	100
CC060399P			29	48	26	Domestic	4	90	100
CC060499E			29	48	26	Domestic	4	80	90
CC062299B			29	48	26	Domestic			90
CC052799B			29	48	26	Domestic	4	56	73
CC111899F			29	48	26	Domestic			90
CC091699J			29	48	26	Domestic	4	90	100
CC102999A			29	48	26	Domestic	4	65	75
CC102999B			29	48	26	Domestic			
CC110199B			29	48	26	Domestic Test Irr.	4	80	90
CC112399D			29	48	26	Domestic	4	80	90
CC112999G			29	48	26		4	60	80
CC120399G			29	48	26	Domestic			
CC121599G			29	48	26	Domestic	4	80	90
CC062200C			29	48	26	Domestic	4	80	90
CC022500C			29	48	26	Domestic			90
CC041300F			29	48	26	Domestic	4	80	90

Note: Entries shown in bold italics indicate wells identified or constructed after the previous inventory.

TABLE 2.2
COLLIER COUNTY ASR
AREA OF REVIEW STUDY
UPDATED WELL INVENTORY

Collier Co. Permit No.	WRS No. (CO-)	USGS No. (C-)	Section	Township	Range	Use	Casing Diameter (inches)	Casing Depth (feet)	Total Depth (feet)
CC042800C			29	48	26	Domestic	4	80	100
CC070400F			29	48	26	Domestic			90
CC062600C			29	48	26	Domestic	4	80	90
CC080200I			29	48	26	Domestic	4	80	90
CC070600B			29	48	26	Domestic			110
CC072400P			29	48	26	Domestic	4	60	70
CC073101G			***29***	***48***	***26***	***Abandoned***			
CC032202M			***29***	***48***	***26***	***Domestic***	***4***	***100***	***110***
CC031302I			***29***	***48***	***26***	***Domestic***	***4***	***70***	***80***
CC030102A			***29***	***48***	***26***		***4***	***80***	***90***
CC073101H			***29***	***48***	***26***	***Abandoned***			
CC112001G			***29***	***48***	***26***	***Abandoned***			
CC121600P			***29***	***48***	***26***	***Domestic***	***4***	***80***	***90***
CC122100A			***29***	***48***	***26***	***Domestic***	***4***	***80***	***90***
CC080200I			***29***	***48***	***26***	***Domestic***	***4***	***80***	***90***
CC010701B			***29***	***48***	***26***	***PWS***	***4***	***80***	***90***
CC010701A			***29***	***48***	***26***	***Abandoned***	***4***	***80***	***90***
CC042901G			***29***	***48***	***26***	***Fire***	***8***	***60***	***70***
CC042901H			***29***	***48***	***26***	***Fire***	***8***	***80***	
CC051601K			***29***	***48***	***26***	***Domestic***			***90***
CC032001F			***29***	***48***	***26***	***Domestic***	***4***	***80***	***90***
CC112001H			***29***	***48***	***26***	***Domestic***	***4***	***80***	***90***
CC030102B			***29***	***48***	***26***	***Domestic***	***4***	***80***	***90***
CC030502K			***29***	***48***	***26***	***Domestic***	***4***	***80***	***90***
CC040102Q			***29***	***48***	***26***	***Irrigation***	***4***	***80***	***90***
	1754		30	48	26	Observation	4	25	40
	1755		30	48	26	Observation	4	6	30
	459	384	30	48	26	Unused	2		58
	2614		30	48	26	Test Core	2		172
CC03229-B			30	48	26	Irrigation	2	65	65
CC11279-D			30	48	26	Irrigation	2	67	67
CC03104-E			30	48	26	Irrigation	8	8	28
CC05282-C			30	48	26	Domestic	4	60	70
CC09163-A			30	48	26	Monitor	4	20	25
CC12026-B			30	48	26	Domestic	4	80	110
CC12173-O			30	48	26	Soil			30
CC021299-E			30	48	26	Soil			
CC021299E			30	48	26	PWS			20
CC052799D			30	48	26	Test			20
CC010600E			30	48	26	Monitor	4	80	90
CC010600F			30	48	26	Monitor	4	80	90
CC011900A			30	48	26	Test			20
CC020800E			30	48	26	Test Irrigation	4	60	70
CC082300A			***30***	***48***	***26***	***Test***			
CC010902A			***30***	***48***	***26***	***Test***	***4***	***15***	***20***
CC031802QQ			***30***	***48***	***26***	***Domestic***	***4***	***80***	***90***

Note: Entries shown in bold italics indicate wells identified or constructed after the previous inventory.

Table 3.1
Pelican Bay Wellfield
Reverse Air Water Quality Versus Depth
From The ASR Exploratory/Monitoring Well

Depth (feet bls)	Chloride (mg/l)	Conductivity (μS)
343	1660	6210
374	1740	6310
406	1900	6800
435	2480	8590
469	2500	8620
500	2460	8600
530	2460	8690
562	2440	8710
593	2400	8600
624	2460	8590
655	2340	8230
687	2260	7590
718	2140	7680
748	2100	7560
770	2120	7560
780	2100	7480
811	2040	7310
842	2080	7500
860	2260	8090
872	2720	9250
904	2480	8960
935	2680	9560
966	2820	9460
997	3000	10060
1028	2780	9470
1058	3520	11410
1089	3260	10870
1100	3940	12750

Table 3.2
Pelican Bay Wellfield
Pumping/Packer Test Water Quality
From The Exploratory/Monitoring Well

Pump Test #1 Interval: 322 to 435 feet bls Q = 335 gpm		
Elapsed Time (minutes)	**Chloride (mg/l)**	**Conductivity (μS)**
23	2440	8680
235	2420	8570
Pump Test #2 Interval: 322 to 566 feet bls Q = 325 gpm		
Elapsed Time (minutes)	**Chloride (mg/l)**	**Conductivity (μS)**
7	2440	8560
217	2520	8460
Packer Test #1 Interval: 624 to 770 feet bls Q = 92 gpm		
Elapsed Time (minutes)	**Chloride (mg/l)**	**Conductivity (μS)**
32	1700	6350
217	2100	7550
Packer Test #2 Interval: 777.5 to 860 feet bls Q = 98 gpm		
Elapsed Time (minutes)	**Chloride (mg/l)**	**Conductivity (μS)**
4	2520	8640
213	2600	8790
Pump Test #3 Interval: 322 to 844 feet bls Q = 490 gpm		
Elapsed Time (minutes)	**Chloride (mg/l)**	**Conductivity (μS)**
21	2460	8550
210	2520	8630

Table 3.2 (cont.)
Pelican Bay Wellfield
Pumping/Packer Test Water Quality
From The Exploratory/Monitoring Well

Upper Zone Water Quality		
Interval (feet)	**Chloride (mg/l)**	**Conductivity (μS)**
322 to 432	2480	8410
Upper Zone Water Quality		
Interval (feet)	**Chloride (mg/l)**	**Conductivity (μS)**
772 to 833	2060	7350

Tab 4.1

Primary and Secondary Water Quality Analyses Results

Chemical Constituent	Unit	MCL	NCWTP 10/26/99	SCWTP 10/26/99	NCWTP 2/23/00	SCWTP 2/23/00	NCWRF 4/27/00	SCWTP 4/26/00	NCWRF 09/06/00	SCWTP 9/6/00
Cations										
Antimony	mg/l	0.006	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Arsenic	mg/l	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Barium	mg/l	2	0.006	0.006	0.005	0.007	0.003	0.009	0.01	0.011
Berylium	mg/l	0.004	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cadmium	mg/l	0.005	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chromium	mg/l	0.1	BDL	0.001	BDL	0.001	BDL	0.002	BDL	BDL
Lead	mg/l	0.015	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mercury	mg/l	0.002	0.00027	NR	BDL	BDL	BDL	BDL	BDL	BDL
Nickel	mg/l	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Selenium	mg/l	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sodium	mg/l	160	99.4	84.9	149	90.8	156	89.1	370	150
Thallium	mg/l	0.002	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Anions										
Cyanide	mg/l	0.2	0.006	0.007	BDL	0.007	BDL	BDL	BDL	0.0055
Fluoride	mg/l	4.0	0.16	BDL	0.8	0.7	0.4	0.8	0.64	0.52
Nitrate/Nitrite (as N)	mg/l	10	0.54	1.51	1.5	0.99	1.08	1.48	1.38	0.32
Nitrate (as N)	mg/l	10	0.31	0.86	0.6	0.21	0.38	BDL	0.38	0.32
Nitrite (as N)	mg/l	1	0.23	0.65	0.9	0.777	0.71	1.51	1.00	BDL
Organics										
Total THM's	ug/l	100	8.4	5.9	6.9	4.4	10	2.2	10.40	11.8
Volatile Organics	ug/l	Variable	BDL	BMCL	BMCL	BMCL	BMCL	BDL	BMCL	BMCL
Pesticides	ug/l	Variable	BDL	BDL	BMCL	BMCL	BDL	BMCL	BDL	BDL
Biological										
Coliforms, Total	col./100 ml	0	NR	NR	NR	NR	NR	NR	NR	NR
Coliforms, Fecal	col./100 ml	0	NR	NR	0	0	0	2	0.00	0
Other										
Gross Alpha	pCi/l		3	2.4	0.8	0.5	1	1.5	2.60	2.1
Turbidity	NTU		NR	NR	NR	NR	NR	NR	NR	NR

BMCL - The term BMCL is provided to note that some constituents were identified, but at concentrations below MCL levels.
Table 4.1A lists the detected chemicals, concentrations, dates and locations where chemicals were detected.
BDL means below detection limits

Table 4.1A
Primary Drinking Water Constituent Concentrations Measured Above Detection Limits

Chemical Constituent	Unit	MCL	Date	Location	Measured Cocentration
Volatile Organics					
1,4 Dichlorobenzene	ug/l	75	10/26/99	NCWRF	1.2
			2/29/00	NCWRF	0.8
			2/29/00	SCWRF	2.2
			4/27/00	NCWRF	0.6
			9/6/00	SCWRF	2.1
Dichloromethane	ug/l	5	9/6/00	NCWRF	0.98
			9/6/00	SCWRF	0.87
Toluene	ug/l	1000	9/6/00	SCWRF	0.8
Pesticides					
Atrazine	ug/l	3	2/29/00	NCWRF	1.06
Bis(2-ethylhexyl)phthalate	ug/l	6	2/29/00	NCWRF	5.22
Endrin	ug/l	2	2/29/00	SCWRF	0.06
			4/27/00	SCWRF	0.12

Table 4.2
Secondary Drinking Water Quality Analyses

Chemical Constituents	Unit	MCL	NCWRF 10/26/99	SCWRF 10/26/99	NCWRF 2/23/00	SCWRF 2/23/00	NCWRF 4/27/00	SCWTP 4/26/00	NCWRF 9/6/00	SCWTP 9/6/00
Cations										
Aluminum	mg/l	0.2	BDL	BDL	0.23	0.05	0.08	BDL	0.11	0.11
Copper	mg/l	1	0.005	BDL	BDL	BDL	BDL	BDL	BDL	0.0042
Iron	mg/l	0.3	0.123	0.283	0.13	0.24	0.15	0.36	BDL	0.099
Managese	mg/l	0.05	0.016	0.023	0.014	0.022	0.014	BDL	0.014	0.02
Silver	mg/l	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Zinc	mg/l	5	BDL	BDL	0.026	BDL	0.027	0.031	0.15	0.15
Anions										
Chloride	mg/l	250	221	121	211	119	237	120	180	220
Fluoride	mg/l	2	0.16	BDL	0.8	0.7	0.4	0.8	0.64	0.52
Sulfate	mg/l	250	56	56	92	46	143	98	77	48
Other										
Color	APHA Units	15	30	30	40	70	30	30	40	50
Odor	TON	3	16	16	2	0	2	8	2	2
pH	ph Uniys	6.5 - 8.5	7.52	7.39	7.46	7.62	7.63	7.43	7.6	7.2
TDS	mg/l	500	550	460	680	452	748	452	640	540
MBA Surfactants	mg/l	0.5	0.1	0.1	0.1	0.2	0.1	0.1	0.15	0.23
Unregulated Group I	ug/l		NR	NR	BDL	BDL	BDL	BDL	BDL**	NR
Unregulated Group II*	ug/l		NR	NR	BDL	BDL	BDL	*	BDL**	BDL**
Unregulated Group III	ug/l		NR	NR	BDL	BDL	BDL	BDL	BDL**	BDL**

* All below BDL except chloroform and bromomethane. Chloroform included with trihalomethanes in primary drinking water standards. Bromomethane detected at 1.7 ug/l which is below MCL at SCWTP on 4/26/00.

** Only partial list of GI, GII, and GIII chemicals tested.

Table 4.3
Summary of Analyses for Cryptsporidium and Giardia Lamblia

Biological Units	Units	NCWRF 10/7/99	NCWRF 2/22/00	SCWRF 2/22/00	NCWRF 4/27/00	SCWTP 4/26/00	NCWRF 9/6/00	SCWTP 9/6/00
Cryptosporidium								
Empty cysts	Oocycsts/100L	ND	ND	ND	ND	NR	NR	NR
Cysts w. Amorphous Struct.	Oocycsts/100L	ND	ND	ND	ND	NR	NR	NR
Cysts w. Internal Structure	Oocycsts/100L	ND	ND	ND	ND	NR	NR	NR
Total	Oocycsts/100L	ND	ND	ND	ND	NR	NR	NR
Giardia Lamblia								
Empty cysts	Cycsts/100L	86	560	1000	ND	NR	NR	NR
Cysts w. Amorphous Structure	Cycsts/100L	43	140	ND	ND	NR	NR	NR
Cysts w. 1 Internal Structure	Cycsts/100L	ND	ND	ND	ND	NR	NR	NR
Cysts w. >1 Internal Structure	Cycsts/100L	ND	ND	ND	ND	NR	NR	NR
Total	Cycsts/100L	129	700	1000	ND	NR	NR	NR

Table 4.4
Summary of Analyses
of
Minimum Criteria for Sewage Effluent Constituents

Chemical Constituent	NCWTP 10/26/99	SCWTP 10/26/99	NCWRF 2/23/00	SCWTP 2/23/00	NCWRF 4/27/00	SCWTP 4/26/00	NCWRF 9/6/00	SCWTP 9/6/00
Toluene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.8
1,2 Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chloroform	6.8	5.0	5.5	4.4	6.6	2.2	<10.4	<11.8
1,2 Dichloroethylene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Aldrin	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NR
Dieldrin	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NR
Diethylphthalate	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL
Dimethylphthalate	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL
Butylbenzylphthalate	BDL	BDL	BDL	BDL	NR	NR	BDL	BDL
Naphthalene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Anthracene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Phenanthrene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Phenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4,6 Trichlorophenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2-Chlorophenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ammonia	14	3.2	14.1	23.4	8.78	16.2	3.6	4.9
Organic Nitrogen	BDL	0	0.8	0	8.3	3.2	2	3.3
Total Kjeldahl Nitrogen	13	2.72	14.9	21.8	12.6	24.5	5.6	8.2
Total Nitrogen	13	-	16.4	22.8	13.7	26	6	8.5
Soluble ortho-phosphate	2.4	0.54	0.98	2.1	2.34	0.88	1.2	0.41
Total Phosphorous	NR	NR	1.34	2.23	2.68	1.23		NR
Antimony	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

APPENDIX 3.1

ASR EXPLORATION/MONITORING WELL GEOLOGIST'S LOG

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
0-35	No Sample
35-40	Cement fragments only
40-50	Clay, light olive gray (5Y 6/1), slightly sticky, minor silt, minor very fine grained quartz and minor phosphate, minor cement fragments,
50-55	Silty clay, light olive gray (5Y 6/1), soft, sticky, abundant medium to coarse phosphate, common yellowish gray (5Y 8/1) limestone, minor shell
55-60	Limestone, yellowish gray (5Y 8/1) to very light gray (N8), packstone, moderately indurated, common shell, common fine to medium phosphate, minor silty clay as above, fair moldic porosity
60-65	Limestone, yellowish gray (5Y 8/1) to very light gray (N8), packstone, moderately indurated, common shell, common fine to medium phosphate, fair moldic porosity
65-70	Limestone, yellowish gray (5Y 8/1) to medium light gray (N6), packstone, moderately well indurated, common shell, minor fine to medium phosphate, minor white (N9) micritic limestone, trace cement fragments, fair to good moldic porosity
70-75	Limestone, yellowish gray (5Y 8/1), packstone, well indurated, minor shell, trace fine phosphate, moldic porosity
75-85	Limestone, yellowish gray (5Y 8/1), packstone, well indurated, common shell, trace fine phosphate, moldic porosity
85-90	Limestone, yellowish gray (5Y 8/1) to light greenish gray (5GY 8/1), packstone, moderately well indurated, arenitic, fossiliferous, minor echinoderm spines, minor shell, trace fine phosphate
90-95	Limestone, yellowish gray (5Y 7/2) to light gray (N7), packstone, moderately indurated, arenitic, abundant shell, trace fine phosphate
95-105	Limestone, yellowish gray (5Y 7/2), packstone, moderately indurated, arenitic, minor shell, minor fine phosphate
105-110	Limestone, yellowish gray (5Y 7/2), packstone, poorly to moderately indurated, arenitic, minor shell, minor fine phosphate

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
110-125	Limestone, yellowish gray (5Y 7/2), packstone, poorly to moderately indurated, arenitic, common shell, minor fine phosphate
125-130	Sandstone, very light gray (N8) to medium light gray (N6), well indurated, calcareous cement, common fine to medium grained quartz sand, minor shell, trace limestone as above
130-135	Sandstone, very light gray (N8) to medium light gray (N6), well indurated, calcareous cement, abundant fine to medium grained quartz sand, minor shell, trace limestone as above, trace medium phosphate
135-145	Sand, clear to white (N9), fine to medium grained, subrounded quartz, minor sandstone as above
145-150	Sandstone, light greenish gray (5GY 8/1) to light olive gray (5Y 6/1), moderately indurated, calcareous cement, common shell
150-155	Sandstone, light greenish gray (5GY 8/1) to light olive gray (5Y 6/1), moderately indurated, calcareous cement, fossiliferous, abundant shell
155-160	Marl, yellowish gray (5Y 8/1), soft, minor fine to medium phosphate, trace shell, trace echinoid spines
160-165	Marl, greenish gray (5GY 6/1), soft, common shell, minor fine phosphate
165-170	Marly limestone, very light gray (N8) to yellowish gray (5Y 8/1), wackestone, poorly indurated, common shell, common fine to medium quartz
170-175	Limestone, yellowish gray (5Y 8/1), wackestone, moderately indurated, common shell, minor fine to medium quartz, minor lime mud
175-180	Clay, greenish gray (5GY 6/1), stiff, sticky, minor silt, minor very fine grained quartz and minor phosphate, trace shell
180-190	Clay, greenish gray (5GY 6/1), stiff, sticky, trace very fine phosphate, trace shell
190-195	Clay, greenish gray (5GY 6/1), soft, sticky, trace very fine phosphate, trace shell
195-205	Marl, light greenish gray (5GY 8/1) to greenish gray (5GY 6/1), soft, sticky, abundant fine phosphate, common clay as above, trace shell

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
205-215	Marl, light greenish gray (5GY 8/1) to greenish gray (5GY 6/1), soft, sticky, abundant fine phosphate, common shell, minor clay as above
215-220	Marl, light greenish gray (5GY 8/1) to greenish gray (5GY 6/1), soft, sticky, abundant fine phosphate, minor stiff, sticky, dark greenish gray (5GY 4/1) clay, trace shell
220-250	Clay, dark greenish gray (5GY 4/1), soft, sticky, abundant fine phosphate, minor shell
250-255	Marl, yellowish gray (5Y 7/2), soft, common fine phosphate, fossiliferous, common clay as above, minor shell
255-260	Marl, as above, minor limestone, light gray (N7), packstone, moderately well indurated, common fine phosphate
260-265	Limestone, yellowish gray (5Y 8/1) to light gray (N7), packstone, well indurated, fossiliferous, common fine to medium quartz and phosphate, minor shell
265-270	Limestone, yellowish gray (5Y 8/1) to light gray (N7), packstone, well indurated, fossiliferous, common fine to medium quartz and phosphate, minor shell, trace light olive gray (5Y 5/2) poorly indurated sandstone
270-275	Sandstone, light greenish gray (5GY 8/1), moderately indurated, calcareous cement, common fine phosphate, common shell
275-280	Sandstone, light greenish gray (5GY 8/1), poorly to moderately indurated, calcareous cement, abundant fine phosphate, common shell
280-290	Marl, greenish gray (5GY 6/1), moderately soft, common fine phosphate, minor shell, trace sandstone as above
290-305	Marly limestone, light greenish gray (5GY 8/1), packstone, poorly indurated, common shell, trace fine phosphate, fair moldic porosity
305-320	Marly limestone, light greenish gray (5GY 8/1), packstone, poorly indurated, common shell, minor light greenish gray (5GY 8/1) clay, trace fine phosphate, fair moldic porosity
320-325	Limestone, light greenish gray (5GY 8/1), packstone, moderately indurated, common shell, minor fine phosphate, minor marl as above, fair moldic porosity

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
325-330	Marl, yellowish gray (5Y 8/1) to light greenish gray (5GY 8/1), soft, minor shell, minor fine phosphate
330-335	Marly limestone, yellowish gray (5Y 8/1) to light greenish gray (5GY 8/1), packstone, poorly to moderately indurated, common shell, minor fine to medium phosphate
	Note: Driller noted harder drilling at 335'
335-340	Limestone, yellowish gray (5Y 8/1) to light greenish gray (5GY 8/1), packstone, moderately indurated, fossiliferous, common fine phosphate, minor shell, minor light greenish gray (5GY 8/1) soft sticky clay
340-350	Marly limestone, yellowish gray (5Y 8/1) to light greenish gray (5GY 8/1), packstone, moderately indurated, common shell, common fine phosphate
350-355	Limestone, yellowish gray (5Y 8/1), packstone, moderately indurated, common fine phosphate, minor shell, trace echinoid spines, trace very light gray (N8) limestone, wackestone
355-360	Limestone, yellowish gray (5Y 8/1), packstone, moderately indurated, common fine phosphate, minor shell, minor light greenish gray (5GY 8/1) soft sticky clay, trace echinoid spines
	Note: drilling speed increased between 359-360'
360-365	Limestone, yellowish gray (5Y 7/2), wackestone, moderately indurated, slightly marly, fossiliferous, trace fine phosphate
365-370	Clay, yellowish gray (5Y 8/1) to very light gray (N8), soft, common very fine to fine quartz and phosphate, minor limestone as above
370-375	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), wackestone, moderately indurated, minor fine phosphate, minor clay as above, minor shell
375-380	Marl, yellowish gray (5Y 8/1), soft, minor fine phosphate, trace shell
380-385	Clay, greenish gray (5GY 6/1), soft, sticky, slightly silty, minor yellowish gray (5Y 8/1) limestone (wackestone), trace very fine phosphate
385-390	Marl, pale olive (10Y 6/2), soft, fossiliferous, trace fine phosphate,

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
390-395	Limestone, yellowish gray (5Y 8/1) to light gray (N7), packstone, moderately well indurated, fossiliferous, common fine phosphate, fair moldic porosity
395-400	Limestone, yellowish gray (5Y 8/1) to light gray (N7), packstone, moderately well indurated, fossiliferous, minor fine phosphate, trace shell, fair moldic porosity
400-405	Limestone, yellowish gray (5Y 8/1) to very light gray (N8), wackestone to packstone, moderately indurated, minor lime mud, minor fine phosphate, trace shell
405-410	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), wackestone to packstone, moderately well indurated, trace very fine phosphate, good moldic porosity
410-415	Limestone, yellowish gray (5Y 7/2), dolomitic, packstone, well indurated, fossiliferous, minor shell, good moldic porosity
415-420	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), slightly dolomitic, packstone, well indurated, minor shell, fair moldic porosity
420-425	Limestone, very pale orange (10YR 8/2), slightly dolomitic, wackestone to packstone, moderately well indurated, minor shell, good moldic porosity
425-430	Limestone, yellowish gray (5Y 8/1), slightly dolomitic, packstone, moderately well indurated, minor shell, trace fine phosphate, fair moldic porosity
430-435	Limestone, yellowish gray (5Y 8/1) to light gray (N7), packstone, moderately well indurated, slightly chalky, fossiliferous, trace very fine phosphate, good moldic porosity
435-440	Limestone, yellowish gray (5Y 8/1) to light gray (N7), packstone, moderately well indurated, slightly chalky, fossiliferous, trace very fine phosphate, good moldic porosity
440-445	Limestone, yellowish gray (5Y 8/1) to light gray (N7), packstone, moderately well indurated, fossiliferous, minor lime mud, minor fine phosphate, trace light olive gray (5Y 6/1) dolomitic limestone, fair moldic porosity

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
445-450	Marl, yellowish gray (5Y 8/1) to very light gray (N8), soft, minor shell, minor fine phosphate, trace dolomitic limestone as above
450-455	Marl, yellowish gray (5Y 8/1) to very light gray (N8), soft, minor shell, minor fine phosphate
455-460	Limestone, yellowish gray (5Y 8/1) to light gray (N7), wackestone, moderately well indurated, abundant fine phosphate, common shell
460-465	Marl, yellowish gray (5Y 8/1) to very light gray (N8), soft, common fine phosphate, minor shell, minor limestone as above
465-470	Limestone, yellowish gray (5Y 8/1), packstone, moderately indurated, arenitic, fossiliferous, common fine phosphate, common shell, minor medium light gray (N6) limestone
470-475	Limestone, yellowish gray (5Y 8/1), packstone, moderately indurated, arenitic, fossiliferous, common fine phosphate, common shell, trace medium light gray (N6) limestone
475-480	Marl, yellowish gray (5Y 8/1) to very light gray (N8), soft, abundant fine phosphate, common limestone as above, minor shell
480-485	Marl, yellowish gray (5Y 8/1) to very light gray (N8), soft, abundant fine phosphate, common shell, minor limestone as above
485-490	Limestone, yellowish gray (5Y 8/1) to very light gray (N8), packstone, moderately well indurated, fossiliferous, minor fine phosphate, trace shell, fair to good moldic porosity
490-495	Marl, yellowish gray (5Y 8/1) to light olive gray (5Y 6/1), soft, abundant fine phosphate, trace shell
495-500	Clay, greenish gray (5GY 6/1), soft, sticky, abundant fine phosphate, minor marl as above
500-505	Clay, yellowish gray (5Y 8/1), soft, abundant fine phosphate, common coarse phosphate, minor yellowish gray limestone (packstone) with abundant fine phosphate, minor light olive gray (5Y 6/1) limestone (mudstone to wackestone) moderately well indurated
505-510	Limestone, yellowish gray (5Y 8/1) to light olive gray (5Y 6/1), wackestone, moderately indurated, abundant fine phosphate, minor shell, minor clay as above

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
510-515	Limestone, very pale orange (10YR 8/2), wackestone, well indurated, fossiliferous, common shell, minor lime mud
515-520	Clay, greenish gray (5GY 6/1), stiff, silty, common very fine to medium phosphate, minor limestone as above
520-525	Marly limestone, yellowish gray (5Y 8/1) to very light gray (N8), wackestone to packstone, moderately indurated, fossiliferous, common fine to coarse phosphate
525-530	Limestone, yellowish gray (5Y 8/1) to very light gray (N8), wackestone, moderately indurated, chalky, abundant fine phosphate
530-535	Clay, yellowish gray (5Y 8/1), soft, sticky, sandy, common very fine to fine phosphate, trace limestone as above
535-540	Clay, yellowish gray (5Y 8/1), soft, sticky, sandy, common very fine to fine phosphate, minor very light gray (N8) sandy limestone,
540-545	Limestone, very pale orange (10YR 8/2), mudstone to wackestone, moderately well indurated, fossiliferous, common shell, minor fine phosphate, trace fine quartz
545-550	Marl, light greenish gray (5GY 8/1), soft, common fine phosphate, minor limestone as above
550-555	Marl, yellowish gray (5Y 8/1) to light greenish gray (5GY 8/1), soft, fossiliferous, common fine to medium phosphate, minor shell
555-560	Marly limestone, yellowish gray (5Y 8/1) to very light gray (N8), wackestone, moderately indurated, common fine phosphate, minor shell, trace coarse phosphate
560-570	Clay, light greenish gray (5GY 8/1), moderately stiff, silty, minor very fine to medium phosphate, trace limestone as above
570-575	Clay, light greenish gray (5GY 8/1), moderately stiff, silty, minor very fine to medium phosphate, minor limestone as above
575-580	Clay, light greenish gray (5GY 8/1), soft, sticky, slightly silty, trace fine phosphate, trace limestone as above
580-585	Clay, light greenish gray (5GY 8/1), soft, sticky, slightly silty, trace fine phosphate and quartz, minor limestone as above

