

3.02 WELDING

- A. **Method:** Welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.
- B. **Quality:** In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as indicated by the AWS Code. Upon completion of welding, weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. Sharp corners of material that is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

3.03 GALVANIZING

- A. Structural steel plates, shapes, bars, and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the requirements of ASTM A 123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts, anchor bolts, nuts, and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A 153.
- B. Field repairs to damaged galvanizing shall be made by preparing the surface and applying a coating.
 - 1. Surface preparation shall consist of removing oil, grease, soil, and soluble material by cleaning with water and detergent (SSPC SP1) followed by brush off blast cleaning (SSPC SP7), over an area extending at least 4-inches into the undamaged area.
 - 2. Coating shall be applied to at least 3-mils dry film thickness. Use **Zinc-Clad XI** by **Sherwin-Williams**, **Galvax** by **Alvin Products**, or **Galvite** by **ZRC Worldwide**.

3.04 DRILLED ANCHORS

- A. Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, cleaned and dry. Drilled anchors shall not be installed until the concrete has reached the required 28-day compressive strength. Adhesive anchors shall not be loaded until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

- END OF SECTION -

MISCELLANEOUS METALWORK

SECTION 09900

PAINTING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The Contractor shall furnish all materials, labor equipment, and incidentals required to provide a protective coating system for the surfaces listed herein and not otherwise excluded.
- B. The work includes painting and finishing of exterior exposed items and surfaces such as construction signs, guardrails, posts, pipes, fittings, valves, equipment, and all other work obviously required to be painted unless otherwise specified herein or on the Drawings. The omission of minor items in the schedule of work shall not relieve the Contractor of his obligation to include such items where they come within the general intent of the Specifications as stated herein. The following major items to be painted on the Project shall include, but not be limited to, the following:
 - 1. Exposed well casing, pipes, valves, and flanges.
 - 2. Exposed steel.
 - 3. Paint color will be coordinated with the Owner.
- C. "Paint" as used herein means all coating systems, materials, including primers, emulsions, enamels, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
- D. The following items will not be painted:
 - 1. Any code-requiring labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.
 - 2. Any moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts, unless otherwise indicated.
 - 3. Traffic stripes on paving.
 - 4. Aluminum handrails, walkways, windows, louvers and grating.
 - 5. Stainless steel angles, tube, pipe, etc.

6. Products with polished chrome, aluminum, nickel or stainless steel finish.
7. Flexible couplings, lubricated bearing surfaces, insulation and metal and plastic pipe interiors.
8. Plastic switch plates and receptacle plates.
9. Signs and nameplates.
10. Finish hardware.
11. Structural members and panels factory coated.
12. Any packing glands, unless otherwise indicated.

1.02 RELATED WORK

- A. NOT USED.

1.03 QUALITY ASSURANCE

- A. Provide the best quality grade of the various types of coatings as regularly manufactured by approved paint materials manufacturers. Materials not displaying the manufacturer's identification as a standard, best grade product will not be acceptable.
- B. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only within recommended limits.
- C. Undercoat and finish coat paints shall be compatible.
- D. Painting shall be accomplished by experienced painters specializing in industrial painting familiar with all aspects of surface preparations and applications required for this project.

1.04 SUBMITTALS

- A. Submittals shall include manufacturer's data and samples as indicated below and shall be prepared and submitted in time to provide adequate review by the Engineer.
- B. Samples - Painting:
 1. Paint colors will be selected by the Engineer. Compliance with all other requirements is the exclusive responsibility of the Contractor.
 2. Samples of each finish and color shall be submitted to the Engineer for approval before any work is started.

3. Samples shall be prepared so that an area of each sample indicates the appearance of the various coats. For example, where three coat work is specified, the sample shall be divided into three areas: one showing the application of one coat only, one showing the application of two coats and one showing the application of all three coats.
4. Such samples when approved in writing shall constitute a standard, as to color and finish only, for acceptance or rejection of the finish work.
5. For piping, valves, equipment and miscellaneous metal work, provide sample chips or color charts of all paint selected showing color, finish and general characteristics.
6. Rejected samples shall be resubmitted until approved.

1.05 DELIVERY, HANDLING AND STORAGE

- A. Deliver all materials to the job site in original, unopened packages and containers bearing manufacturer's name and label.