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
585-590	Marl, greenish gray (5GY 6/1) to very light gray (N8), soft, abundant fine to coarse phosphate, minor greenish gray (5GY 6/1) well indurated limestone (mudstone to wackestone) with common fine phosphate; minor shell
590-595	Clay, dark greenish gray (5GY 4/1), stiff, silty, abundant yellowish gray (5Y 8/1) moderately indurated limestone (wackestone); minor shell, minor fine phosphate
595-600	Clay, greenish gray (5GY 6/1) to medium gray (N5), stiff, sticky, common fine to coarse phosphate, minor limestone as above
600-605	Limestone, yellowish gray (5Y 8/1), packstone, moderately indurated, common fine to coarse phosphate, minor yellowish gray (5Y 8/1) lime mud, minor shell
605-610	Limestone, yellowish gray (5Y 8/1), packstone, moderately indurated, common fine to coarse phosphate, minor light gray (N7) limestone (mudstone); minor yellowish gray (5Y 8/1) lime mud, minor shell
610-615	Limestone, light olive gray (5Y 6/1) to yellowish gray (5Y 8/1), mudstone to packstone, dolomitic, moderately well indurated, minor shell, trace fine phosphate, fair moldic porosity
615-620	Limestone, yellowish gray (5Y 8/1) to light gray (N7), packstone, moderately indurated, minor lime mud, minor limestone as above
620-625	Clay, very light gray (N8) to medium light gray (N6), soft, sticky, minor limestone as above, trace fine phosphate
625-635	Limestone, yellowish gray (5Y 8/1), packstone to grainstone, moderately well indurated, common shell, minor medium light gray (N6) limestone, trace fine phosphate, good moldic porosity
635-640	Limestone, yellowish gray (5Y 7/2), packstone to grainstone, moderately indurated, arenitic, slightly chalky, minor shell, trace fine phosphate
640-645	Limestone, yellowish gray (5Y 7/2), packstone to grainstone, moderately indurated, arenitic, slightly chalky, minor shell, minor fine phosphate, minor very light gray (N8) limestone (packstone) with common fine phosphate; trace spar

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
645-650	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), packstone, moderately well indurated, common shell, minor fine phosphate, fair moldic porosity
650-655	Limestone, very light gray (N8) to yellowish gray (5Y 8/1), packstone to grainstone, moderately indurated, arenitic, minor shell, trace fine phosphate
655-660	Marl, yellowish gray (5Y 8/1) to very light gray (N8), soft, common fine to coarse phosphate, trace shell
660-670	Limestone, yellowish gray (5Y 8/1) to very light gray (N8), packstone, moderately indurated, arenitic, common fine phosphate, minor shell
670-675	Limestone, yellowish gray (5Y 8/1) to very light gray (N8), packstone, moderately well indurated, slightly arenitic, common fine phosphate, minor shell, fair moldic porosity
675-680	Limestone, yellowish gray (5Y 8/1) to very light gray (N8), packstone, moderately well indurated, slightly arenitic, common fine phosphate, minor shell, trace medium gray (N5) mudstone; fair moldic porosity
680-685	Limestone, yellowish gray (5Y 8/1) to very light gray (N8), packstone, well indurated, common fine phosphate, minor shell, trace olive gray (5Y 4/1) dolomite; good moldic porosity
685-695	Limestone, yellowish gray (5Y 8/1) to very light gray (N8), packstone, well indurated, minor fine phosphate, minor shell
695-700	Limestone, very light gray (N8) to yellowish gray (5Y 7/2), packstone, well indurated, common fine phosphate, minor shell, rare olive black (5Y 2/1) dolomite; fair moldic porosity
700-710	Limestone, yellowish gray (5Y 8/1) to very light gray (N8), wackestone to packstone, moderately well indurated, slightly arenitic, minor fine phosphate, minor shell, trace spar, fair moldic porosity
710-715	Limestone, yellowish gray (5Y 8/1) to very light gray (N8), wackestone to packstone, moderately indurated, arenitic, minor fine phosphate, trace shell, fair moldic porosity
715-720	Limestone, yellowish gray (5Y 8/1) to very light gray (N8), wackestone to packstone, moderately indurated, slightly arenitic, minor fine phosphate, minor shell, fair moldic porosity

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
720-725	Limestone, very light gray (N8) to yellowish gray (5Y 7/2), packstone, moderately well indurated, minor shell, trace fine phosphate, fair moldic porosity
725-730	Limestone, yellowish gray (5Y 8/1) to light gray (N7), wackestone to packstone, dolomitic, well indurated, common shell, trace fine phosphate, fair moldic porosity
730-735	Limestone, very pale orange (10YR 8/2), packstone, moderately well indurated, slightly arenitic, minor shell, trace limestone as above, fair moldic porosity
735-740	Dolomite, light olive gray (5Y 6/1), sucrosic, well indurated, abundant yellowish gray (5Y 8/1) limestone (wackestone to packstone) with trace fine phosphate; minor shell
740-745	Limestone, yellowish gray (5Y 8/1), wackestone to packstone, well indurated, fossiliferous, minor dolomite as above, fair moldic porosity
745-755	Marly limestone, yellowish gray (5Y 8/1) to very light gray (N8), wackestone to packstone, moderately indurated, minor yellowish gray (5Y 8/1) dolomite; fair moldic porosity
755-760	Marl, yellowish gray (5Y 8/1) to greenish gray (5GY 6/1), soft, abundant very fine phosphate, minor very fine quartz, minor limestone as above
760-765	Marly limestone, yellowish gray (5Y 8/1) to very light gray (N8), wackestone, moderately indurated, common light olive gray (5Y 6/1) dolomite; minor lime mud, minor shell, trace fine phosphate, fair moldic porosity
765-770	Clay, medium gray (N5), stiff, slightly sticky, minor very fine to fine phosphate, common limestone as above
770-775	Limestone, yellowish gray (5Y 8/1) to light greenish gray (5GY 8/1), packstone to grainstone, dolomitic, moderately indurated, minor fine quartz sand, trace fine phosphate
775-780	Clay, light olive gray (5Y 6/1), soft, slightly sticky, dolomitic, minor well indurated microcrystalline dolomite
780-785	Dolomite, light olive gray (5Y 6/1), microcrystalline, well indurated, common yellowish gray (5Y 8/1) dolomitic limestone; minor fine quartz sand, trace lime mud

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
785-790	Limestone, light olive gray (5Y 6/1), packstone, well indurated, slightly dolomitic, slightly arenitic, fossiliferous, common shell, good moldic porosity
790-795	Limestone, light olive gray (5Y 6/1), packstone, well indurated, slightly dolomitic, slightly arenitic, fossiliferous, common shell, minor fine quartz and phosphate, trace medium gray (N5) sucrosic dolomite; good moldic porosity
795-800	Limestone, yellowish gray (5Y 7/2), wackestone to packstone, well indurated, slightly arenitic, fossiliferous, minor shell, fair to good moldic porosity
800-805	Limestone, very pale orange (10YR 8/2), packstone, moderately well indurated, slightly arenitic, common very light gray (N8) lime mud, minor shell, trace limestone as above
805-810	Limestone, very pale orange (10YR 8/2), wackestone to packstone, moderately indurated, slightly arenitic, slightly chalky, minor pale yellowish brown (10YR 6/2) dolomite; fair moldic porosity
810-815	Limestone, very pale orange (10YR 8/2), packstone, moderately indurated, arenitic, minor shell, minor medium light gray (N6) dolomite; trace lime mud
815-820	Limestone, very pale orange (10YR 8/2), packstone, moderately indurated, arenitic, slightly chalky, minor shell, trace medium light gray (N6) dolomite
820-825	Limestone, very pale orange (10YR 8/2), packstone, moderately indurated, arenitic, slightly chalky, minor shell
825-830	Limestone, yellowish gray (5Y 8/1), packstone to grainstone, moderately indurated, arenitic, slightly chalky, common shell, fair moldic porosity
830-835	Limestone, yellowish gray (5Y 8/1) to very light gray (N8), wackestone, moderately indurated, slightly arenitic, chalky, minor shell
835-845	Limestone, yellowish gray (5Y 8/1), packstone to grainstone, moderately indurated, arenitic, slightly chalky, minor shell
845-850	Limestone, very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), packstone to grainstone, moderately indurated, slightly arenitic, slightly chalky, fossiliferous, fair to good moldic porosity

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
850-855	Limestone, yellowish gray (5Y 8/1), packstone, well indurated, minor shell, common limestone as above, fair moldic porosity
855-860	Limestone, very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), packstone, moderately indurated, common shell, minor very light gray (N8) lime mud
860-865	Limestone, yellowish gray (5Y 8/1) to light gray (N7), packstone to grainstone, moderately indurated, slightly arenitic, fossiliferous, minor shell, fair to good moldic porosity Note: the driller indicated that the bottom 1' was much softer and was drilling like clay
865-870	Limestone, yellowish gray (5Y 8/1) to light gray (N7), packstone to grainstone, moderately indurated, arenitic, fossiliferous, minor shell, fair to good moldic porosity
870-880	Limestone, very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), packstone to grainstone, moderately indurated, arenitic, fossiliferous, minor shell, fair moldic porosity
880-885	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), packstone to grainstone, moderately indurated, arenitic, fossiliferous, trace shell, fair moldic porosity
885-890	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), packstone to grainstone, moderately indurated, arenitic, fossiliferous, common shell, fair moldic porosity
890-895	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), packstone to grainstone, moderately well indurated, arenitic, fossiliferous, minor shell, fair moldic porosity
895-900	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), packstone to grainstone, moderately well indurated, arenitic, fossiliferous, minor shell, trace light olive gray (5Y 6/1) limestone, wackestone to packstone, slightly dolomitic; fair moldic porosity
900-905	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), packstone to grainstone, moderately well indurated, arenitic, fossiliferous, minor shell, fair moldic porosity

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
905-910	Limestone, yellowish gray (5Y 8/1), packstone to grainstone, moderately indurated, arenitic, slightly chalky, minor shell, trace limestone as above, fair moldic porosity
910-915	Limestone, yellowish gray (5Y 8/1), wackestone to packstone, moderately well indurated, moderately arenitic, minor shell, fair to good moldic porosity
915-925	Limestone, yellowish gray (5Y 8/1) to light gray (N7), packstone to grainstone, moderately indurated, arenitic, fossiliferous, minor shell, fair moldic porosity
925-935	Limestone, yellowish gray (5Y 8/1) to light gray (N7), packstone to grainstone, moderately indurated, arenitic, fossiliferous, minor shell
935-940	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), packstone to grainstone, moderately well indurated, moderately arenitic, fossiliferous, common shell, trace light olive gray (5Y 6/1) microcrystalline dolomite; fair to good moldic porosity
940-950	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), packstone to grainstone, moderately well indurated, moderately arenitic, fossiliferous, common shell, common shell casts, fair to good moldic porosity
950-955	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), packstone to grainstone, moderately well indurated, moderately arenitic, slightly chalky, fossiliferous, common shell, minor shell casts, fair to good moldic porosity
955-965	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), wackestone to grainstone, moderately indurated, arenitic, slightly chalky, minor shell
965-970	Limestone, very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), wackestone to packstone, moderately indurated, slightly arenitic, slightly chalky, minor shell, fair moldic porosity
970-975	Limestone, very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), wackestone to packstone, moderately indurated, slightly arenitic, slightly chalky, minor shell, minor light gray (N7) lime mud, fair moldic porosity
975-980	Limestone, yellowish gray (5Y 7/2), wackestone to packstone, moderately well indurated, common shell, good moldic porosity

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
980-985	Limestone, yellowish gray (5Y 8/1), mudstone to wackestone, moderately well indurated, slightly chalky, minor shell, minor limestone as above, fair moldic porosity
985-990	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), packstone, moderately well indurated, fossiliferous, common shell, good moldic porosity
990-995	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), packstone to grainstone, moderately well indurated, arenitic, slightly chalky, fossiliferous, minor shell, fair moldic porosity
995-1000	Limestone, yellowish gray (5Y 7/2) to very pale orange (10YR 8/2), wackestone to packstone, moderately well indurated, fossiliferous, common shell, minor very light gray (N8) lime mud, trace olive gray (5Y 4/1) microcrystalline dolomite, fair moldic porosity
1000-1010	Limestone, light gray (N7) to yellowish gray (5Y 8/1), packstone to grainstone, moderately indurated, arenitic, common shell, fair moldic porosity
1010-1015	Limestone, yellowish gray (5Y 8/1) to light gray (N7), wackestone to packstone, moderately well indurated, slightly arenitic, fossiliferous, common shell, trace light olive gray (5Y 6/1) dolomite; fair to good moldic porosity
1015-1020	Limestone, yellowish gray (5Y 8/1) to light gray (N7), wackestone to packstone, moderately well indurated, slightly arenitic, fossiliferous, common shell, trace fine quartz, trace light olive gray (5Y 6/1) dolomite; fair to good moldic porosity
1020-1025	Limestone, yellowish gray (5Y 8/1) to light gray (N7), wackestone to packstone, moderately indurated, abundant fine to medium quartz sand, fossiliferous, minor shell, fair moldic porosity
1025-1030	Limestone, yellowish gray (5Y 8/1) to light gray (N7), wackestone to packstone, moderately indurated, abundant fine to medium quartz sand, fossiliferous, minor shell, trace olive black (5Y 2/1) dolomite, fair moldic porosity
1030-1035	Limestone, yellowish gray (5Y 8/1) to light gray (N7), wackestone to packstone, moderately indurated, abundant fine to medium quartz sand, fossiliferous, common shell, trace olive black (5Y 2/1) dolomite; fair moldic porosity

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
1035-1040	Limestone, yellowish gray (5Y 8/1) to light gray (N7), wackestone to packstone, moderately indurated, abundant fine to medium quartz sand, fossiliferous, common shell, minor pale yellowish brown (10YR 6/2) limestone, wackestone, minor fine quartz sand; trace olive black (5Y 2/1) dolomite; fair moldic porosity
1040-1045	Limestone, yellowish gray (5Y 8/1) to light gray (N7), wackestone to packstone, moderately indurated, abundant shell, common fine to medium quartz sand, fossiliferous, trace olive black (5Y 2/1) dolomite; fair moldic porosity
1045-1050	Limestone, yellowish gray (5Y 8/1) to light olive gray (5Y 6/1) to very pale orange (10YR 8/2), wackestone to grainstone, moderately indurated, arenitic, common fine quartz sand, common shell, trace olive gray (5Y 4/1) dolomite
1050-1055	Limestone, yellowish gray (5Y 7/2) to light gray (N7), packstone to grainstone, moderately indurated, arenitic, abundant fine quartz sand, fossiliferous, common shell, trace olive black (5Y 2/1) cryptocrystalline dolomite
1055-1060	Limestone, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), packstone to grainstone, moderately well indurated, slightly arenitic, fossiliferous, common shell, common limestone as above, trace light olive gray (5Y 6/1) dolomitic clay and silt; good moldic porosity
1060-1065	Limestone, light olive gray (5Y 6/1), grainstone, poorly to moderately indurated, arenitic, slightly chalky, common fine quartz sand, minor shell
1065-1070	Marly limestone, yellowish gray (5Y 8/1), packstone to grainstone, moderately indurated, common fine quartz sand, common shell, fair moldic porosity
1070-1080	Limestone, yellowish gray (5Y 7/2), packstone to grainstone, moderately well indurated, arenitic, fossiliferous, common fine quartz sand, common shell
1080-1085	Limestone, yellowish gray (5Y 8/1) to light olive gray (5Y 6/1), packstone to grainstone, moderately indurated, arenitic, fossiliferous, common fine quartz sand, common shell, minor olive gray (5Y 4/1) dolomitic limestone; fair moldic porosity

Collier County ASR
Lithologic Log
Exploratory Well EW-1 (CO-3398)

Depth	Lithology
1085-1090	Limestone, yellowish gray (5Y 8/1) to light olive gray (5Y 6/1), packstone to grainstone, moderately indurated, arenitic, fossiliferous, common fine quartz sand, common shell, minor olive gray (5Y 4/1) dolomitic limestone; trace olive gray (5Y 4/1) dolomitic clay and silt; fair moldic porosity
1090-1095	Limestone, light olive gray (5Y 6/1), packstone to grainstone, moderately indurated, arenitic, common shell, common fine quartz sand, minor very light gray (N8) lime mud, minor olive black (5Y 2/1) dolomite
1095-1100	Limestone, light olive gray (5Y 6/1), packstone to grainstone, moderately indurated, arenitic, common shell, common fine quartz sand, minor olive black (5Y 2/1) dolomite

APPENDIX 3.2

FGS CORE-WELL CORE DESCRIPTION

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
0 - 1.5	Fill
1.5 - 2	Limestone, dark yellowish orange (10YR 6/6) and very pale orange (10YR 8/2), grainstone, friable, fine quartz sand, minor silt
2 - 7	NO SAMPLE
7 - 9	Limestone, medium gray (N5) to very pale orange (10YR 8/2), packstone, friable, silty, fine quartz sandy, fair interparticle porosity
9 - 14	Limestone, yellowish gray (5Y 8/1), packstone, moderately well indurated, highly fossiliferous (shelly), fine quartz sandy
14 - 18	NO SAMPLE
18 - 22	Limestone, medium gray (N5), recrystallized limestone, well indurated, vuggy, sparry, fair vuggy porosity
22 - 27	Clay, yellowish gray (5Y 8/1) to light greenish gray (5GY 8/1), soft, sticky, silty, calcareous, trace of very fine sand (phosphate and quartz)
27 - 32	NO SAMPLE
32 - 47	Clay, pale olive (10Y 6/2), soft, sticky, silty, calcareous, trace of very fine quartz sand
47 - 49.5	Clay as above, but phosphatic (very fine to very coarse-grained), trace of very fine quartz sand
49.5 - 57	Limestone, light olive gray (5Y 6/1), packstone, well indurated, moldic, highly fossiliferous (including shell and coral), trace of very fine sand (phosphate and quartz), moldic porosity
57 - 57.5+	Clay, pale olive (10Y 6/2), soft, sticky, silty, calcareous, finely phosphatic, common fragments of limestone, yellowish gray (5Y 8/1), packstone, well indurated, fossiliferous, moldic, sparry, moldic porosity
57.5+ - 62	Limestone, yellowish gray (5Y 8/1), wackestone to packstone, well indurated, moldic, variably sparry, moldic porosity

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
62 - 65	Limestone, white (N9) to yellowish gray (5Y 8/1), packstone, moldic, highly fossiliferous (including pellets), chalky, shelly, moldic porosity
65 - 68	Limestone, yellowish gray (5Y 8/1), packstone, fair moldic
68 - 69	Limestone, yellowish gray (5Y 8/1) and light gray N 7), packstone, highly moldic, highly fossiliferous, minor quarts sand
69 - 76.5	Limestone, yellowish gray (5Y 8/1), packstone, well indurated, moldic, highly fossiliferous, minor quarts sand, moldic porosity
76.5 - 89.5	Limestone, yellowish gray (5Y 8/1), packstone, well indurated, highly moldic, highly fossiliferous, slight quarts sand, slight phosphatic sand, moldic porosity
89.5 - 90.5	Limestone, yellowish gray (5Y 8/1), grainstone, airenetic (sandy) poorly indurated, slight quarts sand, slight phosphatic sand
90.5 - 91.5	Same as above only less induration, lightly cemented calcareous sand
91.5 - 92	Limestone, yellowish gray (5Y 7/2), packstone to wackestone, medium induration, some fossils and shell fragments, traces of silica and phosphatic sand, moldic porosity
92 - 93.5	Limestone, yellowish gray (5Y 7/2), packstone to wackestone, medium induration, friable, some shell, some casts, traces of silica and phosphatic sand, moldic porosity
93.5 - 96	Limestone same as above, less indurated, less moldic, more sandy
96 - 96.5	Limestone, yellowish gray (5Y 7/2), packstone, moderate induration, moderate moldic, some fossils, slight fine silica and phosphatic sand
96.5 - 97	Limestone same as above, less indurated, less moldic
97 - 102	Limestone, yellowish gray (5Y 7/2), packstone to wackestone, medium to well induration, moldic, fossiliferous, shell fragments, slight fine silica and phosphatic sand, fair moldic porosity (*Note: not much core from this interval.)
102 - 109	Limestone, yellowish gray (5Y 7/2), boundstone, poorly indurated calcareous sand, crumbly, slightly moldic, some fine silica sand and fine phosphatic sand

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
109 - 117	Calcareous sand to fine silt, yellowish gray (5Y 7/2), minor fine silica and phosphatic sand
117 - 122	Same as above, better induration, still soft and friable
122 - 127	Calcareous sand to fine silt, yellowish gray (5Y 7/2), minor fine silica and phosphatic sand
127 - 127.5	Limestone, yellowish gray (5Y 7/2), medium induration, minor shell fragments, minor molds, minor fine silica and phosphatic sand, fair porosity
127.5 - 130	Limestone, yellowish gray (5Y 7/2) and light gray (N7), packstone, well indurated, moldic, fossiliferous, silica sand (10%), minor phosphatic sand (1%)
130 - 131	Driller listed as cavity, no core recovered
131 - 132	Limestone, yellowish gray (5Y 7/2) and light gray (N7), packstone, carbonate sand (60%), silica sand (40%), medium size, sub-angular, well indurated, moldic, shell fragments, trace phosphatic sand
132 - 137	Limestone, yellowish gray (5Y 7/2), packstone same as above, more calcareous, slightly finer grain size
137 - 138	Limestone, yellowish gray (5Y 7/2), packstone same as above, less indurated, less moldic
138 - 139	Limestone, yellowish gray (5Y 7/2), wackestone, very poorly indurated, medium to very fine grain size carbonate particles (70%), medium to fine grain size silica sand (30%), some shell fragments and molds, carbonate mud or silt base
139 - 142	No sample retrieved
142 - 147	Limestone, pale olive(10Y 6/2) and pale greenish yellow (10Y 8/2), wackestone moderately indurated, very fine to fine grain size carbonate particles (70%), fine grain size silica sand (30%), carbonate mud or silt base, slightly moldic
147 - 152	Limestone, pale greenish yellow (10Y 8/2), packstone, sandy limestone, well indurated, moldic, fossiliferous

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
152 - 157	Core barrel in sample box, one small piece of sample; Limestone, yellowish gray (5Y 8/1) and medium gray (N6), wackestone, well indurated, slightly moldic, trace of silica sand
*157 - 158.5	Sand, yellowish gray (5Y 7/2), aprox. 50% silica sand and 50% carbonate sand, medium to fine grain size, sub-rounded, trace phosphatic sand
158.5 - 162	Clay, light greenish gray (5GY 8/1), calcareous silt to clay, minor very fine silica sand (5%), trace very fine phosphatic sand
162 - 170	Clay, yellowish gray (5Y 7/2), calcareous clay, trace very fine silica sand (less than 2%), trace very fine phosphatic sand
170 - 172	Marl, white(N9), and greenish gray (5GY 6/1), calcareous silt, sand and mud, limestone and shell fragments, trace fine silica sand, trace fine phosphatic sand
172 - 177	Limestone, white (N9), wackestone, similar to above only better induration, moldic, fossiliferous, minor fine silica and phosphatic sand
177 - 177.5	Marl, white (N9), same as 170'-172'
177.5 - 182	Clay, greenish gray (5GY 6/1), calcarous mud and silt, trace of very fine silica sand
182 - 186.8	No sample
186.8 - 187	Clay, dark greenish gray (5G 4/1), calcareous clay, some silt and very fine carbonate sand, trace very fine phosphatic sand
187 - 197	Clay, greenish gray (5G 6/1), calcareous clay, minor silt to very fine calcareous sand
197 - 207	Clay, grayish yellow green (5GY 7/2), calcareous clay, some very fine phosphatic sand (2%)
207 - 217	Marl, yellowish gray (5Y 7/2), limestone fragments, phosphatic sand, minor silica sand
217 - 227	Clay, grayish olive green (5GY 3/2), minor fine dolomitic rhombs and minor fine phosphatic sand

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
227 - 232	Clay, dark greenish gray (5GY 4/1), dense, minor fine dolomitic rhombs and minor fine phosphatic sand
232 - 251.5	Clay, dark greenish gray (5GY 4/1), same as above with more calcareous fine sand and fine phosphatic sand (5%)
251.5 - 270	Limestone, very pale orange (10YR 8/2), wackestone, well indurated, highly moldic, highly fossiliferous, slight fine phosphate, moldic porosity
270 - 275	Limestone, grayish yellow green (5GY 7/2), packstone to grainstone, calcarenite, medium to fine grain size, sub-rounded, well indurated, moldic, some fine silica (5%)and some fine phosphate (5%)
275 - 276	Limestone, pale greenish yellow (10Y 8/2), wackestone to packstone, well indurated, highly moldic, fossiliferous, minor fine phosphate (2%)
276 - 280	Limestone, light bluish gray (5B 7/1), packstone to grainstone, calcarenite, medium to fine grain size, sub-rounded, poor to moderately indurated, slightly moldic, some fine silica (5%) and some fine phosphate (5%)
280 - 281	Limestone, light bluish gray (5B 7/1) calcarenite, same as above only poorly indurated
281 - 282	Limestone, grayish yellow green (5GY 7/2), packstone, calcarenite, moderately indurated, moldic, some fine silica (5%)and some fine phosphate (5%)
282 - 283.5	Limestone, greenish gray, (5G 6/1), calcarenite, medium to fine grain size, sub-rounded, fine phosphatic sand (5%), minor fine silica sand
283.5 - 284	Same as above, becoming more indurated, some fossils and shell fragments present
284 - 291	Limestone, yellowish gray (5Y 8/1), wackestone to packstone, moderately indurated, highly moldic, highly fossiliferous, numerous shell fragments, minor fine phosphate
291 - 292	Limestone, yellowish gray (5Y 8/1), wackestone to packstone, moderately to poorly indurated, highly moldic, highly fossiliferous, numerous shell fragments, minor fine phosphate 1-2%)

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
292 - 295	Limestone, yellowish gray (5Y 8/1), packstone to wackestone, same as above, better induration
295 - 302	Limestone, yellowish gray (5Y 7/2), wackestone to packstone, calcarenite, poorly indurated, moldic, numerous shell fragments, muddy
302 - 305	Limestone, same as above, wackestone to packstone, calcarenite better induration
305 - 307	Limestone, yellowish gray (5Y 8/1), packstone to grainstone, calcarenite, very poorly indurated, shell fragments, minor fine phosphate
307 - 310	Limestone, yellowish gray (5Y 8/1), wackestone to packstone, calcarenite same as above, better induration (still soft, crumbly)
310 - 312	Limestone, same as above, less induration
312 - 318	Limestone, yellowish gray (5Y 7/2), wackestone, well indurated, highly moldic, highly fossiliferous, sparry, minor fine phosphate
*318 - 327	Limestone, very pale orange (10YR 8/2), wackestone, well indurated, highly moldic, highly fossiliferous, sparry, minor phosphate (2%)
327 - 327.1	Clay, dark yellow green (10Y 8/2), and pale olive (10Y 6/2)
327.1 - 332.5	Limestone, yellowish gray (5Y 8/1), recryistalized, wackestone, well indurated, moldic, fossiliferous, sparry, phosphate (2%)
*332.5 - 333	Limestone, very pale orange (10YR 8/2), packstone, calcarenite, fine grain size, sub-rounded, poorly indurated, moldic, shell fragments, minor phosphate
333 - 335	Limestone, very pale orange (10YR 8/2), wackestone to packstone, fair to well induration, abondant shell fragments, moldic, fossiliferous, minor phosphate
335 - 341	Limestone, very pale orange (10YR 8/2), wackestone to packstone, recryistalized, well indurated, highly moldic, highly fossiliferous sparry, trace of phosphate

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
341 - 355	Limestone, yellowish gray (5Y 8/1), calcarenite, poor to moderate induration, shell and limestone fragments, phosphate (10%), silica sand (2%)
335 - 357	Limestone, yellowish gray 5Y 8/1), packstone, recryistalized, well indurated, highly moldic, fossiliferous sparry, minor shell fragments, phosphate (3-5%)
357 - 357.3	Carbonate mud, yellowish gray (5Y 8/1), sandy, silty, limestone and shell fragments (20%), phosphate (3-5%)
357.3 - 362	Limestone, yellowish gray (5Y 8/1), wackestone to packstone, recryistalized, well indurated, moldic, fossiliferous sparry
*362 - 363	Limestone, as above, less induration, soft, friable
363 - 368	Limestone, very pale orange (10YR 8/2), wackestone to packstone, recryistalized, well indurated, moldic, fossiliferous sparry, coral fragments, trace of phosphate (less than 1%)
368 - 369	Limestone, pale olive (10Y 6/2), mudstone to wackestone, carbonate mud matrix with coral and shell fragments (15%), poorly indurated
369 - 370	Lime mud, pale olive (10Y 6/2), some spar (5-10%), phosphate (2-3%), gritty, silty
*370 - 372	Limestone, pale olive (10Y 6/2), mudstone to wackestone, carbonate mud with coral fragments, poorly indurated, trace phosphate (1%)
372 - 375	Lime mud, pale olive (10 6/2), carbonate mud, limestone and spare fragments (10%), phosphate (3-5%)
*375 - 380	Limestone yellowish gray (5Y 7/2), mudstone to wackestone, spare and shell fragments (2-3%), poor to moderate induration, silty, phosphate (5%)
380 - 381	Limestone, yellowish gray (5Y 7/2), recryistalized, sparry, well indurated, fossiliferous, moldic, phosphate (2%)
381 - 383	Limestone, yellowish gray (5Y 8/1), recryistalized, wackestone, fair induration, friable, moldic, sparry, fossiliferous, phosphate (2%)

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
383 - 385	Limestone, yellowish gray (5Y 8/1), mudstone to wackestone, lime mud, fossils (10%), medium induration, trace of phosphate (1-2%)
385 - 389	Clay, pale olive (10Y 6/2), lime mud, minor limestone, shell and spar fragments (2-5%), minor phosphate (1-2%)
389 - 391	Limestone, light olive gray (5Y 5/2), mudstone, dolomitic silt, moderate to poor induration, minor phosphate (1-2%)
391 - 392	Limestone, yellowish gray (5Y 7/2), and light olive gray (5Y 5/2), recryistalized, mudstone, moldic, well indurated, sparry, minor phosphate (1%)
392 - 393	Note in core box- Split spoon----- no sample----
393 - 394	Clay, grayish olive (10Y 4/2), dolomitic clay, stiff
394 - 395	Lime mud, light olive gray (5Y 5/2), 3-5% limestone fragments, white (N9)
395 - 399	Limestone, light olive gray (5Y 5/2), 3-5% limestone fragments, white (N 9), mudstone to wackestone, as above, better induration, still poorly indurated
399 - 400	Marl, very light gray (N9), calcarous silt to mud, fossiliferous limestone and spar fragments (10-20%)
400 - 412	Limestone, very light grey (N8), recryistalized, wackestone, well indurated, very fossiliferous, very moldic, sparry
412 - 416	Dolomitic limestone, very pale orange (10YR 8/2), recryistalized, mudstone to wackestone, well indurated. shallow small molds, some fossils, smooth tight rock, trace of phosphate
416 - 419	Dolomitic limestone, yellowish gray (5Y 8/1), recryistalized, mudstone to wackestone, very fossiliferous, very moldic, sparry, trace of phosphate
419 - 422	Limestone, yellowish gray (5Y 8/1), wackestone to packstone, clayey, poor to moderate induration, fossiliferous, moldic, trace of phosphate

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
422 - 437	Limestone, very pale orange (10YR 8/2), wackestone, well indurated, highly fossiliferous, highly moldic, sparry, trace of phosphate
437 - 445	Limestone, very pale orange (10YR 8/2), wackestone to packstone, poorly indurated (soft, crumbly), shell fragments (10%), trace of phosphate
445 - 446	Lime mud, very pale orange (10YR 8/2), clayey, shell fragments (10%), phosphate (3-5%)
446 - 452	Limestone, very pale orange (10YR 8/2), wackestone, well indurated, highly fossiliferous, highly moldic, trace of phosphate(1-2%) Note: Clay layer from 449.5-449.7, color same as above
452 - 453	Lime mud, yellowish gray (5Y 8/1), limestone and spar fragments (20%), minor phosphate (2%)
453 - 454	Limestone, yellowish gray (5Y 8/1), wackestone to packstone, well indurated, fossiliferous, moldic, some spar, trace of phosphate(1-2%)
454 - 455.5	Lime mud, yellowish gray (5Y 8/1), gritty, small limestone and spar fragments (15%), phosphate (3-5%)
455.5 - 457.5	Dolomite, very pale orange (10YR 8/2), recryistalized, wackestone, well indurated, fossiliferous, moldic, sparry, trace of phosphate (1%)
457.5 - 458	Lime mud, very pale orange (10YR 8/2), limestone fragments (10-20%), phosphate (5%)
458 - 462	Limestone, very pale orange (10YR 8/2), same as above with better induration, still poorly indurated, phosphate (5%)
462 - 465	Marl, very pale orange (10YR 8/2), lime mud matrix with limestone, shell fragment and spar, phosphate (3%), poor apparent permeability
465 - 467	Limestone, yellowish gray (5Y 8/1), wackestone to packstone, moderately indurated, friable, highly fossiliferous, highly moldic, phosphatic (2%)

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
467 - 470	Limestone, yellowish gray (5Y 8/1), wackestone to packstone, same as above only less induration
470 - 471.5	Lime mud(clay), very pale orange (10YR 8/2) and light brownish gray (5Y 6/1) with streaks of light gray (N7), limestone fragments (10%), phosphatic (1-2%)
471.5 - 472.5	Limestone, yellowish gray (5Y 8/1), mudstone, some molds (5%), well indurated, some phosphate (1-2%)
472.5 - 502	Limestone, yellowish gray (5Y 8/1), wackestone, calcarenite, poorly indurated, some fossils and limestone fragments, silty, phosphate increasing with depth
502 - 510	Clay, yellowish gray (5Y 8/1), sandy (phosphatic and calcareous), sticky, silty
510 - 512	Limestone, yellowish gray (5Y 8/1), wackestone, friable, sandy (phosphatic and limestone grains), fossiliferous (some replaced by spar), silty
512 - 514	Limestone, yellowish gray (5Y 8/1), wackestone, moderate induration, silty, fossiliferous, sparsely finely phosphatic
514 - 515	Limestone, yellowish gray (5Y 8/1), packstone, well indurated, moldic, fossiliferous, phosphatic (fine to coarse-grained)
515 - 522	Limestone, white (N9) to yellowish gray (5Y 7/2), wackestone, friable, sandy (fine to very coarse phosphate and limestone grains), silty
522 - 523	Limestone, yellowish gray, packstone, well indurated, fossiliferous, phosphatic (fine to very coarse-grained), pin-point vugs
523 - 527.5	Limestone, greenish gray (5GY 6/1), wackestone, moderately indurated, sandy (fine to very coarse phosphate and limestone grains), silty
527.5 - 531	Limestone, greenish gray (5GY 6/1) to yellowish gray (5Y 7/2), packstone, well indurated, moldic, highly fossiliferous, phosphatic (fine to very coarse-grained)

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
531 - 534	Limestone, yellowish gray (5Y 8/1), wackestone, well indurated, moldic, fossiliferous, phosphatic (fine to very coarse-grained)
534 - 542	Clay, yellowish gray (5Y 7/2), sandy (fine to very coarse phosphate and limestone grains), calcareous, sticky, silty
542 - 552	Limestone, yellowish gray (5Y 8/1), mudstone, moderately indurated, finely phosphatic, silty
552 - 553	Limestone, yellowish gray (5Y 7/2), wackestone, well indurated, highly fossiliferous, sparry, finely phosphatic, pin-point vugs
553 - 562	Clay, yellowish gray (5Y 7/2), variably sandy (fine to coarse phosphate and limestone grains), calcareous, sticky, silty, poor apparent permeability
562 - 564.5	Limestone, white (N9), wackestone, well indurated, fossiliferous, chalky, sparsely phosphatic, fair interparticle porosity, poor apparent permeability
564.5 - 566	Limestone, light olive gray (5Y 6/1) to yellowish gray (5Y 8/1), wackestone, well indurated, moldic, highly fossiliferous, phosphatic (fine to very coarse-grained), fair moldic porosity, poor apparent permeability
566 - 582	Clay, light olive gray (5Y 6/1), variably sandy (fine to very coarse limestone grains), calcareous, sticky, silty, variably sparsely phosphatic, poor apparent permeability
582 - 583.5	Limestone, very light gray (N8), wackestone, moderate to well indurated, variably moldic, fossiliferous, fair to poor moldic porosity, poor apparent permeability
583.5 - 588	Limestone, yellowish gray (5Y 7/2), mudstone, friable, silty, poor apparent permeability
588 - 600	Limestone, very light gray (N8) to greenish gray (5GY 6/1), wackestone, moderately to well indurated, highly fossiliferous, variably phosphatic (fine to very coarse), poor interparticle porosity, poor apparent permeability

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
600 - 603.5	Claystone, olive gray (5Y 4/1), moderately well indurated, fissile, poor apparent permeability
603.5 - 606.5	Limestone, light olive gray (5Y 6/1), mudstone, well indurated, sparsely phosphatic, poor apparent permeability
606.5 - 608.5	Limestone, light olive gray (5Y 6/1) to olive gray (5Y 4/1), wackestone, well indurated, variably moldic, fossiliferous, variably phosphatic, fair to poor moldic porosity, poor apparent permeability
608.5 - 610	Limestone, yellowish gray (5Y 7/2), mudstone, friable, sparsely finely phosphatic, poor apparent permeability
610 - 619	Limestone, white (N9) to very light gray (N8), wackestone, well indurated, variably moldic, chalky, fossiliferous, minor vugs with secondary crystal growth occurring in some of these vugs, fair moldic porosity
619 - 620	Limestone, yellowish gray (5Y 7/2), mudstone, friable, sparsely fossiliferous, minor fine to very coarse phosphate
620 - 625	Limestone, white (N9) to yellowish gray (5Y 8/1), packstone, well indurated, variably moldic and vuggy, fossiliferous, variably phosphatic, fair moldic porosity
625 - 638	Limestone, yellowish gray (5Y 8/1), wackestone, well indurated, variably moldic and vuggy, fossiliferous, variably chalky, phosphatic (fine to very coarse-grained), fair to poor moldic porosity
638 - 640	Limestone, white (N9) to yellowish gray (5Y 7/2), mudstone, moderately indurated to friable, highly phosphatic, variably chalky
640 - 655	Limestone, white (N9) to yellowish gray (5Y 8/1), wackestone, well indurated, variably moldic, chalky, fossiliferous, minor vugs with secondary crystal growth occurring in some of these vugs, good to fair moldic porosity
655 - 657	Limestone, white (N9) to yellowish gray (5Y 8/1), wackestone, well indurated, fossiliferous, abundant casts and molds, pelycypod, gastropod, coral, minor fine-grained quartz, minor fine-grained phosphate, moldic porosity

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
657 - 660	Limestone, white (N9) to yellowish gray (5Y 8/1), packstone, moderately indurated to friable, chalky, abundant foraminifer
660 - 662	Clay, white (N9) to yellowish gray (5Y 8/1), cohesive, common fine-grained phosphate, trace fine-grained quartz
662 - 668	Limestone, white (N9), wackestone, well indurated, fossiliferous (pelycypods, gastropods), common phosphate, minor quartz, moldic porosity (calcite recrystallization in some molds)
668 - 670	Limestone, white (N9), wackestone, moderately indurated, chalky, fossiliferous (pelycypods, gastropods), occasional fine-grained phosphate and quartz
670 - 680	Limestone, white (N9), wackestone, well indurated, fossiliferous (pelycypods, gastropods) common phosphate, minor quartz, moldic porosity (calcite recrystallization in some molds)
680 - 682	Limestone, white (N9), wackestone, moderately indurated, chalky, fossiliferous (pelycypods, gastropods), occasional fine-grained phosphate and quartz
682 - 683	Limestone, white (N9), wackestone, well indurated, fossiliferous (pelycypods, gastropods) common phosphate, minor quartz, moldic porosity
683 - 698	Limestone, white (N9), wackestone, moderately to well indurated, chalky, fossiliferous (pelycypods, gastropods, corals), occasional fine-grained phosphate and quartz
698 - 700	Limestone, white (N9), grainstone, moderately indurated, chalky, fossiliferous (pelycypods, gastropods), occasional fine-grained phosphate and quartz
700 - 705	Limestone, white (N9), wackestone, moderately indurated, chalky, fossiliferous (pelycypods, gastropods), occasional fine-grained phosphate and quartz
705 - 710	Clay, white (N9), calcareous, silty, rare fine-grained phosphate

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
710 - 721	Limestone, white (N9), wackestone, well indurated, fossiliferous (pelycypods, gastropods, corals, barnacles), common phosphate, minor quartz, moldic porosity (calcite recrystallization in some molds)
721 - 723	Clay, white (N9), calcareous, silty
723 – 738	Limestone, white (N9), wackestone, moderately to well indurated, fossiliferous (pelycypods, gastropods, echinoderms, corals)
738 – 741	Limestone, white (N9), wackestone, moderately indurated, fossiliferous (pelycypods, gastropods, echinoderms, corals)
741 - 747	Limestone, yellowish gray (5Y 8/1), wackestone, moderately to well indurated, fossiliferous (pelycypods, corals), solution cavities
747 - 748.5	Cavity
748.5 - 751	Limestone, yellowish gray (5Y 8/1), wackestone, moderately to well indurated, fossiliferous (pelycypods, corals), solution cavities
751 - 763	Dolomitic limestone, light olive gray (5Y 6/1), wackestone, very well indurated, fossiliferous (pelycypods, gastropods, corals), high degree of recrystallization
763 - 765	Cavity
765 - 767	Clay, yellowish gray (5Y 7/2), silty, sticky, cohesive
767 - 769	Limestone, yellowish gray (5Y 8/1), mudstone, well indurated, silty
769 - 774	Limestone, yellowish gray (5Y 7/2), grainstone/packstone, well indurated, highly recrystallied (sparry), rare fossils
774 - 776	Cavity

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
776 - 780	Limestone, white (N9) to yellowish gray (5Y 8/1), wackestone, moderately to well indurated, chalky, common fossil (gastropods)
780 - 791	Dolostone, yellowish gray (5Y 7/2) to pale olive (10Y 6/2), crystalline, fossiliferous, very well indurated
791 - 800	Limestone, yellowish gray (5Y 8/1), wackestone, well indurated, some dolomitization, fossiliferous (pelycypods, scallops)
800 - 810	Limestone, white (N9) to yellowish gray (5Y 8/1), mudstone, moderately to well indurated, silty, rare phosphate
810 - 820	Limestone, yellowish gray (5Y 7/2), packstone/grainstone, moderately to well indurated, fossiliferous (mollusks, echinoderms)
820 - 830	No recovery
830 - 833	Limestone, yellowish gray (5Y 7/2) to yellowish gray (5Y 8/1), packstone, moderately to well indurated, sparry, oolitic
833 - 840	Limestone, very pale orange (10YR 8/2), packstone/grainstone, poorly to moderately indurated, sparry, occasionally fossiliferous
840 - 850	Clay, bluish white (5B 9/1) to white (N9), calcareous, firm
850 - 860.5	Limestone, yellowish gray (5Y 7/2), wackestone, poorly to moderately indurated with streaks of clay (yellowish gray (5Y 7/2)), fossiliferous, partially dolomitized
860.5 - 870	Sand, yellowish gray (5Y 7/2), calcareous, medium to coarse-grained, poorly sorted
870 - 871	Limestone, yellowish gray (5Y 7/2), wackestone, well indurated, moldic, highly fossiliferous, sparsely phosphatic
871 - 876	Limestone, white (N9) to yellowish gray (5Y 7/2), mudstone, moderately indurated, silty, interbedded with clay, yellowish gray (5Y 7/2), firm, sticky, silty

PELICAN BAY WELLFIELD
Lithologic Log
(PBWF #1)

Depth	Lithology
876 - 880	NO SAMPLE
880 - 898	Limestone, white (N9) to yellowish gray (5Y 7/2), mudstone, moderately indurated, silty, interbedded with clay, yellowish gray (5Y 7/2), firm, sticky, silty
898 - 899.75	Sand, yellowish gray (5Y 7/2), calcareous, medium to coarse-grained, poorly sorted
899.75 - 900	Limestone, white (N9) to yellowish gray (5Y 7/2), mudstone, moderately indurated, silty, interbedded with clay, yellowish gray (5Y 7/2), firm, sticky, silty

APPENDIX 3.3

LABORATORY CORE ANALYSES

OMNI Laboratories, Inc.

February 8, 2002

Mr. Mark Pearce
Water Resource Solutions
428 Pine Island Road SW
Cape Coral, Florida 33991

Subject: Permeability to Water and X-ray Diffraction
File: H-3801

Mr. Pearce:

A testing program to determine current permeability to water and x-ray diffraction has been completed for Water Resource Solutions. Four shelby tubes of clay material were received for this study which was authorized in a letter from Mr. Mark Pearce of Water Resource Solutions to Mr. Steve Hoff of OMNI Laboratories dated January 3, 2002. Interim data were e-mailed to Mr. Pearce as available. Final results testing are presented below.

Permeability to Water

From each shelby tube, a one inch diameter, vertically oriented cylindrical core plug was obtained. The core plugs were trimmed to right cylinders as long as possible. To preserve sample integrity during testing, each sample was encased in a nickel sleeve with stainless steel screens on each end. The length and diameter was measured and corrected for the packaging material.

Each sample was briefly evacuated under tap water and installed in a hydrostatic coreholder. A net confining stress of 400 psi was applied, and a backpressure of 200 psi was established. Tap water was injected at a suitable constant rate while monitoring produced volumes, differential pressure and elapsed time. Permeability to water was caculated from the observed data using Darcy's law.

Sample Depth, feet	Length, cm	Diameter, cm	Effective Permeability to Water, millidarcys	Sample Description
189	2.19	2.48	0.543	Clst, gry
198	2.50	2.42	0.120	Sh, vslty, tan, tr crs qtz gr
225	1.99	2.40	0.254	Clst, gry
245	2.38	2.30	2.47	Slst, dk gry, vfg-slt size qtz, lam

X-ray Diffraction (XRD) Analysis

A representative portion of each sample was dried, extracted if necessary, and then ground in a Brinkman MM-2 Retsch Mill to a fine powder. This ground sample was next loaded into an aluminum sample holder. This "bulk" sample mount was scanned with a Philips X-ray diffractometer using nickel-filtered copper K-alpha radiation at standard scanning parameters. Computer analysis of the diffractograms provide qualitative identification of mineral phases and semiquantitative analysis of the relative abundance (in weight percent) of the various mineral phases. It should also be noted that X-ray diffraction **does not** allow the identification of non-crystalline (amorphous) material, such as organic material and volcanic glass.

An oriented clay fraction mount was also prepared for each sample from the ground powder. The samples were further size fractionated by centrifuge to separate the <4 micron fraction. Ultrasonic

treatment was used to suspend the material, then a dispersant was used to prevent flocculation when noted. The solution containing the clay fraction was then passed through a Fisher filter membrane apparatus allowing the solids to be collected on a cellulose membrane filter. These solids were then mounted on a glass slide, dried, and scanned with the Philips diffractometer. The oriented clay mount was then glycolated and another diffractogram prepared to identify the expandable, water sensitive minerals. When necessary, the patterns were deconvoluted, or the samples heat treated, to aid in distinguishing kaolinite and chlorite.

Sample Depth, ft.	CARBONATES Weight percent			OTHER MINERALS Weight percent						TOTALS Weight percent		
	Calcite	Dolomite	Siderite	Quartz	K-spar	Plag.	Pyrite	Zeolites	Halite	Clays	Carb.	Other
189	18	25	3	12	2	4	5	0	0	31	46	23
225	1	45	2	18	3	7	4	0	0	20	48	32
245[1]	1	17	12	31	4	8	6	0	0	21	30	49
AVERAGE	7	29	6	20	3	6	5	0	0	24	41	35

[1] contains an unidentified component due to low amount and peak interference

Sample Depth, ft	CLAYS Weight percent				TOTALS Weight percent		
	Chlorite	Kaolinite	Illite	Mixed*	Clays	Carb.	Other
198	4	10	48	38	100		

* Randomly-interstratified mixed-layer illite/smectite

We appreciate the opportunity to have been of service to Water Resource Solutions. Please contact us if we may be of further assistance.

Thank you,

Jennifer Cutler
OMNI Laboratories, Inc.

OMNI Laboratories, Inc.

May 20, 2002

Mr. Mark Pearce
Water Resource Solutions
428 Pine Island Road SW
Cape Coral, Florida 33991

Subject: Permeability to Water
File: S-00130

Mr. Pearce:

A testing program to determine current permeability to water and has been completed for Water Resource Solutions. Two shelby tubes of clay material and one PVC tube with a clay sample and a dolomite sample were received for this study which was authorized in a letter from Mr. Mark Pearce of Water Resource Solutions to Mr. Steve Hoff of OMNI Laboratories dated May 2, 2002. Interim data were e-mailed to Mr. Pearce as available. Final results testing are presented below.

Permeability to Water

From each sample, a one inch diameter, vertically oriented cylindrical core plug was obtained. The core plugs were trimmed to right cylinders as long as possible. To preserve sample integrity during testing, each sample was encased in a nickel sleeve with stainless steel screens on each end. The length and diameter was measured and corrected for the packaging material.

Each sample was briefly evacuated under tap water and allowed to soak for 72 hours prior to installing in a hydrostatic coreholder. A net confining stress of 500 psi was applied, and a backpressure of 100 psi was established. Tap water was injected at a suitable constant pressure while monitoring produced volumes, incremental volumes and elapsed time. Permeability to water was caculated from the observed data using Darcy's law.

Sample Depth, feet	Length, cm	Diameter, cm	Effective Permeability to Water, millidarcys	Sample Description
526	2.00	2.48	0.011	Clst, gry
602	1.55	2.54	0.005	Clst, gry
755C	1.60	2.53	0.017	Clst, gry
755D	1.44	2.53	0.039	Dol, gry

We appreciate the opportunity to have been of service to Water Resource Solutions. Please contact us if we may be of further assistance.

Thank you,

Jennifer Cutler
OMNI Laboratories, Inc.

APPENDIX 7.1

MODEL INPUT/OUTPUT DATA

MODEL INPUT DATA
COLASR1.DAT

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collierasr1 1 MGD; 5 layers, 235 COLUMNS, R1=2ft, inj into layer 3 site Cl bkgrnd=2100, Extended Plume
cl(inj)=200,Clcutoff=500 (0.) POR=.30;  cit bis LEAKANCE = 0.186 GPD/FT2 (0.025/day) T= 70,000 GPD/FT
   2    0    0    0    0    0    1    0    0   01    0    0    0     | M-2 NCALL, RSTRT, SURF, IFREE, NPLP, NPLT, NPLC, IUNIT, LBIO,
 258    1    9    3    0    1    1    2    0    9    0    1    0    0| M-3-1 NX, NY, NZ, HTG, NCP, NRT, KOUT, PRT, NSMAX, NABLMX, NRC
   0    0    1    0                                                  | M-3-2 <#repository blks> <switch for soln of prime eqtns> <#lo
 .0E-06  3.0E-06       0.0       1.0       1.0                       | R1-1  <compres of res fluid> <rk compres> <coef therm exp res
     0.0       0.0       0.0       0.0      75.       0.0  2.2E-04| R1-2  <rock therm cond: (-x dir) (-y dir) (-z dir)> <conv fctr
   173.0      14.7      80.     63.25     62.18                       | R1-3  <rockdens> <ref pres> <ref temp> <dens res fluid> <dens
   0    1    1    2                                                  | R1-6  <# entries in : (conc-vis
      80      0.90      80.      0.88
     100      0.90
     100      0.88
       5        80
    3000        80
       0         0                                                   | R1-12 <# overburd blksyy> <# underburdn blks>
    80.       260.      100.        0.                               | R1-16 <ref temp for hydcond & dens> <init pres at ref dpth> <r
     0.7        0.     10000.      55.                               | R1-22 <well radius> <rad to cntr of 1st blk> <max rad> <depth
    125.      36.6      13.2      0.15       0.0
    200.     0.024     0.008      0.15       0.0                     | R1-23 <lyr thckness> <horiz K> <vert K> <porosity> <heat capac
    150.        54.       18.      0.15       0.0
    160.    0.0003    0.0001      0.15       0.0                     | R1-23
     95.      27.0       9.0      0.15       0.0                     | R1-23
     50.      0.06     0.002      0.15       0.0                     | R1-23
     60.      166.       56.      0.15       0.0                     | R1-23
     45.     0.024     0.008      0.15       0.0
     50.       10.        3.      0.15       0.0
     10        20        30        40        50        60        70
     80        90       100       110       120       130       140
    150       160       170       180       190       200       210
    220       230       240       250       260       270       280
    290       300       310       320       330       340       350
    360       370       380       390       400       410       420
    430       440       450       460       470       480       490
    500       510       520       530       540       550       560
    570       580       590       600       610       620       630
    640       650       660       670       680       690       700
    710       720       730       740       750       760       770
    780       790       800       810       820       830       840
    850       860       870       880       890       900       910
    920       930       940       950       960       970       980
    990      1000      1010      1020      1030      1040      1050
   1060      1070      1080      1090      1100      1110      1120
   1130      1140      1150      1160      1170      1180      1190
   1200      1210      1220      1230      1240      1250      1260
   1270      1280      1290      1300      1310      1320      1330
   1340      1350      1360      1370      1380      1390      1400
   1410      1420      1430      1440      1450      1460      1470
   1480      1490      1500      1510      1520      1530      1540
   1550      1560      1570      1580      1590      1600      1610
   1620      1630      1640      1650      1660      1670      1680
   1690      1700      1710      1720      1730      1740      1750
   1760      1770      1780      1790      1800      1810      1820
   1830      1840      1850      1860      1870      1880      1890
   1900      1910      1920      1930      1940      1950      1960
   1970      1980      1990      2000      2010      2020      2030
   2040      2050      2060      2070      2080      2090      2100
   2110      2120      2130      2140      2150      2160      2170
   2180      2190      2200      2210      2220      2230      2240
   2250      2260      2270      2280      2290      2300      2310
   2320      2330      2340      2350      2360      2380      2410
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    2450       2490       2550       2600       2700       2900       3200
    3500       3750       4000       4300       4600       5000       5500
    6000       6500       7000       7500       8000       8500       9000
                                                                              | R1-26blnk  reservoir modifications (none)
  3    0                                                                      | R1-27 <type of aquifer influence function (const press & brine
  1    0    0
    8560         24     100000        360                                    | R1-31
                                                                              | R1-33 BLN <end of list> for VAB (face type) modifications
  1    0    0
                                                                              | I-1  end of list blank record
0.0                                                                           | R1A-2 <salt-dissolution coefficient>
  1    1    1    0    0    0    0    0    0    0    0                        | R2-1 STRESS PERIOD 0 == STRESS PERIOD 0 == STRESS PERIOD 0 ==
  1        0.5       cit bis                                                | R2-2 specify the solver weighting scheme
  1                                                                           | R2-4 <# wells)
     0.                                                                       | R2-5 <production rates> (no pumping during this first SP)
  1    1    1    7    7    1                                                | R2-7-1 Define well <well #> <i> <j> <top lyr cmpltd> <bot lyr
   5.9E5         0.        80.          1                                    | R2-7-2 <well index> <bot hol pres> <inj flu temp> <inj flu con

   1.E-6      1.E-6          0          0          0          0          0         0|R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsmx> <dpmx
  0    1    1   -1   -1   -1  211     0 0000     0   00     0    0     0| R2-13 Output Control
  1    0    0    0    0    0    0    0    0    0    0
  1
       0
       1         0.       0.95       0.25        50.   00   9.        0.1 0.000001
  0    1    1   -1   -1   -1  110     0 0000     0   00     0    0     0| r2-13
  1    0    0    0    0    0    0    0    0    0    0                        | R2-1 STRESS PERIOD 1 == STRESS PERIOD 1 == STRESS PERIOD 1 ==
  1                                                                           | R2-4 <# wells)
-1.35e5                                                                       | R2-5 <production rates> (first injection phase, -Q = inj.)   2
     1.5         0.       0.95       0.25        50.         9.       0.05   .000001  | R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsmx> <d
  0    1    1   -1   -1   -1  110     0 0000     0   00     0    0     0| R2-13 Output Control
  0    0    0    0    0    0    0    0    0    0    0                        | R2-1 STRESS PERIOD 1 == STRESS PERIOD 1 == STRESS PERIOD 1 ==
     3.0         0.       0.95       0.25        50.         9.       0.5    .00001  | R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsmx> <d
  0    1    1   -1   -1   -1  211     0 0000     0   00     0    0     0| R2-13 Output Control
  0    0    0    0    0    0    0    0    0    0    0                        | R2-1 STRESS PERIOD 1 == STRESS PERIOD 1 == STRESS PERIOD 1 ==
   1000.         0.       0.95       0.25        50.         9.         1    .00001  | R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsmx> <d
  0    1    1   -1   -1   -1  110     0 0002     1   00     0    0     0| R2-13 Output Control
  1    1    1   -1    0   -1
       6         6         6         6         6         6
  1  258    1    1    1    9       -99         0
  0    0    0    1    0    0    0    0    0    0    0                        | R2-1 STRESS PERIOD 1 == STRESS PERIOD 1 == STRESS PERIOD 1 ==
  1                                                                           | R2-4 <# wells)
       0                                                                      | R2-5 <production rates> (first injection phase, -Q = inj.)   2
    200.         0.       0.95       0.25        50.         9.       1.0    .000001  | R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsmx> <d
  0    1    1   -1   -1   -1  110     0 0000     0   00     0    0     0| R2-13 Output Control
  1    0    0    0    0    0    0    0    0    0    0                        | R2-1 STRESS PERIOD 1 == STRESS PERIOD 1 == STRESS PERIOD 1 ==
  1                                                                           | R2-4 <# wells)
1.35e5                                                                        | R2-5 <production rates> (first injection phase, -Q = inj.)   2
    225.         0.       0.95       0.25        50.         9.       1.0    .000001  | R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsmx> <d
  0    1    1   -1   -1   -1  110     0 0000     0   00     0    0     0| R2-13 Output Control
  1    1    0    0    0    0    0    0    0    0    0                        | R2-1 STRESS PERIOD 0 == STRESS PERIOD 0 == STRESS PERIOD 0 ==
  1                                                                           | R2-4 <# wells)
     0.                                                                       | R2-5 <production rates> (no pumping during this first SP)
  1    1    1    3    3    1                                                | R2-7-1 Define well <well #> <i> <j> <top lyr cmpltd> <bot lyr
   5.9E5         0.        80.         0.1                                   | R2-7-2 <well index> <bot hol pres> <inj flu temp> <inj flu con

    300          0.       0.95       0.25        50.         9.       1.0      0.001       0|R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsm
  0    1    1   -1   -1   -1  211     0 0000     0   00     0    0     0| R2-13 Output Control
  1    0    0    0    0    0    0    0    0    0    0
  1
```

```
-1.35e5
   400        0.      0.95      0.25       50.   00   9.       1.0   0.00001
 0   1   1   -1   -1   -1  110     0 0000    0   00    0    0    0| r2-13
 1   0   0   0    0    0   0   0   0    0    0                     | R2-1 STRESS PERIOD 1 == STRESS PERIOD 1 == STRESS PERIOD 1 ==
 1
     0
   500.        0.      0.95      0.25       50.        9.       1.0    .00001  | R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsmx> <d
 0   1   1   -1   -1   -1  211     0 0000    0   00    0    0    0| R2-13 Output Control
 1   0   0   0    0    0   0   0   0    0    0                     | R2-1 STRESS PERIOD 1 == STRESS PERIOD 1 == STRESS PERIOD 1 ==
 1                                                                | R2-4 <# wells)
 1.35e5                                                           | R2-5 <production rates> (first injection phase, -Q = inj.)   2
   555.        0.      0.95      0.25       50.        9.       1.0   .000001  | R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsmx> <d
 0   1   1   -1   -1   -1  110     0 0000    0   00    0    0    0| R2-13 Output Control
 1   0   0   0    0    0   0   0   0    0    0                     | R2-1 STRESS PERIOD 1 == STRESS PERIOD 1 == STRESS PERIOD 1 ==
 1                                                                | R2-4 <# wells)
     0                                                            | R2-5 <production rates> (first injection phase, -Q = inj.)   2.
   600.        0.      0.95      0.25       50.        9.       1.0   .000001  | R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsmx> <d
 0   1   1   -1   -1   -1  110     0 0000    0   00    0    0    0| R2-13 Output Control
 1   1   0   0    0    0   0   0   0    0    0
 1                                                                | R2-4 <# wells)
-1.35e5                                                          | R2-5 <production rates> (no pumping during this first SP)
 1   1   1   3    3    1                                         | R2-7-1 Define well <well #> <i> <j> <top lyr cmpltd> <bot lyr
  5.9E5       0.       80.       0.1                            | R2-7-2 <well index> <bot hol pres> <inj flu temp> <inj flu con

   700        0.      0.95      0.25       50.        9.       1.0     0.001       0|R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsm
 0   1   1   -1   -1   -1  211     0 0000    0   00    0    0    0| R2-13 Output Control
 1   0   0   0    0    0   0   0   0    0    0
 1
     0
   800        0.      0.95      0.25       50.   00   9.       1.0   0.00001
 0   1   1   -1   -1   -1  110     0 0000    0   00    0    0    0| r2-13
 1   0   0   0    0    0   0   0   0    0    0                     | R2-1 STRESS PERIOD 1 == STRESS PERIOD 1 == STRESS PERIOD 1 ==
 1
 1.35e5
   868        0.      0.95      0.25       50.        9.       1.0    .00001  | R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsmx> <d
 0   1   1   -1   -1   -1  211     0 0000    0   00    0    0    0| R2-13 Output Control
 1   0   0   0    0    0   0   0   0    0    0                     | R2-1 STRESS PERIOD 1 == STRESS PERIOD 1 == STRESS PERIOD 1 ==
 1                                                                | R2-4 <# wells)
     0                                                            | R2-5 <production rates> (first injection phase, -Q = inj.)   2
   900.        0.      0.95      0.25       50.        9.       1.0   .000001  | R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsmx> <d
 0   1   1   -1   -1   -1  110     0 0000    0   00    0    0    0| R2-13 Output Control
 1   1   0   0    0    0   0   0   0    0    0                     | R2-1 STRESS PERIOD 0 == STRESS PERIOD 0 == STRESS PERIOD 0 ==
 1                                                                | R2-4 <# wells)
-1.35e5                                                          | R2-5 <production rates> (no pumping during this first SP)
 1   1   1   3    3    1                                         | R2-7-1 Define well <well #> <i> <j> <top lyr cmpltd> <bot lyr
  5.9E5       0.       80.       0.1                            | R2-7-2 <well index> <bot hol pres> <inj flu temp> <inj flu con

  1000        0.      0.95      0.25       50.        9.       1.0     0.001       0|R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsm
 0   1   1   -1   -1   -1  211     0 0000    0   00    0    0    0| R2-13 Output Control
 1   0   0   0    0    0   0   0   0    0    0
 1
     0
  1100        0.      0.95      0.25       50.   00   9.       1.0   0.00001
 0   1   1   -1   -1   -1  110     0 0000    0   00    0    0    0| r2-13
 1   0   0   0    0    0   0   0   0    0    0                     | R2-1 STRESS PERIOD 1 == STRESS PERIOD 1 == STRESS PERIOD 1 ==

1.35e5
  1200.        0.      0.95      0.25       50.        9.       1.0    .00001  | R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsmx> <d
 0   1   1   -1   -1   -1  110     0 0000    0   00    0    0    0| R2-13 Output Control
 0   0   0   1    0    0   0   0   0    0    0                     | R2-1 STRESS PERIOD 1 == STRESS PERIOD 1 == STRESS PERIOD 1 ==
```

```
 1                                                                    | R2-4 <# wells)
-1.35e5                                                              | R2-5 <production rates> (first injection phase, -Q = inj.)   2
  1070.        0.       0.95       0.25        50.         9.        1.0   .000001  | R2-12 TIME-STEP SPECS <tchg> <dt> <dcmx> <dsmx> <d
 1    1    1   -1   -1   -1  110    0 0000    0    00    0    0    0| R2-13 Output Control
 0    0    0    1    0    0    0    0    0    0    0
```

10	30	50	70	90	110	130
150	170	190	220	260	300	340
380	420	460	500	540	580	635
710	785	860	935	1010	1085	1160
1235	1310	1400	1500	1600	1700	1800
1900	2000	2100	2200	2300	2400	2500
2600	2700	2800	2900	3000	3100	3200
3300	3400	3500	3600	3700	3800	3900
4000	4100	4200	4300	4400	4500	4600
4700	4800	4900	5000	5100	5200	5300
5400	5500	5600	5700	5800	5900	6000
6100	6200	6300	6400	6500	6600	6700
6800	6900	7000	7100	7200	7300	7400
7500	7600	7700	7800	7900	8000	8100
8200	8300	8400	8500	8600	8700	8800
8900	9000	9100	9200	9300	9400	9500
9600	9700	9800	9900	10000	10100	10200
10300	10400	10500	10600	10700	10800	10900
11000	11100	11200	11300	11400	11500	11600
11700	11800	11900	12000	12100	12200	12300
12400	12500	12600	12700	12800	12900	13000
13100	13200	13300	13400	13500	13600	13700
13800	13900	14000	14100	14200	14300	14400
14500	14600	14700	14800	14900	15000	15100
15200	15300	15400	15500	15600	15700	15800
15900	16000	16100	16200	16300	16450	16650
16850	17050	17250	17450	17650	17850	18050
18250	18450	18650	18850	19050	19250	19450
19650	19850	20050	20250	20450	20650	20850
21050	21250	21550	21950	22350	22750	23150
23550	23950	24350	25750	26150	26550	26950
27350	27750	28150	28550	28950	29350	29750
30150	30550	30950	31350	31750	32150	32550
32950	33350	33750	34150	35550		

MODEL CONTOUR OUTPUT
COLASR1.XYZ

1.000E+03	1054BRINE CONC.	
10.00000	55.00000	1.9179729E-20
10.00000	217.5000	9.2792271E-16
10.00000	392.5000	5.0502232E-11
'0.00000	547.5000	7.5860882E-07
10.00000	675.0000	4.7971283E-03
10.00000	747.5000	0.2084760
10.00000	802.5000	0.9996617
10.00000	855.0000	0.3439520
10.00000	902.5000	7.1991494E-02
20.00000	55.00000	1.6934164E-20
20.00000	217.5000	8.2202722E-16
20.00000	392.5000	4.4936311E-11
20.00000	547.5000	6.7911964E-07
20.00000	675.0000	4.3348379E-03
20.00000	747.5000	0.1905331
20.00000	802.5000	0.9996192
20.00000	855.0000	0.3172198
20.00000	902.5000	6.4667264E-02
30.00000	55.00000	1.6239804E-20
30.00000	217.5000	7.8601119E-16
30.00000	392.5000	4.2805476E-11
30.00000	547.5000	6.4367230E-07
30.00000	675.0000	4.1098752E-03
30.00000	747.5000	0.1782190
30.00000	802.5000	0.9995700
30.00000	855.0000	0.2911260
30.00000	902.5000	5.8100873E-02
40.00000	55.00000	1.5767336E-20
'0.00000	217.5000	7.6119898E-16
J.00000	392.5000	4.1318001E-11
40.00000	547.5000	6.1850975E-07
40.00000	675.0000	3.9512135E-03
40.00000	747.5000	0.1694944
40.00000	802.5000	0.9995158
40.00000	855.0000	0.2711613
40.00000	902.5000	5.2985598E-02
50.00000	55.00000	1.5346548E-20
50.00000	217.5000	7.3920428E-16
50.00000	392.5000	4.0007562E-11
50.00000	547.5000	5.9648143E-07
50.00000	675.0000	3.8132761E-03
50.00000	747.5000	0.1625621
50.00000	802.5000	0.9994571
50.00000	855.0000	0.2553121
50.00000	902.5000	4.8754243E-02
60.00000	55.00000	1.4940312E-20
60.00000	217.5000	7.1818820E-16
60.00000	392.5000	3.8770380E-11
60.00000	547.5000	5.7595386E-07
60.00000	675.0000	3.6852258E-03
60.00000	747.5000	0.1567697
60.00000	802.5000	0.9993941
60.00000	855.0000	0.2423801
40.00000	902.5000	4.5137551E-02
.00000	55.00000	1.4537991E-20
70.00000	217.5000	6.9761705E-16
70.00000	392.5000	3.7575521E-11
70.00000	547.5000	5.5642339E-07
70.00000	675.0000	3.5637030E-03

70.00000	747.5000	0.1517881
70.00000	802.5000	0.9993271
70.00000	855.0000	0.2315870
70.00000	902.5000	4.1982367E-02
80.00000	55.00000	1.4137497E-20
80.00000	217.5000	6.7736984E-16
80.00000	392.5000	3.6414613E-11
80.00000	547.5000	5.3772814E-07
80.00000	675.0000	3.4475861E-03
80.00000	747.5000	0.1474178
80.00000	802.5000	0.9992563
80.00000	855.0000	0.2223997
80.00000	902.5000	3.9191279E-02
90.00000	55.00000	1.3739769E-20
90.00000	217.5000	6.5746983E-16
90.00000	392.5000	3.5287099E-11
90.00000	547.5000	5.1982332E-07
90.00000	675.0000	3.3365202E-03
90.00000	747.5000	0.1435250
90.00000	802.5000	0.9991817
90.00000	855.0000	0.2144407
90.00000	902.5000	3.6697427E-02
100.0000	55.00000	1.3346611E-20
100.0000	217.5000	6.3798148E-16
100.0000	392.5000	3.4194710E-11
100.0000	547.5000	5.0269955E-07
100.0000	675.0000	3.2303935E-03
100.0000	747.5000	0.1400149
100.0000	802.5000	0.9991035
100.0000	855.0000	0.2074366
100.0000	902.5000	3.4452305E-02
110.0000	55.00000	1.2959826E-20
110.0000	217.5000	6.1896955E-16
110.0000	392.5000	3.3139301E-11
110.0000	547.5000	4.8635159E-07
110.0000	675.0000	3.1291381E-03
110.0000	747.5000	0.1368174
110.0000	802.5000	0.9990218
110.0000	855.0000	0.2011862
110.0000	902.5000	3.2419182E-02
120.0000	55.00000	1.2580906E-20
120.0000	217.5000	6.0048481E-16
120.0000	392.5000	3.2122108E-11
120.0000	547.5000	4.7076772E-07
120.0000	675.0000	3.0326588E-03
120.0000	747.5000	0.1338797
120.0000	802.5000	0.9989368
120.0000	855.0000	0.1955401
120.0000	902.5000	3.0569266E-02
130.0000	55.00000	1.2210956E-20
130.0000	217.5000	5.8256104E-16
130.0000	392.5000	3.1143591E-11
130.0000	547.5000	4.5592768E-07
130.0000	675.0000	2.9408164E-03
130.0000	747.5000	0.1311607
130.0000	802.5000	0.9988484
130.0000	855.0000	0.1903858
130.0000	902.5000	2.8879350E-02
140.0000	55.00000	1.1850731E-20
140.0000	217.5000	5.6521660E-16

140.0000	392.5000	3.0203522E-11
140.0000	547.5000	4.4180386E-07
140.0000	675.0000	2.8534323E-03
140.0000	747.5000	0.1286282
140.0000	802.5000	0.9987569
,40.0000	855.0000	0.1856378
140.0000	902.5000	2.7330292E-02
150.0000	55.00000	1.1500692E-20
150.0000	217.5000	5.4845741E-16
150.0000	392.5000	2.9301140E-11
150.0000	547.5000	4.2836350E-07
150.0000	675.0000	2.7702990E-03
150.0000	747.5000	0.1262564
150.0000	802.5000	0.9986622
150.0000	855.0000	0.1812303
150.0000	902.5000	2.5906018E-02
160.0000	55.00000	1.1161070E-20
160.0000	217.5000	5.3228000E-16
160.0000	392.5000	2.8435302E-11
160.0000	547.5000	4.1557073E-07
160.0000	675.0000	2.6911924E-03
160.0000	747.5000	0.1240244
160.0000	802.5000	0.9985645
160.0000	855.0000	0.1771118
160.0000	902.5000	2.4592838E-02
170.0000	55.00000	1.0831924E-20
170.0000	217.5000	5.1667422E-16
170.0000	392.5000	2.7604623E-11
170.0000	547.5000	4.0338839E-07
170.0000	675.0000	2.6158813E-03
'0.0000	747.5000	0.1219150
170.0000	802.5000	0.9984638
170.0000	855.0000	0.1732416
170.0000	902.5000	2.3378966E-02
180.0000	55.00000	1.0513189E-20
180.0000	217.5000	5.0162530E-16
180.0000	392.5000	2.6807575E-11
180.0000	547.5000	3.9177930E-07
180.0000	675.0000	2.5441350E-03
180.0000	747.5000	0.1199140
180.0000	802.5000	0.9983603
180.0000	855.0000	0.1695874
180.0000	902.5000	2.2254172E-02
190.0000	55.00000	1.0204708E-20
190.0000	217.5000	4.8711554E-16
190.0000	392.5000	2.6042563E-11
190.0000	547.5000	3.8070717E-07
190.0000	675.0000	2.4757287E-03
190.0000	747.5000	0.1180097
190.0000	802.5000	0.9982538
190.0000	855.0000	0.1661227
190.0000	902.5000	2.1209521E-02
200.0000	55.00000	9.9062600E-21
200.0000	217.5000	4.7312544E-16
200.0000	392.5000	2.5307983E-11
0.0000	547.5000	3.7013722E-07
∠00.0000	675.0000	2.4104467E-03
200.0000	747.5000	0.1161920
200.0000	802.5000	0.9981446
200.0000	855.0000	0.1628261

200.0000	902.5000	2.0237175E-02
210.0000	55.00000	9.6175827E-21
210.0000	217.5000	4.5963459E-16
210.0000	392.5000	2.4602254E-11
210.0000	547.5000	3.6003651E-07
210.0000	675.0000	2.3480849E-03
210.0000	747.5000	0.1144523
210.0000	802.5000	0.9980327
210.0000	855.0000	0.1596795
210.0000	902.5000	1.9330225E-02
220.0000	55.00000	9.3383853E-21
220.0000	217.5000	4.4662226E-16
220.0000	392.5000	2.3923846E-11
220.0000	547.5000	3.5037414E-07
220.0000	675.0000	2.2884516E-03
220.0000	747.5000	0.1127833
220.0000	802.5000	0.9979182
220.0000	855.0000	0.1566680
220.0000	902.5000	1.8482572E-02
230.0000	55.00000	9.0683602E-21
230.0000	217.5000	4.3406784E-16
230.0000	392.5000	2.3271291E-11
230.0000	547.5000	3.4112129E-07
230.0000	675.0000	2.2313678E-03
230.0000	747.5000	0.1111787
230.0000	802.5000	0.9978010
230.0000	855.0000	0.1537788
230.0000	902.5000	1.7688810E-02
240.0000	55.00000	8.8071909E-21
240.0000	217.5000	4.2195110E-16
240.0000	392.5000	2.2643195E-11
240.0000	547.5000	3.3225121E-07
240.0000	675.0000	2.1766674E-03
240.0000	747.5000	0.1096330
240.0000	802.5000	0.9976813
240.0000	855.0000	0.1510011
240.0000	902.5000	1.6944138E-02
250.0000	55.00000	8.5545580E-21
250.0000	217.5000	4.1025241E-16
250.0000	392.5000	2.2038238E-11
250.0000	547.5000	3.2373914E-07
250.0000	675.0000	2.1241964E-03
250.0000	747.5000	0.1081414
250.0000	802.5000	0.9975591
250.0000	855.0000	0.1483255
250.0000	902.5000	1.6244286E-02
260.0000	55.00000	8.3101436E-21
260.0000	217.5000	3.9895283E-16
260.0000	392.5000	2.1455177E-11
260.0000	547.5000	3.1556221E-07
260.0000	675.0000	2.0738124E-03
260.0000	747.5000	0.1066995
260.0000	802.5000	0.9974345
260.0000	855.0000	0.1457438
260.0000	902.5000	1.5585446E-02
270.0000	55.00000	8.0736344E-21
270.0000	217.5000	3.8803420E-16
270.0000	392.5000	2.0892846E-11
270.0000	547.5000	3.0769936E-07
270.0000	675.0000	2.0253842E-03

270.0000	747.5000	0.1053038
270.0000	802.5000	0.9973074
270.0000	855.0000	0.1432489
270.0000	902.5000	1.4964214E-02
280.0000	55.00000	7.8447234E-21
280.0000	217.5000	3.7747915E-16
280.0000	392.5000	2.0350149E-11
280.0000	547.5000	3.0013113E-07
280.0000	675.0000	1.9787904E-03
280.0000	747.5000	0.1039507
280.0000	802.5000	0.9971781
280.0000	855.0000	0.1408345
280.0000	902.5000	1.4377543E-02
290.0000	55.00000	7.6231125E-21
290.0000	217.5000	3.6727117E-16
290.0000	392.5000	1.9826060E-11
290.0000	547.5000	2.9283962E-07
290.0000	675.0000	1.9339193E-03
290.0000	747.5000	0.1026373
290.0000	802.5000	0.9970464
290.0000	855.0000	0.1384950
290.0000	902.5000	1.3822700E-02
300.0000	55.00000	7.4085126E-21
300.0000	217.5000	3.5739452E-16
300.0000	392.5000	1.9319620E-11
300.0000	547.5000	2.8580832E-07
300.0000	675.0000	1.8906678E-03
300.0000	747.5000	0.1013610
300.0000	802.5000	0.9969124
300.0000	855.0000	0.1362253
300.0000	902.5000	1.3297228E-02
310.0000	55.00000	7.2006447E-21
310.0000	217.5000	3.4783429E-16
310.0000	392.5000	1.8829930E-11
310.0000	547.5000	2.7902200E-07
310.0000	675.0000	1.8489405E-03
310.0000	747.5000	0.1001193
310.0000	802.5000	0.9967762
310.0000	855.0000	0.1340211
310.0000	902.5000	1.2798914E-02
320.0000	55.00000	6.9992407E-21
320.0000	217.5000	3.3857634E-16
320.0000	392.5000	1.8356151E-11
320.0000	547.5000	2.7246661E-07
320.0000	675.0000	1.8086497E-03
320.0000	747.5000	9.8909936E-02
320.0000	802.5000	0.9966379
320.0000	855.0000	0.1318782
320.0000	902.5000	1.2325759E-02
330.0000	55.00000	6.8040427E-21
330.0000	217.5000	3.2960727E-16
330.0000	392.5000	1.7897497E-11
330.0000	547.5000	2.6612918E-07
330.0000	675.0000	1.7697138E-03
330.0000	747.5000	9.7731043E-02
330.0000	802.5000	0.9964974
330.0000	855.0000	0.1297931
330.0000	902.5000	1.1875957E-02
340.0000	55.00000	6.6148041E-21
340.0000	217.5000	3.2091441E-16

340.0000	392.5000	1.7453230E-11
340.0000	547.5000	2.5999769E-07
340.0000	675.0000	1.7320579E-03
340.0000	747.5000	9.6580770E-02
340.0000	802.5000	0.9963548
340.0000	855.0000	0.1277625
340.0000	902.5000	1.1447871E-02
350.0000	55.00000	6.4312886E-21
350.0000	217.5000	3.1248577E-16
350.0000	392.5000	1.7022664E-11
350.0000	547.5000	2.5406107E-07
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350.0000	747.5000	9.5457467E-02
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860.0000	902.5000	2.1911345E-03
870.0000	55.00000	1.4143378E-21
870.0000	217.5000	7.7489208E-17
870.0000	392.5000	4.8069158E-12
870.0000	547.5000	8.3083592E-08
870.0000	675.0000	6.4131908E-04

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870.0000	802.5000	0.9863903
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870.0000	902.5000	2.1247955E-03
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880.0000	217.5000	7.5239312E-17
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880.0000	547.5000	8.1240535E-08
880.0000	675.0000	6.2954507E-04
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890.0000	547.5000	7.9430049E-08
890.0000	675.0000	6.1795134E-04
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900.0000	675.0000	6.0653412E-04
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1350.000	675.0000	2.3446625E-04
1350.000	747.5000	3.1365107E-02
1350.000	802.5000	0.9648724
1350.000	855.0000	2.8035659E-02
1350.000	902.5000	4.4157747E-04
1360.000	55.00000	2.1201086E-22
1360.000	217.5000	1.3996374E-17
1360.000	392.5000	1.0640505E-12
1360.000	547.5000	2.3083614E-08
1360.000	675.0000	2.2873889E-04
1360.000	747.5000	3.0913149E-02
1360.000	802.5000	0.9638300
1360.000	855.0000	2.7527740E-02
1360.000	902.5000	4.2617667E-04
1370.000	55.00000	2.0236510E-22
1370.000	217.5000	1.3420774E-17
1370.000	392.5000	1.0254281E-12
1370.000	547.5000	2.2371526E-08
1370.000	675.0000	2.2310427E-04
1370.000	747.5000	3.0463086E-02
1370.000	802.5000	0.9627342
1370.000	855.0000	2.7025379E-02
1370.000	902.5000	4.1125688E-04
1380.000	55.00000	1.9308660E-22
1380.000	217.5000	1.2864457E-17
1380.000	392.5000	9.8790434E-13
1380.000	547.5000	2.1675611E-08
1380.000	675.0000	2.1756160E-04
1380.000	747.5000	3.0014922E-02
1380.000	802.5000	0.9615821
1380.000	855.0000	2.6528540E-02
1380.000	902.5000	3.9680491E-04
1390.000	55.00000	1.8416460E-22
1390.000	217.5000	1.2326951E-17
1390.000	392.5000	9.5145818E-13
1390.000	547.5000	2.0995654E-08
1390.000	675.0000	2.1211012E-04
1390.000	747.5000	2.9568660E-02
1390.000	802.5000	0.9603707
1390.000	855.0000	2.6037190E-02
1390.000	902.5000	3.8280787E-04
1400.000	55.00000	1.7558857E-22
1400.000	217.5000	1.1807793E-17
1400.000	392.5000	9.1606869E-13
1400.000	547.5000	2.0331438E-08
1400.000	675.0000	2.0674908E-04
1400.000	747.5000	2.9124304E-02
1400.000	802.5000	0.9590968
1400.000	855.0000	2.5551294E-02

1400.000	902.5000	3.6925320E-04
1410.000	55.00000	1.6734813E-22
1410.000	217.5000	1.1306523E-17
1410.000	392.5000	8.8171515E-13
1410.000	547.5000	1.9682748E-08
1410.000	675.0000	2.0147775E-04
1410.000	747.5000	2.8681862E-02
1410.000	802.5000	0.9577573
1410.000	855.0000	2.5070822E-02
1410.000	902.5000	3.5612865E-04
1420.000	55.00000	1.5943312E-22
1420.000	217.5000	1.0822688E-17
1420.000	392.5000	8.4837699E-13
1420.000	547.5000	1.9049372E-08
1420.000	675.0000	1.9629540E-04
1420.000	747.5000	2.8241343E-02
1420.000	802.5000	0.9563489
1420.000	855.0000	2.4595743E-02
1420.000	902.5000	3.4342224E-04
1430.000	55.00000	1.5183356E-22
1430.000	217.5000	1.0355841E-17
1430.000	392.5000	8.1603381E-13
1430.000	547.5000	1.8431096E-08
1430.000	675.0000	1.9120132E-04
1430.000	747.5000	2.7802758E-02
1430.000	802.5000	0.9548681
1430.000	855.0000	2.4126028E-02
1430.000	902.5000	3.3112231E-04
1440.000	55.00000	1.4453967E-22
1440.000	217.5000	9.9055425E-18
40.000	392.5000	7.8466540E-13
1440.000	547.5000	1.7827709E-08
1440.000	675.0000	1.8619483E-04
1440.000	747.5000	2.7366120E-02
1440.000	802.5000	0.9533114
1440.000	855.0000	2.3661647E-02
1440.000	902.5000	3.1921748E-04
1450.000	55.00000	1.3754187E-22
1450.000	217.5000	9.4713570E-18
1450.000	392.5000	7.5425169E-13
1450.000	547.5000	1.7239000E-08
1450.000	675.0000	1.8127522E-04
1450.000	747.5000	2.6931446E-02
1450.000	802.5000	0.9516753
1450.000	855.0000	2.3202575E-02
1450.000	902.5000	3.0769663E-04
1460.000	55.00000	1.3083076E-22
1460.000	217.5000	9.0528568E-18
1460.000	392.5000	7.2477279E-13
1460.000	547.5000	1.6664758E-08
1460.000	675.0000	1.7644183E-04
1460.000	747.5000	2.6498750E-02
1460.000	802.5000	0.9499559
1460.000	855.0000	2.2748785E-02
1460.000	902.5000	2.9654891E-04
70.000	55.00000	1.2439712E-22
1470.000	217.5000	8.6496200E-18
1470.000	392.5000	6.9620898E-13
1470.000	547.5000	1.6104773E-08
1470.000	675.0000	1.7169397E-04

1470.000	747.5000	2.6068054E-02
1470.000	802.5000	0.9481494
1470.000	855.0000	2.2300252E-02
1470.000	902.5000	2.8576373E-04
1480.000	55.00000	1.1823195E-22
1480.000	217.5000	8.2612311E-18
1480.000	392.5000	6.6854070E-1

PART II

CLASS V UIC PERMIT APPLICATION
RECLAIMED WATER ASR PROJECT

Florida Department of Environmental Protection

Twin Towers Office Bldg., 2600 Blair Stone Road, Tallahassee, Florida 32399-2400

DEP Form No:	62-528.900(1)
Form Title:	Application to Construct/ Operate/Abandon Class I, III, or V Injection Well Systems
Effective Date:	
DEP Application No.:	(Filled in by DEP)

APPLICATION TO CONSTRUCT/OPERATE/ABANDON CLASS I, III, OR V INJECTION WELL SYSTEMS

Part I. Directions

A. All applicable items must be completed in full in order to avoid delay in processing this application. Where attached sheets or other technical documentation are utilized in lieu of the blank space provided, indicate appropriate cross-reference in the space and provide copies to the Department in accordance with C. below. Where certain items do not appear applicable to the project, indicate N/A in the appropriate spaces.

B. All information is to be typed or printed in ink.

C. Four (4) copies of this application and four (4) copies of supporting information such as plans, reports, drawings and other documents shall be submitted to the appropriate District/Subdistrict office. An engineering report is also required to be submitted to support this application pursuant to the applicable sections of Rule 62-528, F.A.C. The attached list* shall be used to determine completeness of supporting data submitted or previously received. A check for the application fee in accordance with Rule 62-4.050, F.A.C., made payable to the Department shall accompany the application.

D. For projects involving construction, this application is to be accompanied by four (4) sets of engineering drawings, specifications and design data as prepared by a Professional Engineer registered in Florida, where required by Chapter 471, Florida Statutes.

E. Attach 8 1/2" x 11" USGS site location map indicating township, range and section and latitude/longitude for the project.

PART II. General Information

A. Applicant Name Collier Co. Water-Sewer District Title Wastewater Director

Address 3301 Tamiami Trail East, Bldg. H

City Naples State Florida Zip 34112

Telephone Number (941) 732-2554

B. Project Status: ☒ New ☐ Existing

☐ Modification (specify) _____

*"Engineering and Hydrogeologic Data Required for Support of Application to Construct, Operate and Abandon Class I, III, or V Injection Wells"

C. Well Type: ☐ Exploratory Well ☒ Test/Injection Well

D. Type of Permit Application

- ☐ Class I Test/Injection Well Construction and Testing Permit
- ☐ Class I Well Operation Permit
- ☐ Class I Well Operation Repermitting
- ☐ Class I Well Plugging and Abandonment Permit
- ☐ Class III Well Construction/Operation/Plugging and Abandonment Permit
- ☐ Class I Exploratory Well Construction and testing Permit
- ☒ Class V Well Construction Permit
- ☐ Class V Well Operation Permit
- ☐ Class V Well Plugging and Abandonment Permit
- ☐ Monitor Well Only

E. Facility Identification:

Name Pelican Bay Wellfield

Facility Location: Street Livingston Road

City Naples County Collier

SIC Code(s) 4941

F. Proposed facility located on Indian Lands: Yes ☐ No ☒

G. Well Identification:

Well No. 1 of 1 Wells
(total #)

Purpose (Proposed Use) ASR Well for Reclaimed Water

Well Location: Latitude: 26 ° 16 ' 59 " Longitude: 81 ° 45 ' 13.5 "
(attach separate sheet(s), if necessary, for multiple wells)

Subpart B. General Project Description:

H. General Project Description: Describe the nature, extent and schedule of the injection well project. Refer to existing and/or future pollution control facilities, expected improvement in performance of the facilities and state whether the project will result in full compliance with the requirements of Chapter 403, F.S., and all rules of the Department. Attach additional sheet(s) if necessary or cross-reference the engineering report.

ASR wells to store and recover reclaimed water (See accompanying engineering report).

DEP Form No:	62-528.900(1)
Form Title:	Application to Construct/ Operate/Abandon Class I, III, or V Injection Well Systems
Effective Date:	
DEP Application No.:	(Filled in by DEP)

PART III. Statement by Applicant and Engineer

A. Applicant

I, the owner/authorized representative* of _____, certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. I understand that this certification also applies to all subsequent reports submitted pursuant to this permit. Where construction is involved, I agree to retain the design engineer, or other professional engineer registered in Florida, to provide inspection of construction in accordance with Rule 62-528.455(1)(c), F.A.C.

Joseph B Cheatham — Signed

9-6-02 — Date

Joseph B. Cheatham, Wastewater Director — Name and Title (Please Type)

(941) 732-2554 — Telephone Number

*Attach a Letter of Authorization.

B. Professional Engineer Registered in Florida

This is to certify that the engineering features of this injection well have been designed/examined by me and found to be in conformity with modern engineering principles applicable to the disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgement, that the well, when properly maintained and operated, will discharge the effluent in compliance with all applicable statutes of the State of Florida and the rules of the Department. It is also agreed that the undersigned will furnish the applicant a set of instructions for proper maintenance and operation of the well.

Signed

Lloyd E. Horvath
Name (Please Type)

Water Resource Solutions
Company Name (Please Type)

(Please Affix Seal)

428 Pine Island Road, S.W., Cape Coral, Florida 33991
Mailing Address (Please Type)

Florida Registration No. 25260 Date 8/23/02 Phone No. (239) 574-1919

ENGINEERING AND HYDROLOGIC DATA REQUIRED FOR SUPPORT OF APPLICATION TO CONSTRUCT, OPERATE, AND ABANDON CLASS I, III, OR V INJECTION WELL SYSTEMS

The following information shall be provided for each type of permit application.

A. CLASS I TEST/INJECTION WELL CONSTRUCTION AND TESTING PERMIT

1. A map showing the location of the proposed injection wells of well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, public water systems, mines (surface and subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of public record and pertinent information known to the applicant is required to be included on this map.

2. A tabulation of data on all wells within the area of review which penetrate into the proposed injection zone, confining zone, or proposed monitoring zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Department may require.

3. Maps and cross sections indicating the general vertical and lateral limits within the area of review of all underground sources of drinking water, their position relative to the injection formation and the direction of water movement, where known, in each underground source of drinking water which may be affected by the proposed injection.

4. Maps and cross sections detailing the hydrology and geologic structures of the local area.

5. Generalized maps and cross sections illustrating the regional geologic setting.

6. Proposed operating data.

   (a) Average and maximum daily rate and volume of the fluid to be injected;

   (b) Average and maximum injection pressure; and,

   (c) Source and an analysis of the chemical, physical, radiological and biological characteristics of injection fluids.

7. Proposed formation testing program to obtain an analysis of the chemical, physical and radiological characteristics of and other information on the injection zone.

8. Proposed stimulation program.

9. Proposed injection procedure.

10. Engineering drawings of the surface and subsurface construction details of the system.

11. Contingency plans to cope with all shut-ins or well failures, so as to protect the quality of the waters of the State as defined in Rule 62-3 and 62-520, F.A.C., including alternate or emergency discharge provisions.

12. Plans (including maps) and proposed monitoring data to be reported for meeting the monitoring requirements in Rule 62-528.425, F.A.C.

13. For wells within the area of review which penetrate the injection zone but are not properly completed or plugged, the corrective action proposed to be taken under Rule 62-528.300(5), F.A.C.

14. Construction procedures including a cementing and casing program, logging procedures, deviation checks, proposed methods for isolating drilling fluids from surficial aquifers, proposed blowout protection (if necessary), and a drilling, testing and coring program.

15. A certification that the applicant has ensured, through a performance bond or other appropriate means, the resources necessary to close, plug or abandon the well as required by Rule 62-528.435(9), F.A.C.

B. CLASS I INJECTION WELL OPERATION PERMIT

1. A report shall be submitted with each application for a Class I Well operating permit, which shall include, but not be limited to, the following information:

   (a) Results of the information obtained under the construction permit described in A. CLASS I TEST/INJECTION WELL CONSTRUCTION AND TESTING PERMIT, including:

      (1) All available logging and testing program data and construction data on the well or well field;

      (2) A satisfactory demonstration of mechanical integrity for all new wells pursuant to Rule 62-528.300(6), F.A.C;

      (3) The actual operating data, including injection pressures versus pumping rates where feasible, or the anticipated maximum pressure and flow rate at which the permittee will operate, if approved by the Department;

      (4) The actual injection procedure;

      (5) The compatibility of injected waste with fluids in the injection zone and minerals in both the injection zone and the confining zone; and,

      (6) The status of corrective action on defective wells in the area of review.

   (b) Record drawings, based upon inspections by the engineer or persons under his direct supervision, with all deviations noted;

   (c) Certification of completion submitted by the engineer of record;

   (d) If requested by the Department, operation manual including emergency procedures;

(e) Proposed monitoring program and data to be submitted;

(f) Proof that the existence of the well has been recorded on the surveyor's plan at the county courthouse; and,

(g) Proposed plugging and abandonment plan pursuant to Rule 62-528.435(2), F.A.C.

C. CLASS I WELL OPERATION REPERMITTING

1. An updated map showing the location of the injection wells or well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, public water systems, mines (surface and subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of pubic record and pertinent information known to the applicant is required to be included on this map.

2. A tabulation of data on all wells within the area of review which penetrate into the injection zone, confining zone, or monitoring zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Department may require.

3. Maps and cross sections indicating the general vertical and lateral limits within the area of review of all underground sources of drinking water, their position relative to the injection formation and the direction of water movement, where known, in each underground source of drinking water which may be affected by the injection.

4. Maps and cross sections detailing the hydrology and geologic structures of the local area.

5. Generalized maps and cross sections illustrating the regional geologic setting.

6. Contingency plans to cope with all shut-ins or well failures, so as to protect the quality of the waters of the State as defined in Rule 62-3 and 62-520, F.A.C., including alternate or emergency discharge provisions.

7. For wells within the area of review which penetrate the injection zone but are not properly completed or plugged, the corrective action proposed to be taken under Rule 62-528.300(5), F.A.C.

8. A certification that the applicant has ensured, through a performance bond or other appropriate means, the resources necessary to close, plug or abandon the well as required by Rule 62-528.435(9), F.A.C.

9. A report shall be submitted with each application for repermitting of Class I Well operation which shall include the following information:

   (a) All available logging and testing program data and construction data on the well or well field;

(b) A satisfactory demonstration of mechanical integrity for all wells pursuant to Rule 62-528.300(6), F.A.C.;

(c) The actual operating data, including injection pressures versus pumping rates where feasible, or the anticipated maximum pressure and flow rate at which the permittee will operate, if approved by the Department;

(d) The actual injection procedure;

(e) The compatibility of injected waste with fluids in the injection zone and minerals in both the injection zone and the confining zone;

(f) The status of corrective actin on defective wells in the area of review;

(g) Record drawings, based upon inspections by the engineer or persons under his direct supervision, with all deviations noted;

(h) Certification of completion submitted by the engineer of record;

(i) An updated operation manual including emergency procedures;

(j) Proposed revisions to the monitoring program or data to be submitted; and,

(k) Proposed plugging and abandonment plan pursuant to Rule 62-528.435(2), F.A.C.

D. CLASS I WELL PLUGGING AND ABANDONMENT PERMIT

1. The reasons for abandonment.

2. A proposed plan for plugging and abandonment describing the preferred and alternate methods, and justification for use.

   (a) The type and number of plugs to be used;

   (b) The placement of each plug including the elevation of the top and bottom;

   (c) The type and grade and quantity of cement or any other approved plugging material to be used; and,

   (d) The method for placement of the plugs.

3. The procedure to be used to meet the requirements of Rule 62-528.435, F.A.C.

E. CLASS III WELLS CONSTRUCTION/OPERATION/PLUGGING AND ABANDONMENT PERMIT

Construction Phase

1. A map showing the location of the proposed injection wells or well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, public water system, mines (surface and subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of public record and pertinent information known to the applicant is required to be included on this map.

2. A tabulation of data on all wells within the area of review which penetrate into the proposed injection zone, confining zone, or proposed monitoring zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Department may require.

3. Maps and cross sections indicating the general vertical and lateral limits within the area of review of all underground sources of drinking water, their position relative to the injection formation and the direction of water movement, where known, in each underground source of drinking water which may be affected by the proposed injection.

4. Maps and cross sections detailing the hydrology and geologic structures of the local area.

5. Generalized maps and cross sections illustrating the regional geologic setting.

6. Proposed operating data:

   (a) Average and maximum daily rate and volume of the fluid to be injected;

   (b) Average and maximum injection pressure; and,

   (c) Source and an analysis of the chemical, physical, radiological and biological characteristics of injection fluids, including any additives.

7. Proposed formation testing program to obtain an analysis of the chemical, physical and radiological characteristics of and other information on the injection zone.

8. Proposed stimulation program.

9. Proposed injection procedure.

10. Engineering drawings of the surface and subsurface construction details of the system.

11. Contingency plans to cope with all shut-ins or well failures or catastrophic collapse, so as to protect the quality of the waters of the State as defined in Rule 62-3 and 62-520, F.A.C., including alternate or emergency discharge provisions.

12. Plans (including maps) and proposed monitoring data to be reported for meeting the monitoring requirements in Rule 62-528.425, F.A.C.

13. For wells within the area of review which penetrate the injection zone but are not properly completed or plugged, the corrective action proposed to be taken under Rule 62-528.300(5), F.A.C.

14. Construction procedures including a cementing and casing program, logging procedures, deviation checks, proposed methods for isolating drilling fluids from surficial aquifers, and a drilling, testing and coring program.

15. A certificate that the applicant has ensured, through a performance bond or other appropriate means, the resources necessary to close, plug or abandon the well as required by Rule 62-528.435(9), F.A.C.

16. Expected changes in pressure, native fluid displacement, direction of movement of injection fluid.

17. A proposed monitoring plan, which includes a plan for detecting migration of fluids into underground sources of drinking water, a plan to detect water quality violation in the monitoring wells, and the proposed monitoring data to be submitted.

Operation Phase

1. The following information shall be provided to the Department prior to granting approval for the operation of the well or well field:

   (a) All available logging and testing program data and construction data on the well or well field;

   (b) A satisfactory demonstration of mechanical integrity for all new wells pursuant to Rule 62-528.300(6), F.A.C.;

   (c) The actual operating data, including injection pressure versus pumping rate where feasible, or the anticipated maximum pressure and flow rate at which the permittee will operate, if approved by the Department;

   (d) The results of the formation testing program;

   (e) The actual injection procedure; and,

   (f) The status of corrective action on defective wells in the area of review.

Plugging and abandonment Phase

1. The justification for abandonment.

2. A proposed plan for plugging and abandonment describing the preferred and alternate methods.

   (a) The type and number of plugs to be used;

   (b) The placement of each plug including the elevation of the top and bottom;

   (c) The type and grade and quantity of cement or any other approved plugging material to be used; and,

   (d) The method for placement of the plugs.

3. The procedure to be used to meet the requirements of Rule 62-528.435, F.A.C.

F. EXPLORATORY WELL CONSTRUCTION AND TESTING PERMIT

1. Conceptual plan of the injection project. Include number of injection wells, proposed injection zone, nature and volume of injection fluid, and proposed monitoring program.

2. Preliminary Area of Review Study. Include the proposed radius of the area of review with justification for that radius. Provide a map showing the location of the proposed injection well or well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, public water systems, mines (surface and subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of public record and pertinent information known to the applicant is required to be included on this map.

3. Proposed other uses of the exploratory well.

4. Drilling and testing plan for the exploratory well. The drilling plan must specify the proposed drilling program, sampling, coring, and testing procedures.

5. Abandonment Plan.

G. CLASS V WELL CONSTRUCTION PERMIT

(This form should be used for Class V Wells instead of Form 62-528.900(3), F.A.C., when there is a need for a Technical Advisory Committee and an engineering report.)

1. Type and number of proposed Class V Wells:

_____ Wells Receiving Domestic Waste

_____ Desalination Process Concentrate Wells (Reverse Osmosis, etc.)

__X__ Aquifer Storage and Recovery Wells using reclaimed water

_____ Aquifer Remediation Wells

_____ Salt-water Intrusion Barrier Wells

_____ Cooling Water Return Flow Wells Open-looped System

_____ Subsidence Control Wells

_____ Sand Backfill Wells

_____ Experimental Technology Wells

_____ Wells used to inject spent brine after halogen recovery

_____ Radioactive Waste Disposal Wells*

_____ Borehole Slurry Mining Wells

_____ Other non-hazardous Industrial or Commercial Disposal Wells

(explain) _____

_____ Other (explain) _____

*Provided the concentrations of the waste do not exceed drinking water standards contained in Chapter 62-550, F.A.C.

2. Project Description:

(a) Description and use of proposed injection system;

(b) Nature and volume of injected fluid (the Department may require an analysis including bacteriological analysis) in accordance with Rule 62-528.635(2)(b), F.A.C.; and,

(c) Proposed pretreatment.

3. Water well contractor's name, title, state license number, address, phone number and signature.

4. Well Design and Construction Details. (For multi-casing configurations or unusual construction provisions, an elevation drawing of the proposed well should be attached.)

   (a) Proposed total depth; 860 feet

   (b) Proposed depth and type of casing(s); 800 feet, fiberglass

   (c) Diameter of well; 16-inch top 220 feet, 12-inch bottom 580 feet

   (d) Cement type, depth, thickness; and, Type II

   (e) Injection pumps (if applicable): _____ gpm @ _____ psi

   Controls: _____

   _____

   _____

5. Water Supply Wells - When required by Rule 62-528.635(1), F.A.C., attach a map section showing the locations of all water supply wells within a one-half (1/2) mile radius of the proposed well. The well depths and casing depths should be included. When required by Rule 62-528.635(2), F.A.C., results of bacteriological examinations of water from all water supply wells within one-half (1/2) mile and drilled to approximate depth of proposed well should be attached.

6. Area of review (When required by Rule 62-528.300(4), F.A.C.)

   Include the proposed radius of the area of review with justification for that radius. Provide a map showing the location of the proposed injection well or well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, public water systems, mines (surface and subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of public record and pertinent information known to the applicant is required to be included on this map.

H. CLASS V WELL OPERATION PERMIT

(Final report of the construction that includes the following information may be submitted with the application to operate.)

1. Permit Number of Class V Construction Permit: _____

2. Owner's Name: _____

3. Type of Wells: _____

4. Construction and Testing Summary:

(a) Actual Dimensions:

Diameter (inches)	Well Depth (feet)	Casing Depth (feet)

(b) Result of Initial Testing

5. Proposed Operating Data:

(a) Injection Rate (GPM);

(b) Description of injected waste; and,

(c) Injection pressure and pump controls.

6. Proposed Monitoring Plan (if any):

(a) Number of monitoring wells;

(b) Depth(s);

(c) Parameters;

(d) Frequency of sampling; and,

(e) Instrumentation (if applicable) Flow _____

Pressure _____

I. CLASS V WELLS PLUGGING AND ABANDONMENT PERMIT

1. Permit number of Class V construction or operating permit.

2. Type of well.

3. Proposed plugging procedures, plans and specifications.

4. Reasons for abandonment.

J. MONITOR WELL PERMIT

This section should be used only when application is made for a monitor well only. If a monitor well is to be constructed under a Class I, III, or V injection well construction permit, it is necessary to fill in this section.

1. A site map showing the location of the proposed monitor wells for which a permit is sought. The map must be to scale and show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, water wells and other pertinent surface features including structures and roads.

2. Maps and cross sections indicating the general vertical and lateral limits within the area of review of all underground sources of drinking water, their position relative to the injection formation and the direction of water movement, where known, in each underground source of drinking water which may be affected by the proposed injection.

3. Maps and cross sections detailing the hydrology and geologic structures of the local area.

4. Generalized maps and cross sections illustrating the regional geologic setting.

5. Proposed formation testing program to obtain an anlysis of the chemical, physical and radiological characteristics of and other information on the monitor zone(s).

6. Proposed monitoring procedure.

7. Engineering drawings of the surface and subsurface construction details of the monitoring system.

8. Proposed monitoring data to be reported for meeting the monitoring requirements in Rule 62-528.425, F.A.C.

9. Construction procedures including a cementing and casing program, logging procedures, deviation checks, proposed methods for isolating drilling fluids from surficial aquifers, proposed blowout protection (if necessary), and a drilling, testing and coring program

10. Monitor Well Information:

☐ On-site ☐ Multizone ☐ Single-zone

☐ Regional ☐ Other (specify) _____

Proposed Monitoring Interval(s) _____

Distance and Direction From Associated Injection Well _____

_____

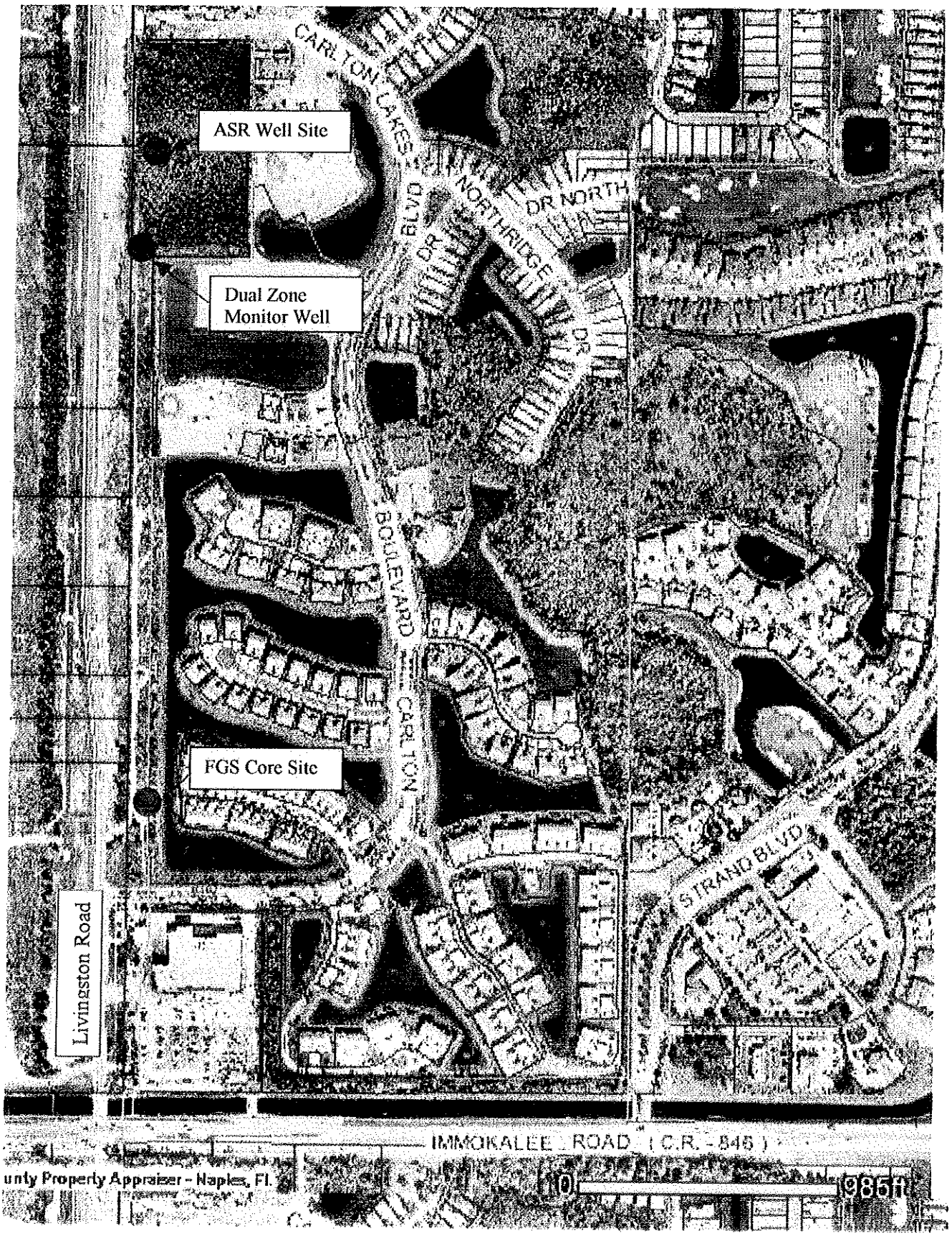
TABLES

TABLE 3010.1

GEOPHYSICAL LOGGING PROGRAM
COLLIER COUNTY ASR EXPLORATION WELL

ASR Exploration Well	Gamma Ray	Caliper	Dual Induction	Temperature	BHC Sonic-VDL	Flow Survey	Video	Fluid Flowing Resistivity
Drill 12.25-inch pilot hole to 320 feet	X		X		X			
Ream 32-inch hole to 320 feet	X	X						
Grout Casing				X				
Drill 12.25-inch pilot hole to 860 feet	X	X	X		X	X	X	X
Ream hole to 790 feet	X	X						
Cement casing to 790 feet +				X			X	

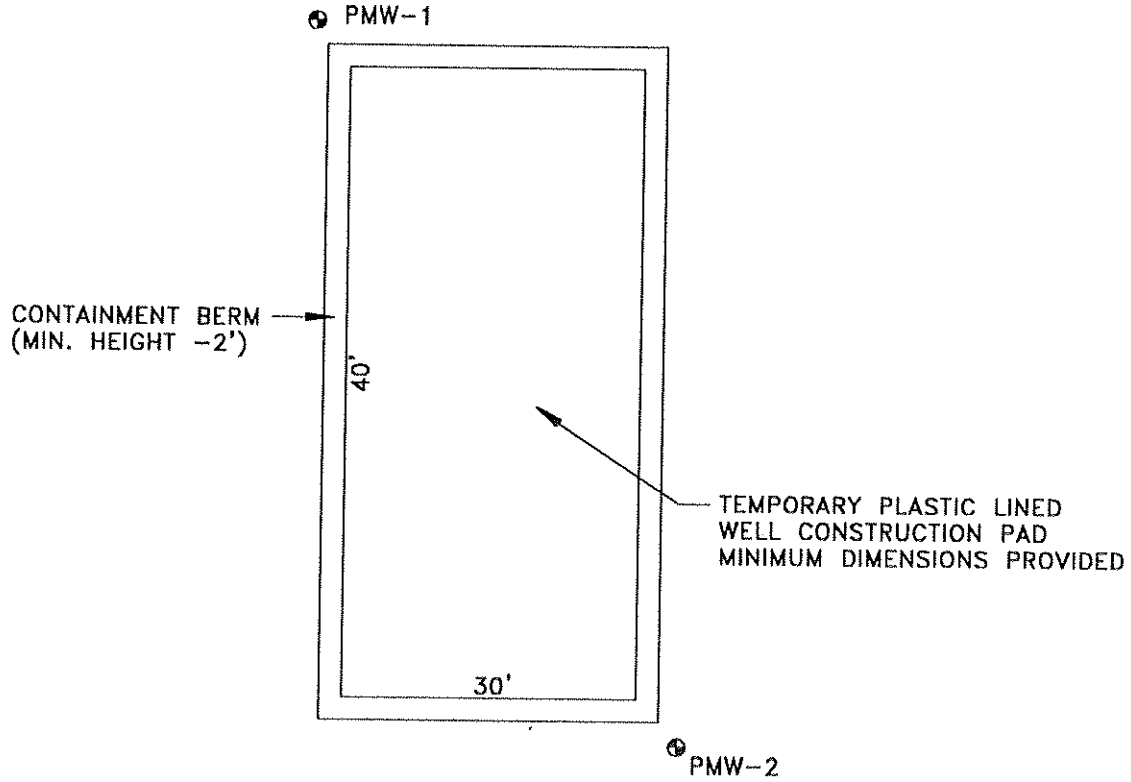
DRAWINGS

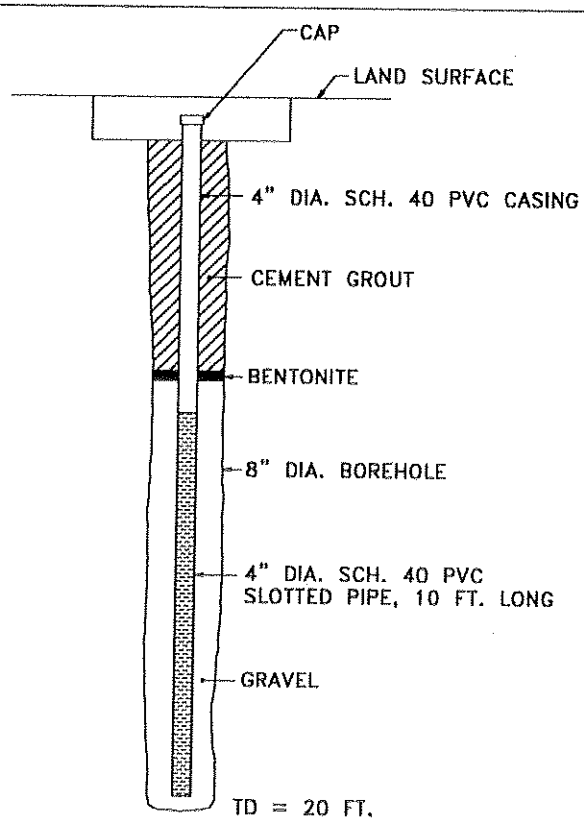


Water Resource Solutions

Project Collier County– ASR
Project Number: 01-0.02 Date: 8-11-02

Drawing 1.1 Location of Sites for the Collier County Reclaimed Water ASR Test Wells

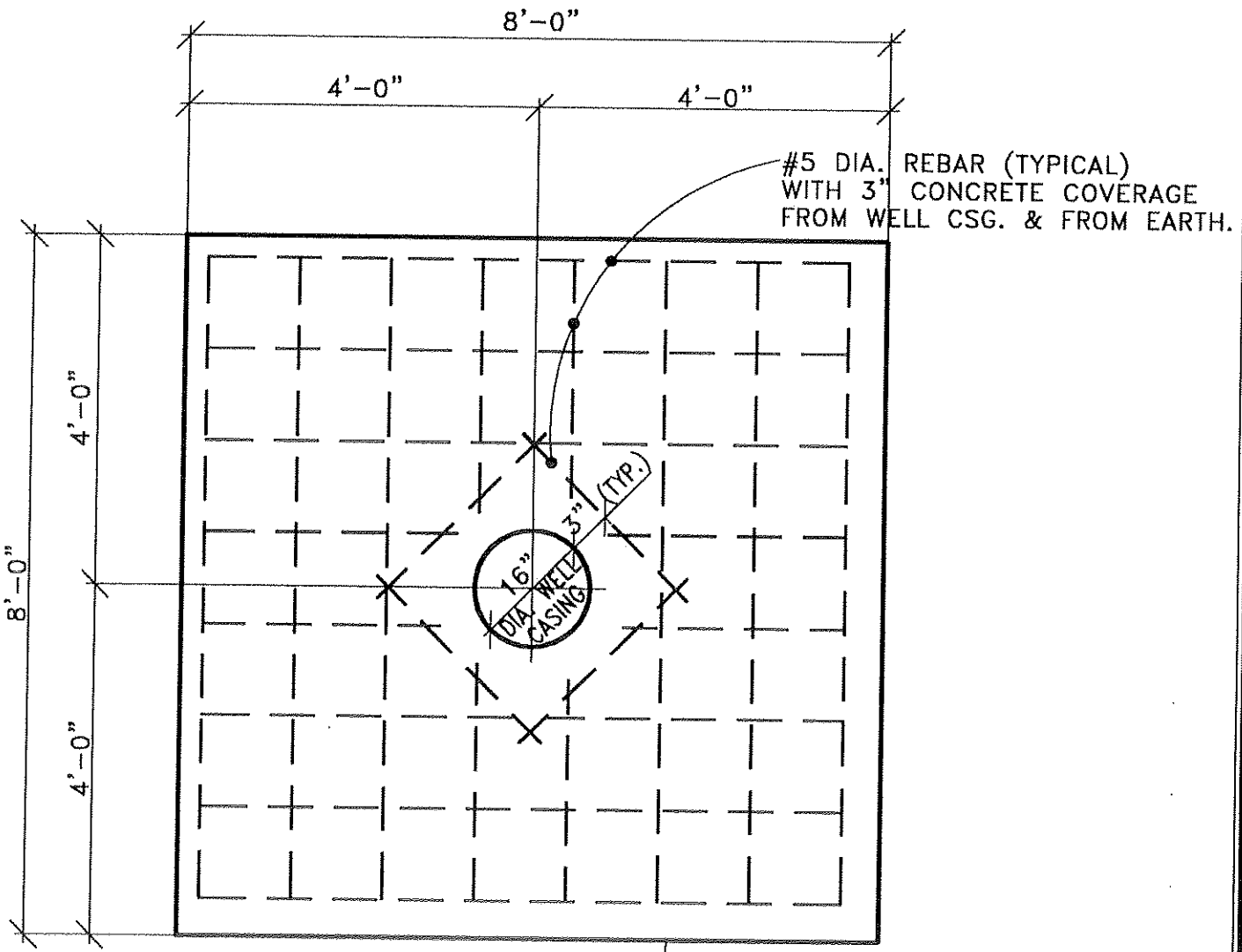




PAD MONITOR WELL CONSTRUCTION DETAILS

Water Resource Solutions	PROJECT NAME: COLLIER CTY ASR	DWG. NUMBER: A-013946PM2-3
	PROJECT NUMBER: 01-03946.A3	DATE: 8/14/02

DRAWING 2. MINIMUM ASR DRILL PAD AND PAD MONITOR WELL DESIGN.



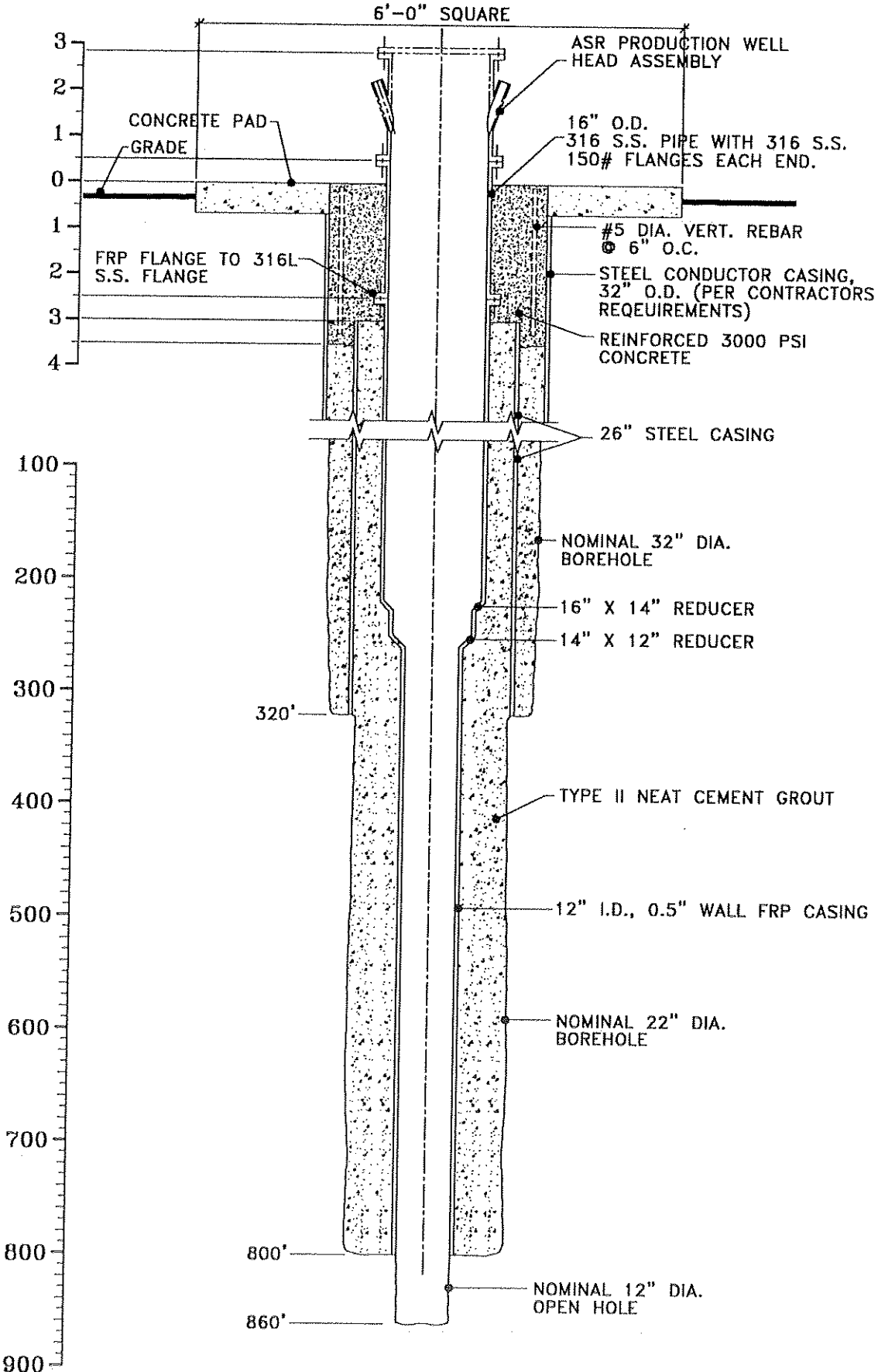
ASR WELL PAD PLAN

0 2

SCALE (FEET)

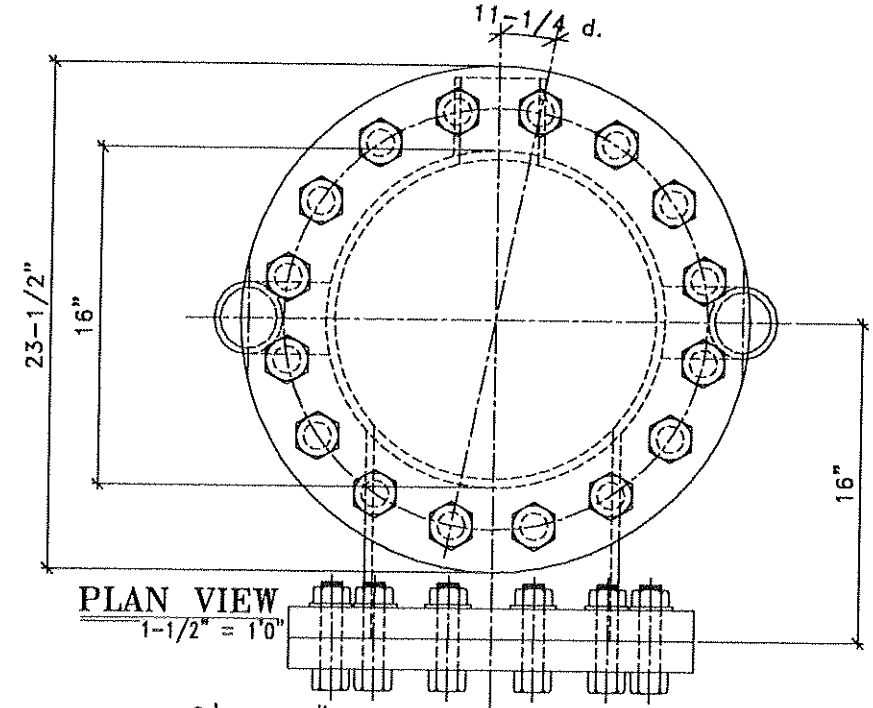
Water Resource Solutions	PROJECT NAME: COLLIER CTY ASR	DWG. NUMBER: A-013946NW-2
	PROJECT NUMBER: 01-03946.A3	DATE: 8/14/02

DRAWING 3. ASR WELL PAD CONSTRUCTION DETAIL.



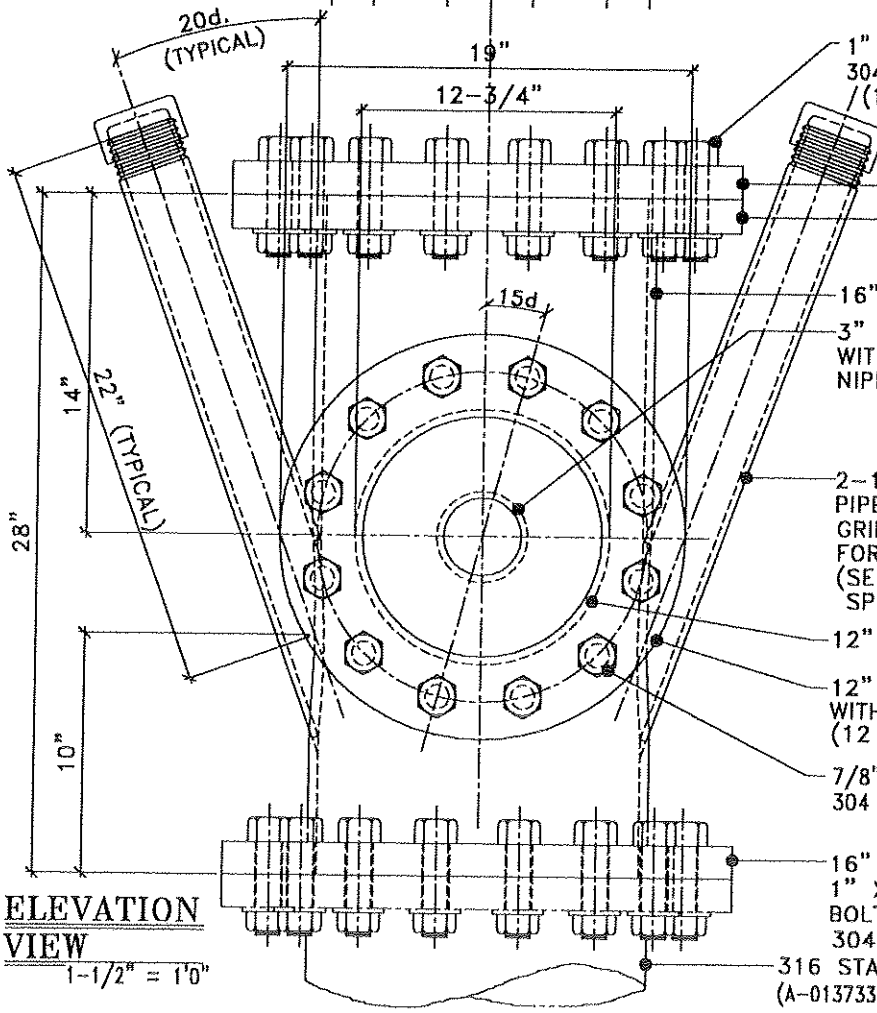
Water Resource Solutions	PROJECT NAME: COLLIER CTY ASR	DWG. NUMBER: A-013946WX-2
	PROJECT NUMBER: 01-03946.02	DATE: 8/14/02

DRAWING 4. ASR PRODUCTION WELL CROSS SECTION.



NOTE:

1. CONTRACTOR SHALL TERMINATE EACH EQUIPMENT PORT WITH A THREADED 2-1/2" 125# BRASS GATE VALVE, A THREADED BRASS NIPPLE AND A THREADED SCH 40 PVC PIPE CAP.



1" X 4-1/2" HEX HEAD 304 S.S. BOLT WITH 304 S.S.LOCKWASHER AND 304 S.S. HEX NUT /(16 REQ'D.)

16" SCH 80 PVC BLIND FLANGE

16" 316 S.S. 150# FLANGE

16" SCH. 40 316 S.S. PIPE

3" SCH. 40 316 S.S. THREADED PIPE WITH 125# S.S. GATE VALVE, S.S. NIPPLE & S.S. CAP. (FARSIDE)

2-1/2" SCH 40 THREADED 316 S.S. PIPE EQUIPMENT PORT. (TYP. 2 PLACES) GRIND INSIDE WELD SEAM SMOOTH FOR RUNNING TRANSDUCER LINES ETC. (SEE NOTE #1 FOR TERMINATION SPECIFICATIONS.)

12" SCH. 40 316 S.S. PIPE

12" 316 S.S. 150# FLANGE WITH 12" SCH 80 PVC BLIND FLANGE. (12 REQ,D.)

7/8" X 4-1/2" HEX HEAD 304 S.S. BOLT WITH 304 S.S.LOCKWASHER AND 304 S.S. HEX NUT

16" 316 S.S. 150# FLANGE WITH 1" X 4-1/2" HEX HEAD 304 S.S. BOLTS, 304 S.S. LOCKWASHER AND 304 S.S. HEX NUTS. (16 REQ'D.)

316 STAINLESS STEEL WELLCAP ADAPTER. (A-013733NY-2/FIG. 6)

Water Resource Solutions	PROJECT NAME: COLLIER CTY ASR	DWG. NUMBER: A-013946WH1-1
	PROJECT NUMBER: 01-03946.03	DATE: 8/7/02

DRAWING 5. ASR PRODUCTION WELLHEAD DIAGRAM.

PART III

TECHNICAL SPECIFICATIONS

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2000 GENERAL OPERATING REQUIREMENTS

2000.1 INTRODUCTION AND SCOPE

The work described in these Specifications and accompanying plans is for the construction and testing of one aquifer storage and recovery (ASR) well. The ASR well will be located near Collier County's Pelican Bay Wellfield which lies on the east side of Livingston Road and approximately 0.6 miles north of the Immokalee Road, Livingston Road intersection as shown on the accompanying plans (Drawing 1). The well location may be changed by the Engineer or Owner prior to the initiation of construction activities depending on site access constraints, hydrogeologic conditions, or other factors.

2000.2 DEFINITIONS

(1) AISI, where used in these Specifications shall mean American Iron and Steel Institute.

(2) ANSI where used in these Specifications shall mean American National Standards Institute.

(3) API where used in these Specifications shall mean American Petroleum Institute.

(4) ASTM where used in these Specifications shall mean American Society of Testing and Materials.

(5) AWWA where used in these Specifications shall mean American Water Works Association.

(6) FDEP where used in these Specifications shall mean the Florida Department of Environmental Protection.

(7) EPA where used in these Specifications shall mean the United States Environmental Protection Agency.

(8) USDA where used in these Specifications shall mean United States Department of Agriculture.

(9) OSHA where used in these Specifications shall mean Occupational Safety and Health Administration.

(10) SFWMD where used in the Specifications shall mean the South Florida Water Management District.

2000.3 PERMITS, CERTIFICATES, AND LICENSES

The Contractor shall procure all permits, certificates, and licenses required of him by law for the execution of the work. The Contractor shall comply with all Federal, State, and local regulations and ordinances relating to the performance of the work. The Engineer must be furnished a copy of each permit prior to commencing work.

2000.4 FDEP CONSTRUCTION PERMIT CRITERIA

The Contractor shall be familiar with all conditions of the ASR well construction permit and shall comply with all requirements of the permit as they relate to the well construction and testing program. A copy of the FDEP construction permit is presented in the Appendix to this document.

2000.5 LABOR AND MATERIALS

The Contractor shall be responsible for all labor, materials, transportation, tools, supplies, equipment, and appurtenances necessary to construct, develop, and test the wells as specified herein. In general, all methods and material used under this section shall be in accordance with the latest revisions of the American Water Works Association Standard for Deep Wells (AWWA A100-90) and the National Water Well Association Standards as they apply to the particular needs or conditions encountered in the proposed work.

2000.6 WORKING HOURS

The Contractor shall perform work on the site only within the designated official working hours as established by the local government, unless a special exception or permit is obtained from the local government by the Contractor and the working hours are approved by the Owner or the Engineer. Section 2000.10(2) provides additional restrictions on working hours and work activities. It is anticipated that normal drilling activities will be conducted 5 days per week, 12 hours per day between the hours of 6:00 A.M. and 8:00 P.M.

2000.7 EXTRA WORK

There are three categories of extra work: 1) drilling equipment and drilling crew performing additional tasks as required by the Owner or Engineer; 2) pump hoist and crew performing additional tasks as required by the Owner or Engineer; 3) crew performing extra work as required by the Owner or Engineer. All extra work must be approved in writing by the Owner or Engineer and documented on the Engineers daily report. No payment for extra work will be allowed unless written approval is granted. The Contractor shall be reimbursed for approved extra work at the hourly rates listed on the Bid Schedule.

2000.8 STANDBY TIME

The Engineer may order the Contractor to stop his operations so that extra work not included in the Specifications such as testing and additional data collection can be performed. The Engineer will advise the Contractor when he proposes to do this and will schedule his request so that it causes a minimum of delay. The Contractor will be reimbursed at hourly rates which will be listed in the Bid Proposal Form.

2000.9 TESTING AND DATA COLLECTION BY ENGINEER

The Engineer may order the Contractor to stop his operations so that previously unspecified testing and data collection by the Engineer can be performed. The Engineer will advise the Contractor when he proposes to do this and will schedule his request so that it causes a minimum of delay.

2000.10 REMEDIAL WORK

If remedial work proves to be necessary to make a well acceptable and come within applicable regulations and/or the Specifications because of mechanical problems, loss of tools in the hole, defective material, or for any other cause, the Contractor shall propose a method of correcting the problem in writing. Suggested methods shall be reviewed and approved by the Engineer before remedial work proceeds. Such work shall be performed at no additional cost to the Owner and shall not extend the length of the Contract. The Contractor is notified that all Specifications shall be met including hole straightness and setting of casings to the points designated by the Engineer.

2000.11 PUBLIC NUISANCE

(1) The Contractor shall not create a public nuisance including, but not limited to, encroachment on adjacent lands, flooding of adjacent lands, excessive noise, or odor.

(2) Sound levels measured by the Engineer or Owner shall not exceed 60 dBA from 6:00 A.M. to 8:00 P.M. The Contractor shall provide and maintain on site a hand-held decibel meter for recording noise levels. This sound level shall be measured at a distance of 400 feet, or at the exterior wall of the nearest residence, whichever is nearest to the drill site. Levels at the drilling equipment shall not exceed 85 dBA at any time. Sound levels in excess of these values are sufficient cause to have the work halted until equipment can be quieted to these levels. Work stoppage by the Engineer or Owner for excessive noise shall not relieve the Contractor of the other portions of this specification including, but not limited to, completion dates and bid amounts. Construction activities will not be conducted between 8:00 P.M. and 6:00 A.M. unless a variance is obtained from Collier County Code Enforcement.

(3) No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

2000.12 PROTECTION OF PROPERTY

The Contractor shall take special precautions to reduce to a minimum the nuisances and damage to property. Any damage to public or private property shall be immediately repaired or paid for by the Contractor at no expense to the Owner. Equipment, tools, and materials shall be located in places where they will produce a minimum of nuisance. The appropriate construction area warning signs shall be posted at each site. Upon completion of his work, the Contractor shall remove all drilling fluids and other materials from the drill site. No mud pits will be allowed at this site.

2000.13 CERTIFICATION OF CHEMICALS

All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval by either EPA or USDA. Use of all chemicals and disposal of residues including acid and recovered water from acidization shall be approved by the Engineer prior to use or disposal.

2000.14 TIME OF COMPLETION

The Contractor shall complete all work required in these specifications within the time period specified in the contract agreement. Drilling activities are anticipated to be conducted 5 days per week, 12 hours per day between the hours of 6:00 A.M. and 8:00 P.M.

2000.15 ENGINEER'S REPORT

The Contractor will prepare a daily report reflecting the pay items completed by the Contractor during the day. Each report will be signed by the Engineer and an authorized individual from the Contractor. The Engineer will be given a copy of the daily reports for his files daily.

2000.16 ABANDONMENT OF WELL(S) BY CONTRACTOR

Any hole in which the Contractor voluntarily stops work, and/or fails to complete in a satisfactory manner, in accordance with applicable regulations and/or the Specifications (and approved changes), shall be considered as abandoned by him. If the Engineer declares the hole abandoned by the Contractor, then no payment will be made for the abandoned hole. All abandoned holes shall be properly plugged and sealed by the Contractor at his own cost in accordance with federal, state, and local regulations. These

holes shall be replaced by the Contractor at his own expense. The Contractor shall submit his plan of action for abandonment and plugging in writing to the Engineer. Casing strings may be removed only with the permission and approval of the Engineer. The value of the work abandoned, and for which payment has been received by the Contractor, shall be retained from subsequent progress payments until such time as the hole is properly replaced by the Contractor.

2000.17 DEMOBILIZATION AND SITE RESTORATION

This will include the removal of all remaining drilling fluids and cuttings at the end of the project. At the completion of drilling, the Contractor shall remove all items and equipment which are not part of the completed well and leave the site in a condition acceptable to the owner. After demobilization is complete, the drilling area shall be clean and free of debris, holes, and/or piles of dirt, brush or other natural or synthetic materials. Any formally existing sod or landscape vegetation shall be replaced with vegetation equal to that destroyed or damaged.

2000.18 GUARANTEE

The Contractor guarantees that the work and service to be performed under the Contract and all workmanship, materials, and equipment performed, furnished, used, or installed for the work shall be free from defects and flaws, and shall be performed and furnished in strict accordance with the Contract Documents; that the strength of all parts of all manufactured equipment shall be adequate and as specified; and that performance test requirements of the Contract Documents shall be fulfilled. The Contractor shall repair, correct, or replace all damage to the work resulting from failures covered by the guarantee at no cost to the Owner. The guarantee shall remain in effect for one year from the date of final acceptance by the Owner.

END OF SECTION

2001 CONSTRUCTION OF ASR STORAGE WELLS AND MONITORING WELLS

2001.1 CONSTRUCTION SCHEDULE

The Contractor shall submit a detailed construction schedule before commencing any site work. The construction schedule shall include a proposed spud date for the ASR well.

2001.2 MOBILIZATION

The Contractor will set-up the equipment necessary to meet the quality of workmanship and the timeliness required by these specifications and to complete the work on schedule.

2001.3 SITE PREPARATION

The Contractor will provide site clearing, excavation and placing of structural fill as necessary to provide access to the site and a level work area for well construction. The Contractor shall submit a site preparation plan for approval by the Engineer and the Owner prior to commencing work.

2001.4 SURVEYING REQUIREMENTS

After final installation, the position of the ASR well and existing dual zone monitoring well will be given in metes and bounds, latitude and longitude, and NGVD elevation at land surface. The initial well location will be staked in the field by the Owner.

2001.5 DRILLING PAD AND PAD MONITORING WELLS

The Contractor shall build a suitable pad as a work floor for the drilling rig at the ASR well construction site. The pad shall be of sufficient size to accommodate the necessary rig and equipment. The Contractor shall submit his plans for construction of the pad to the Engineer for approval. A temporary well pad, as presented in Drawing 2 for the new ASR well will be required as a minimum during construction. Two pad monitoring wells, as presented in Drawing 2 , will also need to be constructed for the drilling pad. The final well pad for the ASR well, as provided in Drawing 3, will be required prior to demobilizing. The final pad shall be crack free upon demobilization and for one year after demobilization.

2001.6 WELL CONSTRUCTION SEQUENCE

The information provided in the following construction sequence outline is only approximate and is meant to be used to develop comparative bids. Actual well casing and open hole depths will vary depending on the specific subsurface conditions encountered. In addition, the well testing procedure described below may be changed in order of occurrence, or deleted, and additional work may be added.

ASR WELL

The basic well design for the ASR well is provided in Drawing 4. The following construction sequence is based on using 16 to12-inch I.D. tapered fiberglass production casing with a collapse pressure rating of 200 psi or higher.

1. Mobilize and prepare site (Section 2001.3).

2. A minimum 32-inch O.D., 0.375-inch wall pit casing will be set at a depth to be determined by the Contractor subject to review by the Engineer. This casing will be grouted in place using the pressure or tremmie method and neat cement (API Class B/ASTM Type II). The cement thickness around this casing should be equal to or greater than 2-inches. The top of the cement during grouting shall be returned to the surface.

3. Drill a nominal 12-inch diameter borehole to approximately 325 feet below land surface (bls) using the mud rotary method. The borehole should extend 10 to 20 feet into competent limestone. Perform inclination survey every 60 to 90 feet.

4. Conduct required geophysical logging (Section 3010).

5. Ream hole to nominal 32 inches. Perform inclination survey every 60 to 90 feet. Clean hole and perform caliper survey.

6. Install approximately 320 feet of 26-inch O.D., 0.375-inch wall steel surface casing.

7. Circulate mud until the return mud properties approach the properties of the injected mud. Pressure grout surface casing with neat cement. Provide Engineer with 24 hour and 72 hour compressive strength test data and two compressive strength test cement samples that can be tested at a later date. If the pressure required to bring returns to the surface, then the grouting of this casing will be accomplished in stages. Temperature logs will need to be performed after each stage to help locate the top of cement. Temperature logs should be run 6-8 hours after a cement stage. Top of cement should be tagged to verify top of cement locations. Contractor shall take appropriate measures to assure that the grouting operations does not exceed the strength of the casing. No cement stage should exceed 50% of the collapse rating of the casing.

8. Clean casing of drilling mud.

9. Drill a 12.25-inch diameter pilot hole using the reverse-air method from base of the surface casing to a point approximately 860 feet bls.

10. Collect clean water samples at every rod change during reverse air drilling of the pilot hole and during the drilling of additional open hole if required. Also monitor flow rates and monitor water levels as required (Section 3040).

11. Conduct required geophysical logging and specified flow tests (Sections 3010 and 3070) and video survey.

12. Ream pilot hole to 22 inches by the reverse air method to the casing setting depth as specified by the engineer (approximately 800 ft).

13. Conduct required geophysical logging (Section 3010).

14. Backfill the well with the drill cuttings to a point 5 feet below the casing set point. A small plug of cement should be set on top of the drill cuttings.

14A. As an alternative, the Contractor may elect to run a cement basket or other similar device on the fiberglass pipe. The tremmie method would than be used to pump all stages of cement and back plugging would not be required.

15. Install approximately 795 feet of 16-inch I.D. to 12-inch I.D. tapered fiberglass casing (Drawing 4) with centralizers as specified in Section 4000.7. The casing shall be run into the hole smoothly and without drag. Well casing shall be joined together following casing manufacturer specifications as required in Section 4000.

16. Grout the annulus with neat cement to a minimum of 100 feet above the bottom of the casing. The maximum surface pressure during this operation should not exceed 50% of the burst pressure of the 16-inch casing. Conduct required temperature log. The Contractor may decide to perform a preliminary pressure test on the casing prior to cementing the casing in place.

17. Grout the remaining annulus in stages to the surface with cement grout containing 4% bentonite by the tremie method. Contractor shall take appropriate measures to assure that the grouting operation does not exceed the strength of the casing. No cement stage should exceed 50% of the collapse rating of the casing. Conduct temperature logs to determine top of cement. Provide Engineer with 24 hour and 72 hour compressive strength test data for neat and 4% bentonite cement samples, and two compressive strength test cement samples for each cement mix that can be tested at a later date.

18. Run casing plumbness and alignment test.

19. Clean out open hole from the base of the production casing to approximately 860 feet bls using the reverse air technique and an 11-inch bit. This work should not begin for at least 24 hours after the last cement stage is performed.

20. Perform pressure test on casing. The pressure test should be conducted at minimum pressure of 110 psi to establish a maximum operating pressure of 73 psi.

21. Develop well, conduct video survey and conduct testing as specified in Section 3070.

22. Collect clean water samples for primary and secondary drinking water standards analysis and minimum criteria for sewage effluent (See Section 3020.2).

23. Conduct optional acid treatment of well (See Section 2010.12) if requested by Project Engineer.

24. Complete wellhead as shown in Drawing 5.

25. Once the ASR and monitor wells are installed, a well step test only will be performed (Section 3070) to evaluate response after the acid treatment.

26. Perform bacterial clearance in the ASR well after final testing when the well is complete.

END OF SECTION

2002 LOCAL GEOLOGIC CONDITIONS

It is anticipated that the boreholes will encounter beds of unconsolidated sand and shell, limestone, sandstone and clay to a depth of approximately +/- 250 feet below land surface. Swelling clays may occur in the geologic units present along the entire wellbore. If swelling clays or other problems are encountered, the drilling fluid and/or drilling technique should be modified so that the casing may be set in the appropriate position and the grouting of the wells can be accomplished as designed. The surface and production casings shall seal off all formations encountered along their entire length. Static hydraulic heads of 20 feet or more at pad level are expected in the carbonate rocks below 150 feet during reverse air drilling and will be encountered higher in the hole while drilling with mud. The Contractor should be prepared to prevent uncontrolled flow of water from the subsurface.

Information regarding subsurface conditions is intended to assist the Contractor in preparing his bid. The Owner or Engineer does not guarantee its accuracy or that it is necessarily indicative of conditions to be encountered in drilling the wells. The Contractor shall satisfy himself regarding all local conditions affecting his work by personal investigation and neither the information on local geology, nor that derived from maps or plans from the Owner or his agents or employees shall act to relieve the Contractor of any responsibility hereunder or from fulfilling any and all of the terms and requirements of the Contract and Specifications.

END OF SECTION

2010 DRILLING REQUIREMENTS

2010.1 GENERAL

All drilling muds will be circulated through mud tanks. No mud pits beyond a sump inside the drilling pad will be utilized. All drilling fluids from mud-rotary drilling activities shall be removed from the construction sites and discarded at an approved location. The Contractor shall furnish to the Engineer and Owner, prior to beginning construction, the name and location of his disposal site along with documentation that the site has been approved by the appropriate regulatory agencies. The fluid displaced from the borehole during cementing operations shall be considered excess drilling fluid and shall be disposed in an approved manner. All costs of disposal shall be included in the price of the well.

All drilling cuttings (mud rotary or reverse air) and fluids from reverse-air drilling and well testing activities shall be discharged to a closed mud tanks, designed to allow sediments to settle. The "solid free" water from reverse-air drilling may then be discharged to a sewer main previously utilized for this service, cuttings will be removed from the site.

2010.2 EQUIPMENT REQUIREMENTS

The Contractor shall use drilling equipment having the capabilities necessary to do the described work. Drilling and other equipment shall be provided in good working condition. Delays or work stoppages due to equipment failure will not be considered a valid reason for extending the length of the contract. The Contractor shall be held responsible and payment may be withheld for damages due to any cause of negligence, faulty operation, or equipment failure.

The Contractor shall provide and operate equipment capable of handling the largest load that will be placed upon the rigs' drilling and supporting equipment. If conditions develop in the field that prove the rig and supporting equipment supplied by the Contractor are incapable of completing a well, the Contractor will be required, at his own expense, to provide a larger rig with the necessary capacity.

2010.3 DRILLING METHODS

The hole for the pit casings will be drilled using the mud rotary system. The pit casing will be grouted in place. For the ASR well, the drilling and reaming of the surface hole will be performed using the mud rotary method. The reverse air method will be used for drilling and reaming operations below the surface casing set at approximately 320 feet bpl.

During all reaming operations, the Contractor shall incorporate the use of a lead bit or stinger and a staged drilling assembly to facilitate pilot hole tracking. Drilling mud shall

be conditioned and recirculated employing suitable devices such as screens, shale shakers, and desanders. Fluids from reverse-air drilling shall be discharged to steel tanks to remove cuttings and then discharged to the sewer system.

2010.4 DRILLING FLUIDS

Mud Density

The density of the drilling fluid should be in the range of 8.8 to 9.1 lbs/gal once intervals with pressures above pad level are encountered. Mud density should remain near 9 lbs/gal so that the well will not flow under static conditions. Excess solids build-up in the mud should be avoided. Care should be taken to prevent swabbing or pressurizing the well due to high viscosity, high gel strength muds while tripping the drill string in and out of the hole.

Mud Viscosity

Marsh funnel viscosity shall remain at or below 40 seconds when circulating prior to cementing. Marsh funnel viscosity of mud entering the hole during drilling operations shall meet these same requirements.

2010.5 WATER SUPPLY

Non-potable water from a nearby well will be available at the ASR site for Contractor use.

2010.6 WELL FLOW CONTROL

Potentiometric heads in the intervals to be drilled are expected to be above land surface. Thus, flowing conditions in wells under construction shall be kept under control at all times. Drilling mud only may be used as weight material to keep the drilling fluid at a density necessary to suppress the flow. Salt and naturally occurring brines such as those produced from oil wells shall not be used as drilling fluid. The use of salt as a weight material, except to kill the well during pump installation or other normal operations requiring flow control with an open wellhead, will not be allowed without approval of the FDEP and Engineer. Since flowing conditions are anticipated during the drilling of these wells, the Contractor shall furnish and install a suitable flow prevention equipment for the well. The flow preventer to be provided will be a commercially available, single annular preventer, or approved equivalent. Manufacturers specifications pertaining to the type of preventer proposed for use by the drilling contractor shall be approved by the Engineer before drilling of the well commences and shall be used during drilling operations below the pit casing to ensure the Contractor's capability to control potential flowing conditions. When no work is being done on the well, a flow preventer shall be put in place such that there will be no chance of flow from an untended well. Each well crew will demonstrate the

operation of the preventer on the well once per week in the presence of the Engineer to demonstrate proficiency in its operation. If flow does occur from a well, it will be the drillers responsibility to clean-up the water to the satisfaction of the Engineer and FDEP.

After periods when the use of a brine solutions is required to install test pumping equipment or permanent wellhead, brine must be removed completely from the well. This shall be performed by purging the well until specific conductance levels in the discharge water are consistently maintained at background values. All cost associated with brine use shall be included in the price of the wells. The brine plug must be contained by the Subcontractor for off-site disposal.

2010.7 STRAIGHT HOLE REQUIREMENTS - PLUMBNESS AND ALIGNMENT

All well boreholes shall be circular, straight, and plumb. No doglegs or departures from a straight line shall be permitted which will interfere with or prevent casings or pumps from being set to their required depths.

Once the final casing is set, the Contractor will demonstrate plumbness and alignment to 220 feet bpl by running a 40 feet long dummy with an outer diameter that is not more than 0.5 inches smaller than the inside diameter of the casing or hole being tested. The dummy unit, lowered on rigid tubing similar in diameter to the pump conductor pipe or as accepted by the Engineer, shall pass freely through the entire tested section. The Engineer may also direct the Contractor to test casing plumbness in accordance with AWWA A100-90 or acceptable revision. Costs for all plumbness and straightness tests shall be included in the price of the wells. The Contractor shall submit to the Engineer a remediation plan to repair the well if the well fails the plumbness and alignment requirements. If the well cannot be repaired, the well shall be plugged in accordance with current state and local requirements. A replacement well will be constructed at the Contractor's expense. In all cases, the casing must be lowered freely to the casing set point as selected by the Engineer.

2010.8 LOST CIRCULATION

Lost circulation conditions may be encountered while drilling with mud. The use of lost circulation materials (LCM) shall be restricted to those materials approved by the FDEP. Costs for any LCM should be included in the mobilization charges or per ft drilling charges.

2010.9 FORMATION SAMPLES

Two sets of formation samples (drill cuttings) shall be collected from the well at 5-foot intervals and at every formation change and drilling break. The samples shall be preserved in cloth sample sacks to be furnished by the Contractor. The sample containers shall be plainly marked with the well identification and shall show the depth below pad

level from which they were collected. The Contractor shall collect the samples, deliver them to the Engineer, and provide facilities acceptable to the Engineer for storage while the samples remain on site. The samples shall be of such volume that one set can later be divided by the Engineer into two sets (one for the Engineer, and one for the SWFWMD. The second set will be sent to Dr. Dan Arthur of the Florida Geological Survey.

2010.10 CEMENTING PROCEDURES

Grouting of all well casings will be accomplished in stages by means of a collarless tremie pipe, with the exception of the first cement stage, for each casing string unless otherwise authorized by the Engineer. The first cement stage will be pressure grouted with the bottom 100 feet of casing being grouted with neat cement. Before each cementing stage, the Contractor shall tag the top of the cement emplaced in the previous stage with a collarless tremie pipe and recondition the mud to assure proper mud displacement by the cement. The Contractor shall run a temperature log after each cement stage used to grout the longstring casing.

Procedures for each stage of cementing shall be continuous. If loss of circulation or no return of fluid is encountered, the Engineer shall be notified immediately of what remedial measures are underway to re-establish the circulation and complete the cementing program according to well design and specifications.

When casing is being set and cemented in place, it is the Contractor's responsibility to insure that operations are conducted in such a manner that the casing collapse and burst strengths (with safety factor) are not exceeded and the casings are not caused to fail. Initial grout volumes should be calculated accordingly to avoid busting the pipe at the surface during pressure grouting. A temperature log will be run at the appropriate time interval after grouting to determine the top of cement for the ASR well and any monitoring wells.

It may be necessary to plug back a portion of the borehole with cement and/or gravel fill. In such cases cementing or gravel shall be done through a tremie pipe or by a method proposed by the Contractor and approved by the Engineer.

The Contractor will provide data on the 24 hour and 72 hour compressive strength, for the first pressure grouting of the ASR well longstring casing and for one cement sample containing 4% bentonite. The Contractor will also provide two compressive. Strength cement samples for each cement mix that can be tested at a later date.

2010.11 DEVELOPMENT

The Contractor shall air-develop the ASR well until, to the satisfaction of the Engineer, the discharge water is free of sediments. The Contractor shall place the drill stem in the open-hole section and vary this height during pumping to enhance development of the entire open-hole section. The Contractor will frequently and regularly surge the well. The Contractor will provide a centrifugal sand sampling, or equivalent device, capable of quantifying sand content in the part per million range. The Contractor shall conduct periodic tests on the discharge water during later portions of the development period to confirm that sand content in the discharge has stabilized. Develop the well with compressed air discharged at a depth of approximately 100 feet. Air compressor should have a volume capability of 125 C.F.M. @ 100 psi.

1. Periodically surge the well for maximum development effect. Well should be developed for a minimum of 4 hours or until water is free from sediment for a period of at least 1 hour.

2. After development install a test pump and conduct a four-stage step-drawdown test (Section 3070) followed the next day by an aquifer performance test. The well shall be sealed at the pump head with an opening into the well fitted with a removable 1.5-inch hose thread valve to allow pressure head measurements when water level is above land surface and the entry of a water level probe when water levels are below land surface. The pump should be capable of pumping from 100 to 900 gpm. A Rossan sand-tester or other similar device should be provided to establish sand production rates for each flow rate.

2010.12 ACID STIMULATION

If it is determined to be appropriate by the Engineer, an acid stimulation treatment may be required. The following procedure will be employed if an acid treatment is required.

1. Using a wellhead of Contractor design and acceptable to the Engineer pump 3000 gallons of diluted hydrochloric acid (4 drums of 32% hydrochloric acid per 1000 gallon of water) into the well. One thousand gallons of acid should be pumped at a point 20 feet above the base of the casing. One thousand gallons should be pumped at a point 20 feet below the casing. One thousand gallons should be pumped from the base of the casing. Acid injection should be approved by the Engineer.

2. Displace acid into the open formation by pumping approximately 5,000 gallons of clean, filtered chase water down the casing.

3. The Contractor should monitor the internal casing pressure and periodically relieve the well casing of any gas by opening gas relief valve and allowing gas only to

escape. The gas-relief pipe (2-inch PVC or larger) should extend a minimum of 50 or more feet away from the well in order to carry gases away from the work area.

4. Water can begin to be recovered 30 minutes after the chase water has been injected.

5. Recover 15,000 gallons of water from the well and store for proper off-site disposal. Continue to recover water from the well until water is clear with a conductivity of 1.2 times the native water conductivity or less or as specified by the Engineer. Water with a conductivity of 1.5 or more times the native water conductivity will be contained, removed from site, and properly disposed. A bid item has been provided for the removal of recovered water based on 5000 gallon loads.

6. If required, replace original wellhead flange. NOTE: All stainless steel threads shall be treated with a special pipe dope designed to prevent galling or ceasing of stainless steel. This requirement includes the nuts and bolts on the wellhead.

7. Only compatible materials and equipment shall be used to come into contact with the acid and reaction byproducts. It is the Contractor's responsibility to be knowledgeable of and comply with all OSHA and EPA regulations, and to ensure the safe working area is maintained. Nothing in these Specifications shall be construed to require the Contractor to perform any work in an unsafe manner. The Contractor may propose alternative techniques to accomplish the work if he has any concerns about the safety of the procedures specified herein.

2010.13 WELLHEAD COMPLETION

The ASR wellhead will be completed as indicated in Drawing 6.

2010.14 DISINFECTION AND BACTERIAL CLEARANCE

(1) Disinfection Procedure. The Subcontractor shall disinfect each of the wells in accordance with AWWA standards for Deep Wells (AWWA A100-90, or latest version) soon after well construction and cleaning procedures have been completed. Where test pumping equipment is to be used, such equipment shall be installed prior to or during a follow up disinfection of the well and all equipment shall be thoroughly cleaned and disinfected in accordance with AWWA A100-90 prior to installation. The Subcontractor shall carry out adequate cleaning procedures immediately preceding disinfection where evidence indicates that normal well construction and development have not adequately cleaned the well. All oil, grease, soil, and other materials, which could protect bacteria from disinfectants, shall be removed from the well.

Disinfection procedures shall ensure that the disinfecting agent is uniformly applied throughout the entire water depth of the well. The disinfecting agent shall be left in the well for a period of at least 24 hours. Any portion of the well casing about the water level shall be maintained in a damp condition with water containing the required concentration of disinfecting agent for a period of not less than 20 minutes. After a 24-hour or longer contact period, the well is to be pumped to clear it of the disinfecting agent. The disposal point for the purged water shall be selected so as to avoid damage to aquatic life or vegetation. The Subcontractor shall take such additional measures as are necessary to render the water suitable for discharge.

(2) Disinfectants. A chlorinating agent approved by applicable state and local regulatory agencies shall be used as the disinfectant. The disinfectant shall be delivered to the site of the work in original, closed containers bearing the original label indicating the percentage of available chlorine. During storage, disinfectants shall not be exposed to the atmosphere or to direct sunlight. Unless superseded by governmental regulation, the quantity of chlorine compounds used for disinfection shall be sufficient to produce a minimum of 100 ppm and not more than 200 ppm residual chlorine in solution when mixed with the total volume of water in the well.

(3) Bacterial Clearance. Following disinfection, a bacteriological survey shall be conducted according to Chapter 555.315 F.A.C. The samples of raw water from the well shall be submitted to a certified laboratory for bacteriological analysis. Bacteriological sampling points will be approved prior to collecting any samples. It is the responsibility of the Contractor to coordinate with the appropriate regulatory body and/or testing lab to effect the successful clearance of said wells. Costs for the testing will be included in the disinfection activities.

The Contractor is to notify the Engineer at least three days in advance of initiation of the bacteriological survey. In the event that samples analyzed exceed drinking water standards, the contractor may elect to either 1) continue sampling until the required number of samples meet the disinfection standards, or 2) discontinue testing, re-disinfect the well, and start the testing procedure over. The latter method is advisable where coliform densities exceed the standard on a regular basis.

Upon successful completion of the bacteriological survey(s), the Contractor shall provide the Engineer with all sampling records, including sampling time, date, and collector name, lab analyses results, and copies of all correspondence with the FDEP generated as a result of the bacteriological survey(s).

2010.15 CUTTINGS, DRILLING FLUID, AND TEST WATER STORAGE AND DISPOSAL

(1) All drilling fluids, cuttings, and formation fluids obtained from mud rotary drilling shall be confined to a steel tank while on site and prior to disposal.

(2) Drilling fluid and cuttings from mud rotary drilling shall be removed from the drilling site and disposed of at an approved location. The Contractor shall furnish to the Engineer and Owner, prior to beginning construction, the name and location of his disposal site along with documentation that the site has been approved by the appropriate regulatory agencies. The fluid displaced from the borehole during cementing operations shall be considered excess drilling fluid and shall be disposed in an approved manner. The Contractor shall not use any other site for disposal purposes without written consent from the Engineer and the FDEP.

(3) Drill cuttings from reverse air drilling will be removed from site.

(4) All water from reverse air drilling and well testing activities shall be discharged to a tank system designed to allow sediments to settle. A minimum of two tanks capable of containing approximately 14,000 gallons each will be required. The solids free water may then be discharged to the sewer force main. If water quality is not sufficient using two tanks, a third tank may be requested for further settling. The tanks will be set up so that they can gravity feed to from the first to last tank at a rate commensurate with all drilling and testing operations.

2010.16 DRILLING RECORDS

1. During drilling of each well, the Contractor shall maintain at the well site a complete log setting forth the following:

   (1) The reference point for all depth measurements.

   (2) The depth at which change of formation occurs.

   (3) The depth and interval of each cavity encountered during drilling.

   (4) The identification of the material of which each stratum is composed.

   (5) The depth interval from which each formation sample is taken.

   (6) The depth interval from which each water sample is taken.

   (7) The depth at which hole diameters change.

(8) Other pertinent data requested by the Engineer or Owner.

2. Upon completion of each well, the Contractor shall also submit to the Engineer a report and as-built drawings to include the following:

   (1) The total depth of the borehole and the length of casing installed in the well.

   (2) The nominal hole diameter.

   (3) The depth or location of any lost drilling fluid, drilling materials, tools, or other drilling problems.

   (4) The type and amount of drilling fluid additives used.

   (5) The depth and diameter of any surface casing.

   (6) The amount and type of cement (cubic yards) used in grouting the well annulus and/or surface casing. Percent bentonite should also be recorded.

   (7) The complete description (including length, diameter, depth, and mill certificates) of the well casing.

   (8) Confirm well location and verify elevation.

   (9) Any remedial work performed on wells.

3. Formation sample bags shall be provided and properly labeled by the Contractor.

END OF SECTION

3010 GEOPHYSICAL LOGGING

The Contractor shall prepare and condition the borehole prior to geophysical logging to insure that it is open and can be logged with a minimum of delay. It shall be the responsibility of the Contractor to perform the required logging, and provide the Engineer with 12 hard copies of each log and video survey and one copy of each log in electronic format (ASCII, or other approved format). All caliper logs will be performed using a four arm (x, y) tool. The Contractor shall utilize computer software to process the caliper and flow log data for the ASR well and produce a log that displays percent flow as a function of depth. The Contractor will be required to demonstrate that the flow log is properly calibrated and can be used to obtain the required data. Field copies will be provided at the time the logs are run. Table 3010-1 provides a summary for the specified logging listed below:

ASR WELL LOGGING PROGRAM

The following three logs will be run in the 12-inch surface casing pilot hole:

Caliper
Dual Induction
Natural Gamma Ray

The following geophysical log will be performed on the reamed hole for the surface casing:

Caliper Log
Gamma Ray

The following geophysical logs will be run in the 12-inch longstring pilot hole for each ASR well prior to reaming (Table 1):

Caliper Log
Dual Inductance
Natural Gamma
Sonic/VDL
Flow Velocity
Fluid Resistivity (Flowing Conditions)
Temperature

Caliper and gamma ray logs will be run in the ASR reamed hole for purposes of establishing a final casing set point.

A television survey of the pilot hole from 325 feet to 860 feet bpl shall be conducted following completion of the flow test. A second television survey shall be conducted after

final completion of the ASR well. The Contractor shall supply all necessary equipment including flow control equipment to perform the required surveys. The television surveys shall be conducted over the entire length of the well. The cost of the television surveys shall be included in the lump sum price for geophysical logging.

END OF SECTION

3020 WATER SAMPLES

3020.1 REVERSE AIR

During reverse air drilling operations, water samples shall be taken from the drill stem discharge at each rod change. These samples shall be given to the Engineer to analyze for conductance, chlorides and other parameters as needed. The Contractor will not be responsible for these analyses.

3020.2 DRINKING WATER STANDARDS AND MINIMUM CRITERIA FOR SEWAGE EFFLUENT ANALYSES REQUIREMENT

Water samples shall also be collected near the end of the final aquifer performance test. Water samples, collected by the driller, shall be analyzed for all primary and secondary drinking water standards by an FDEP certified laboratory which follows all quality assurance guidelines set forth by the State of Florida. In addition, the laboratory will analyze for the Minimum Criteria for Sewage Effluent as listed below:

Minimum Criteria for Sewage Effluent

Biological Oxygen Demand
Temperature
Specific Conductance
Chlorides
Total Coliform
Chloroform
Dissolved Solids (Total)
1,2-Dichloroethylene
1,4 Dichlorobenzene (para-Dichlorobenzene)
Chloroethane
Aldrin
Dieldrin
Diethylphthallate
Dimethylphthallate
Dioxin
Butylbenzylphthallate
Napthalene
Anthracene
Phenanthrene
Phenol
2,4,6-Trichlorophenol
2-Chlorophenol
Total Kjeldahl Nitrogen (TKN)

Nitrate
Nitrite
Total Nitrogen
Total Phosphorous
Ammonia
Nitrogen (Organic)
Orthophosphate (Soluble)

END OF SECTION

3040 DRILLING WATER LEVEL AND FLOW MEASUREMENTS

During reverse air drilling of the ASR well, the Contractor shall furnish and install an accurate device (such as an orifice plate) to measure the total discharge rate from the well and an electric water level indicator or other easily read device to measure the well water level from pad level at the observed flow rate. The Contractor shall record static water level based on pad level at the beginning of each drilling day, the water level after each break in circulation, and the water level and discharge rate every rod change during reverse air drilling based on pad level. Water level and discharge measurements shall be recorded in the Contractor's Daily Log.

END OF SECTION

3070 HYDRAULIC TESTING

(1) Testing Prior To Setting The ASR Longstring Casing

Once the 12-inch pilot hole is drilled to approximately 860 feet, and properly developed, a flow test will be performed using the artesian pressure of the aquifers. A minimum flow rate of 300 gpm is required. If this rate cannot be established then a pump capable of pumping between 300 and 400 gpm will be require. The flow rate will be held stable at the maximum sustainable flow rate or as otherwise specified by the Engineer. At a minimum, the flow test should be conducted for a period of four hours followed by a four hour shut-in period. At all times, the Contractor should be able to control flow from the well and shut-in the well if required. Both a fluid resistivity and flow log will be performed after the flow test and at the test flow rate.

(2) Step Drawdown and Pump Testing of Final ASR Well

One four-stage step drawdown test and a 72-hour pump test shall be performed on the ASR well after the longstring casing is set, the open hole interval cleaned of cuttings and debris, and the well has been properly developed. The Contractor, after review and approval by the Engineer, shall furnish, install, and remove the instruments, pumping equipment, valves, and fittings required to pump the well at constant rates ranging from 100 gpm to 900 gpm; and shall provide a valve, orifice plate and manometer, or other calibrated flow measurement device necessary to control and accurately measure the pump discharge. The Contractor shall also furnish the necessary equipment to measure water levels in the ASR well and up to two other wells after Engineer approval of equipment. The Contractor will insure easy access to the water surface to be measured. Each of the first four pumping stages shall last for one hour or until the drawdown has stabilized (30 minutes minimum) according to the Engineer. The first four steps may be performed without stopping the flow.

After the fourth rate step, the well will be shut-in over night. Flow rate and other data will be collected every 5 minutes during each step of the drawdown test. The next day, the well will be pumped at the maximum rate determined by the Engineer for a 72-hour period (300-400 gpm). At the end of the 72-hour pumping period, the well will again be shut-in. Pressure changes will be collected using a continuous recording device (pressure vs. time) during pumping. Pressure changes should be monitored and recorded using equipment provided by the Contractor for 72-hours after the well has been shut-in. Pressure measurements should be recorded in the pumping well, and both intervals in the dual zone monitor well using continuous recording pressure devices approved by the Engineer.

END OF SECTION

4000 MATERIALS SPECIFICATIONS

4000.1 GENERAL

The minimum standards described in the following Specifications shall apply to all well construction activities. The Contractor may propose to the Engineer the use of alternative well casing materials of an equivalent or higher grade than specified herein. The Contractor shall supply the Engineer with casing mill certificates before installing any casing.

4000.2 ASR WELL PIT CASING

The pit casing shall be new, unused, steel, random length, 32-inch O.D., 0.375-inch wall thickness, and shall conform to API 5L Grade B, ASTM A53 Grade B or Spiral Weld A139 Grade B standards. The casing shall be plain end and beveled for welding and shall be jointed together by certified welders. The Contractor must provide the Engineer proof of welders' certifications before any welding may be started. The length and method of pit casing installation shall be determined by the Contractor, subject to Engineer approval.

4000.3 ASR WELL SURFACE CASING

The surface casing shall be new, unused steel, random length, 26-inch diameter, 0.375-inch wall thickness, and shall conform to API 5L Grade B, ASTM A53 Grade B or Spiral Weld A139 Grade B standards. The casing shall be plain end and beveled for welding and shall be jointed together by certified welders.

4000.4 ASR WELL LONGSTRING CASING

Production casing strings for the ASR wells shall be constructed of new, unused 0.500-inch wall Burgess EON fiberglass reinforced plastic, or approved equivalent. Casing internal diameter shall be 16.0 inches from surface to 220 feet bls, 14.0 inches from 220 to 240 feet bls, and 12.0 inches below 240 feet. Connection of different diameter casing joints shall be made using Burgess adaptor couplings specifically designed for that purpose, or approved equivalent.

Pipe joints shall be connected following the manufacturers recommended practices so that the casing string can withstand the tensile load experienced during installation and the pressure test requirements after installation. The equipment and practices used to secure the casing string during installation and to thread pipe joints together shall be undertaken such that damage to the casing is avoided. Steel tools should not be used to thread this pipe together. A representative of the casing manufacturer shall be present on-site to observe the installation of the production casing string for the ASR well construct.

Casing specifications, including material weight and size, rated working and resistance to hydraulic collapse pressure, tensile strength, and pipe connection plans shall be provided with the Shop Drawings submittals. Any substitute casing materials planned for use must be identified at that time.

4000.5 CENTRALIZERS

Casing for all wells shall be fitted with Halliburton type centralizers with steel FRP or plastic straps at 0, 90, 180, and 270 degrees around the casing at each position. The centralizers shall be located as follows:

Pit casing:

(1). One set at 5 feet above the bottom end of the casing
(2). One set within 5 feet of land surface

Longstring and surface casing all wells:

(1). One set 5 feet above the base of the casing.
(2). One set at 20 feet above the bottom end of the casing.
(3). One set at 40 feet intervals above the centralizer placed 20 feet above the bottom.
(4). One set 20 feet below land surface.

All centralizers shall be in a precise vertical alignment, one above the other, to allow for the placement of tremie pipes in the annulus. The cost of all centralizers shall be included in the unit price for casing installation. Centralizers will have sufficient size/strength to prevent the casing from lying against the borehole wall. The Contractor will provide centralizer specifications for approval by the Engineer prior to installation

4000.6 CEMENT

Sulfate-resistant cement shall be used for all cementing of casings and hole plugging. At a minimum, the lower 100 feet of the longstring casing grout shall be ASTM Type II (API Class B) cement mixed with 5.2 gallons of water per sack of cement. Additional casing grout above the neat cement shall be ASTM Type II cement mixed with up to 4% bentonite. No more water than the water per sack of cement specified in Halliburtons Cementing Tables shall be utilized. Cement additives such as Flocele or gilsonite may be used to regain lost-circulation, if approved in advance by the Engineer. Organic polymers, peanut shells, and cotton seed hulls shall not be used as lost circulation materials. All grout mixtures shall be approved by the Engineer in advance of placement. Prior to commencement of cementing operations, the Contractor shall submit a written procedure for each stage of cementing for each casing string. The unit cost for grout shall include cement and all additives and lost circulation materials. Cement samples from each stage

of cementing will be provided to the Engineer at the time the cement stage is pumped. The Contractor will also have the neat cement samples and sample containing 4% bentonite tested for their 24 and 72 hour compressive strength for the longstring casing. In the event a lost circulation zone is encountered, gravel may be authorized as a fill material prior to cementing. The FDEP will be contacted for approval prior to placing gravel in the hole.

END OF SECTION

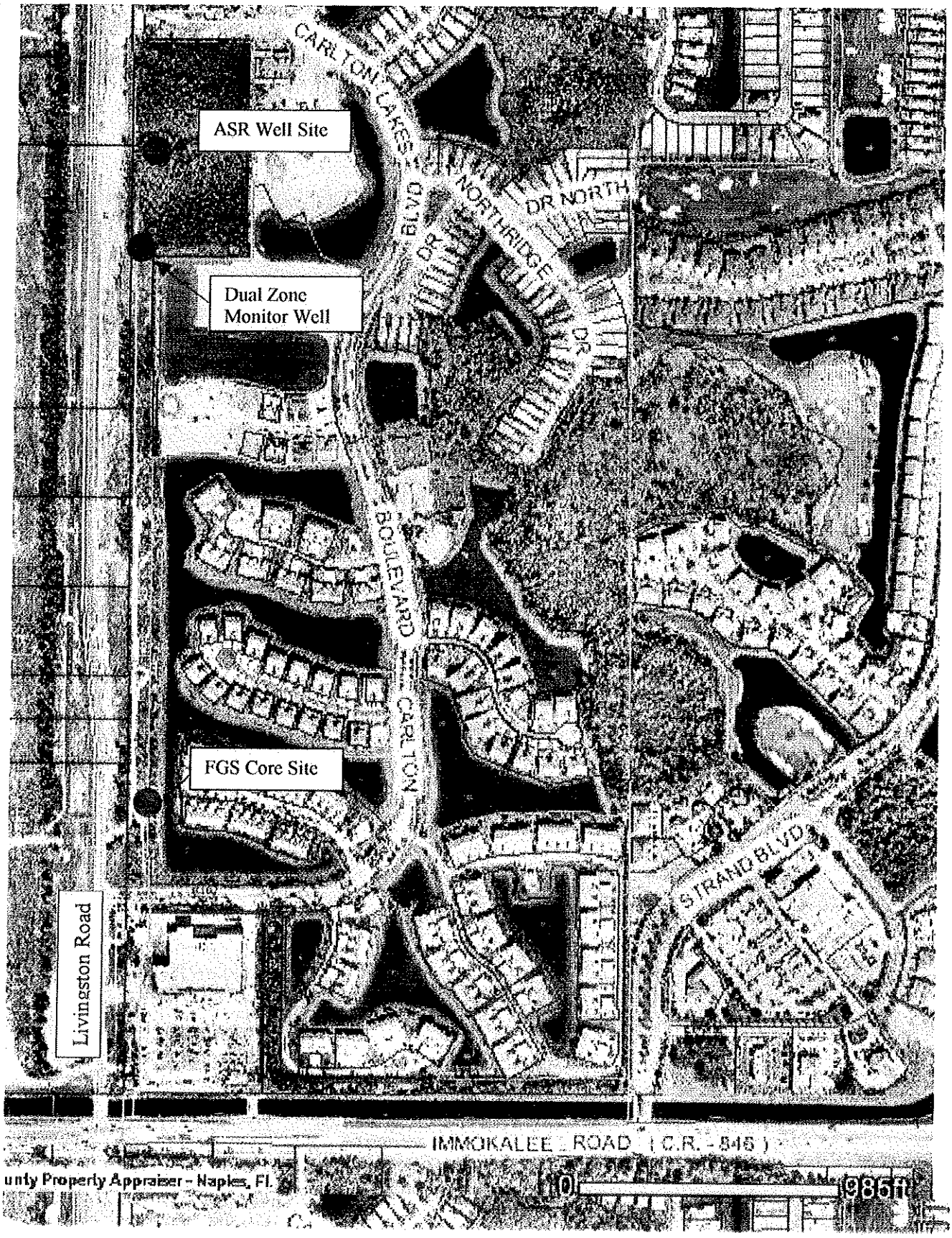
TABLES

TABLE 3010.1

GEOPHYSICAL LOGGING PROGRAM
COLLIER COUNTY ASR EXPLORATION WELL

ASR Exploration Well	Gamma Ray	Caliper	Dual Induction	Temperature	BHC Sonic-VDL	Flow Survey	Video	Fluid Flowing Resistivity
Drill 12.25-inch pilot hole to 320 feet	X		X		X			
Ream 32-inch hole to 320 feet	X	X						
Grout Casing				X				
Drill 12.25-inch pilot hole to 860 feet	X	X	X		X	X	X	X
Ream hole to 790 feet	X	X						
Cement casing to 790 feet ±				X			X	

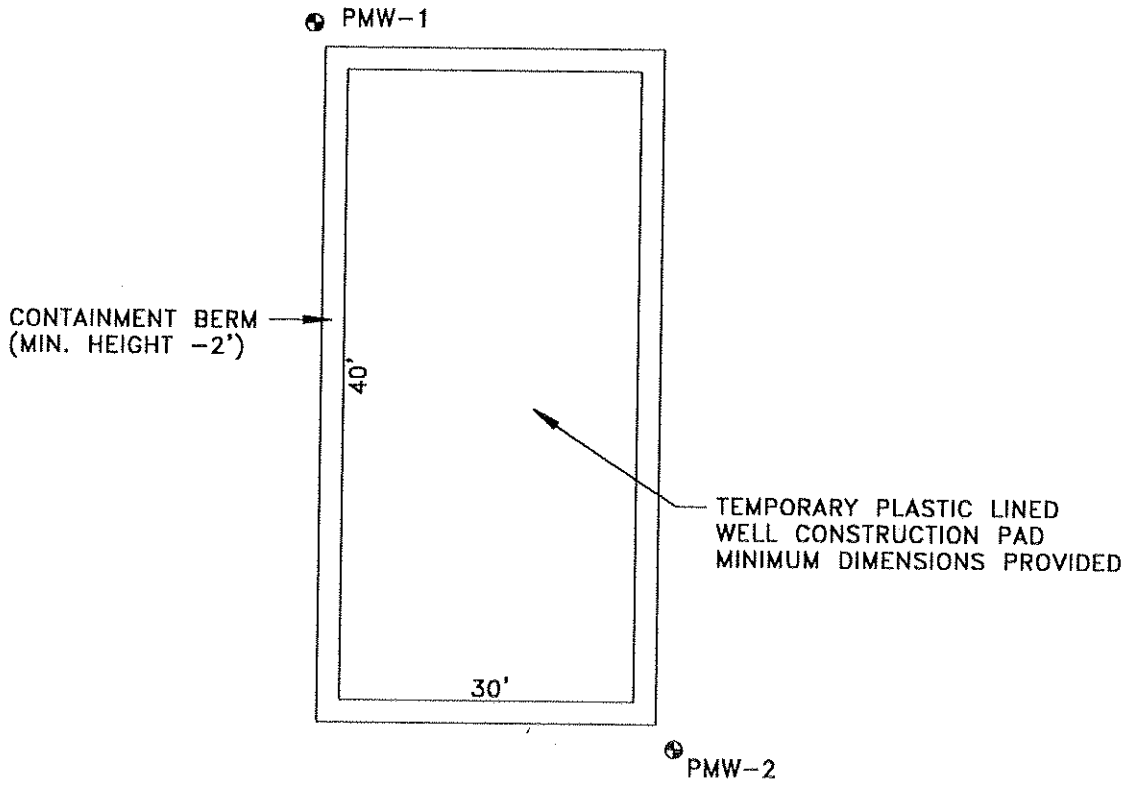
DRAWINGS

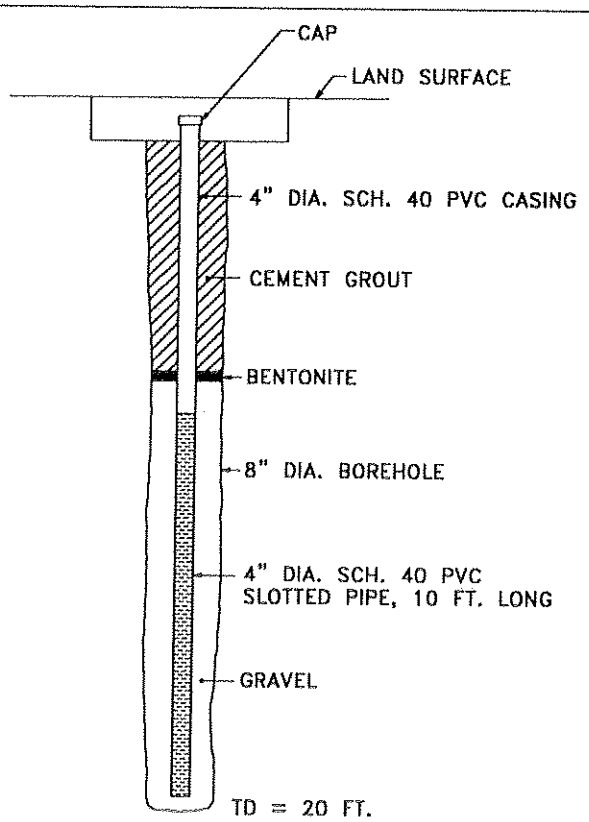


Water Resource Solutions

Project Collier County– ASR
Project Number: 01-0.02 Date: 8-11-02

Drawing 1.1 Location of Sites for the Collier County Reclaimed Water ASR Test Wells

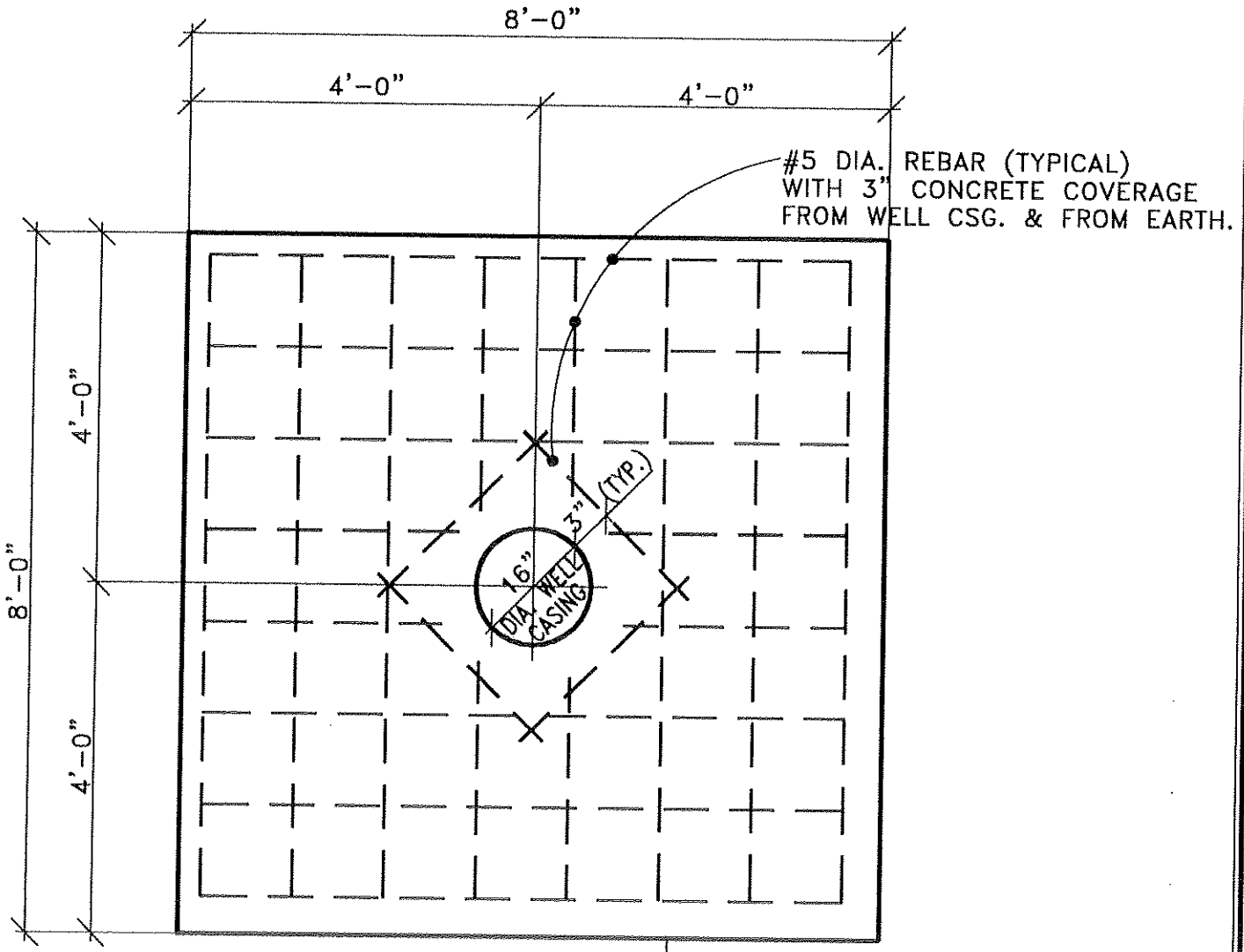




PAD MONITOR WELL CONSTRUCTION DETAILS

Water Resource Solutions	PROJECT NAME: COLLIER CTY ASR	DWG. NUMBER: A-013946PM2-3
	PROJECT NUMBER: 01-03946.A3	DATE: 8/14/02

DRAWING 2. MINIMUM ASR DRILL PAD AND PAD MONITOR WELL DESIGN.

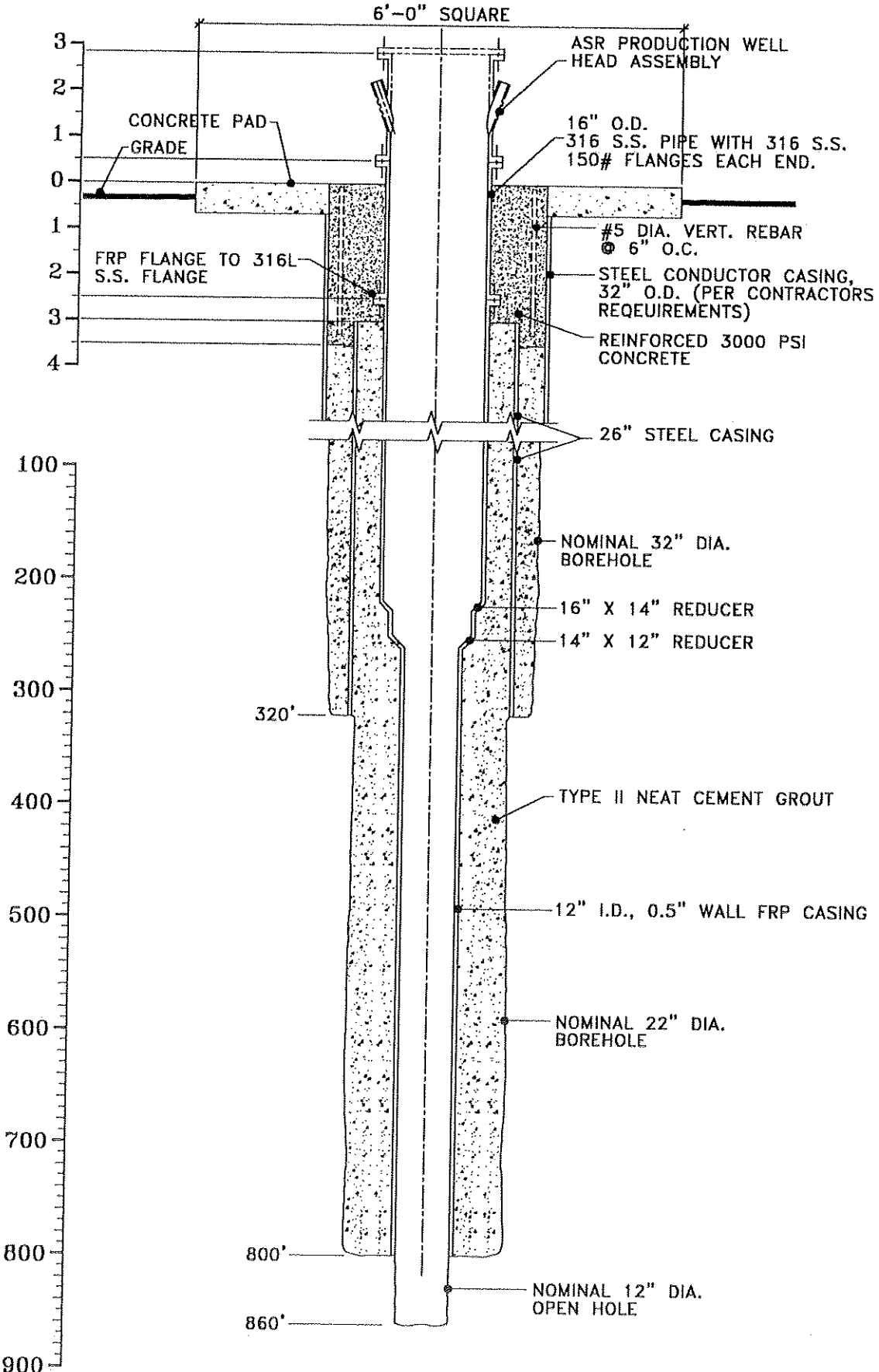


ASR WELL PAD PLAN

0 2
SCALE (FEET)

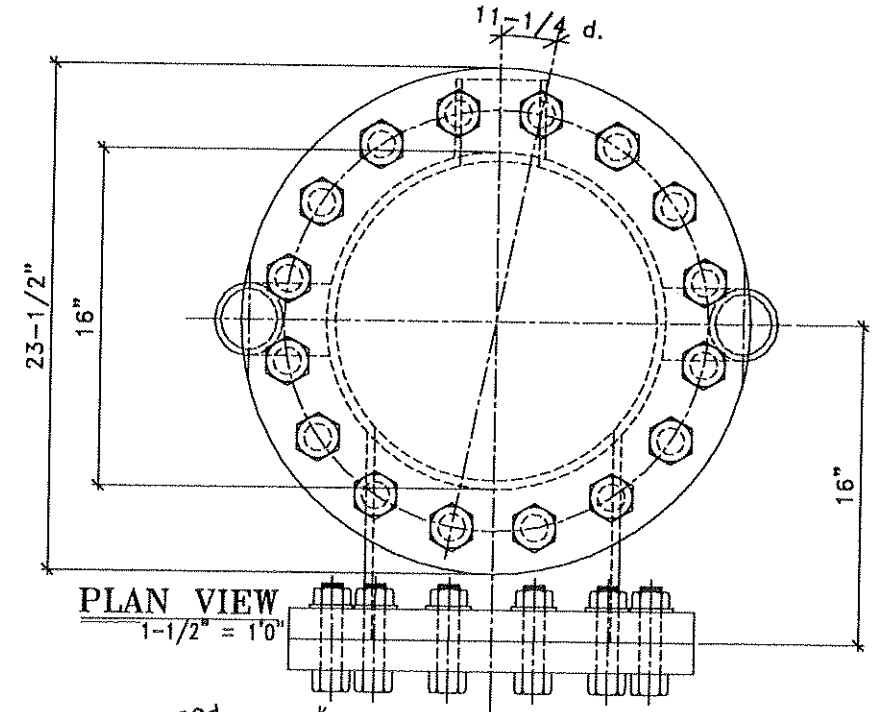
Water Resource Solutions	PROJECT NAME: COLLIER CTY ASR	DWG. NUMBER: A-013946NW-2
	PROJECT NUMBER: 01-03946.A3	DATE: 8/14/02

DRAWING 3. ASR WELL PAD CONSTRUCTION DETAIL.



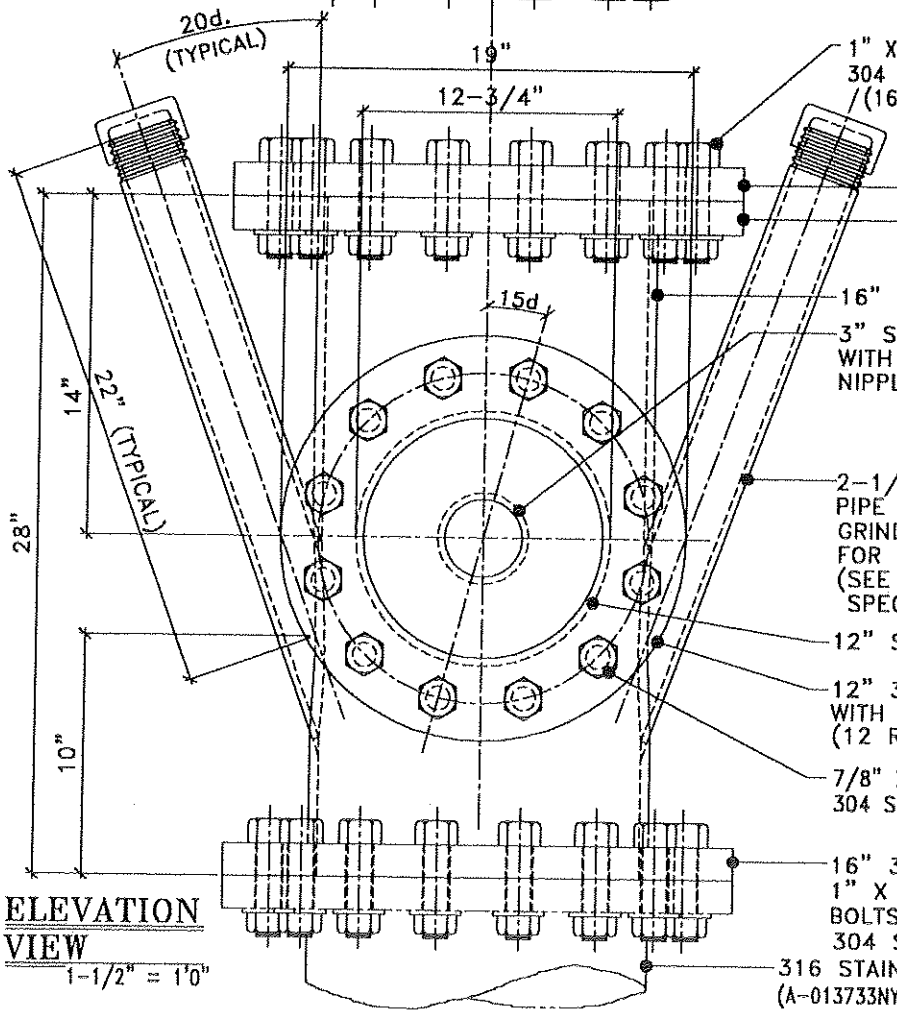
Water Resource Solutions	PROJECT NAME: COLLIER CTY ASR	DWG. NUMBER: A-013946WX-2
	PROJECT NUMBER: 01-03946.02	DATE: 8/14/02

DRAWING 4. ASR PRODUCTION WELL CROSS SECTION.



NOTE:

1. CONTRACTOR SHALL TERMINATE EACH EQUIPMENT PORT WITH A THREADED 2-1/2" 125# BRASS GATE VALVE, A THREADED BRASS NIPPLE AND A THREADED SCH 40 PVC PIPE CAP.



1" X 4-1/2" HEX HEAD 304 S.S. BOLT WITH 304 S.S.LOCKWASHER AND 304 S.S. HEX NUT /(16 REQ'D.)

16" SCH 80 PVC BLIND FLANGE

16" 316 S.S. 150# FLANGE

16" SCH. 40 316 S.S. PIPE

3" SCH. 40 316 S.S. THREADED PIPE WITH 125# S.S. GATE VALVE, S.S. NIPPLE & S.S. CAP. (FARSIDE)

2-1/2" SCH 40 THREADED 316 S.S. PIPE EQUIPMENT PORT. (TYP. 2 PLACES) GRIND INSIDE WELD SEAM SMOOTH FOR RUNNING TRANSDUCER LINES ETC. (SEE NOTE #1 FOR TERMINATION SPECIFICATIONS.)

12" SCH. 40 316 S.S. PIPE

12" 316 S.S. 150# FLANGE WITH 12" SCH 80 PVC BLIND FLANGE. (12 REQ,D.)

7/8" X 4-1/2" HEX HEAD 304 S.S. BOLT WITH 304 S.S.LOCKWASHER AND 304 S.S. HEX NUT

16" 316 S.S. 150# FLANGE WITH 1" X 4-1/2" HEX HEAD 304 S.S. BOLTS, 304 S.S. LOCKWASHER AND 304 S.S. HEX NUTS. (16 REQ'D.)

316 STAINLESS STEEL WELLCAP ADAPTER. (A-013733NY-2/FIG. 6)

Water Resource Solutions	PROJECT NAME: COLLIER CTY ASR	DWG. NUMBER: A-013946WH1-1
	PROJECT NUMBER: 01-03946.03	DATE: 8/7/02

DRAWING 5. ASR PRODUCTION WELLHEAD DIAGRAM.