1. Provide labels on each container with the following information:
 - a. Name or title of material
 - b. Fed. Spec. number if applicable
 - c. Manufacturer's stock number and date of manufacture
 - d. Manufacturer's formula or specification number
 - e. Manufacturer's batch number
 - f. Manufacturer's name
 - g. Generic type
 - h. Contents by volume, for major pigment and vehicle constituents
 - i. Thinning instructions
 - j. Application instructions
 - k. Color name and number

2. Containers shall be clearly marked to indicate any hazards connected with the use of the paint and steps which should be taken to prevent injury to those handling the product.
- B. All containers shall be handled and stored in such a manner as to prevent damage or loss of labels or containers.
- C. The Engineer shall designate areas for storage and mixing of all painting materials. Comply with the requirements of pertinent codes and fire regulations. Proper containers outside of the building shall be provided by the Contractor and used for painting wastes. No plumbing fixtures shall be used for this purpose.
- D. Used rags shall be removed from the buildings every night and every precaution taken against spontaneous combustion.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All paint shall be manufactured by one of the following and shall be their highest grade of paint: Kop-Coat, Inc., Tnemec Company, Inc., Porter Paint Company, or Carboline Company. Requests for approval of other paint manufacturers and materials other than specified shall be submitted to the Engineer for approval.
- B. The following coating systems list a product by name to establish a standard of quality; other products of the same generic types may be submitted to the Engineer for approval. When other than the specified coating system is proposed, the Contractor shall submit on a typewritten list giving the proposed coatings, brand, trade name, generic type and catalog number of the proposed system for the Engineer's approval.
- C. Paint used in successive field coats shall be produced by the same manufacturer. Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to underlying paint.
- D. Emulsion and alkyd paints shall contain a mildewcide and both the paint and mildewcide shall conform to OSHA and Federal requirements, including Federal Specification TT-P-19.
- E. Finish coats containing lead shall not be allowed. Oil shall be pure boiled linseed oil.
- F. Rags shall be clean painters' rags, completely sterilized.

2.02 COATING SYSTEMS

- A. Class 4 Exposures - Metal (Nonsubmerged): Class 4 exposures consist of interior or exterior metal surfaces that do not come in contact with corrosive atmospheres and shall include the following:

1. Surfaces To Be Coated:

- a. Aboveground well piping, valves, fittings, and piping supports.
- b. Miscellaneous steel shapes, angles, etc.

2. Class 4 Coating System:

- a. Surface Preparation: Sandblast to commercial blast surface (SSPC-SP6) all non-galvanized unfinished metal surfaces. All metal surfaces shall be completely degreased by solvent cleaning in compliance with SSPC-SP1.
- b. Prime Coat: Ferrous metals - Carboline 890 self priming, high build, semi-gloss mastic
(4.0 mils DFT)

Non-Ferrous and Galvanized Metals - Wash primer
(0.5 mils DFT)
Kop-Coat: 40 Passivator
- c. Finish Coats: Self priming, high build, semi-gloss epoxy mastic, Carboline 890
(1 coats, 4.0 mils DFT per coat)

- C. Class 6 Exposures - Aluminum: Class 6 exposures consist of aluminum surfaces embedded or in contact with concrete, mortar, or plaster or aluminum in contact with dissimilar metals which may cause corrosion due to electrolysis.

1. Surfaces to be Coated:

- a. Aluminum surfaces in contact with concrete, mortar, or plaster.
- b. Aluminum surfaces in contact with dissimilar metals which may cause corrosion due to electrolysis.

2. Class 6 Coating System:

- a. Surface Preparation: Aluminum surfaces to be coated shall be cleaned in accordance with SSPC-SP1.

- b. Primer Coat: Zinc chromate wash primer.
(1 coat, 0.5 mils, DFT per coat)
(Kop-Coat: 40 Passivator)
- c. Finish Coat: Coal tar epoxy, high build.
(1 coat, 20 mils DFT per coat)
(Kop-Coat: Bitumastic: No. 300-M High Build)

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

- A. In addition to the aforementioned preparations, all dirt, rust, scale, splinters, loose particles, disintegrated paint, grease, oil and other deleterious substances shall be removed from all surfaces which are to be coated.
- B. Hardware, hardware accessories, machined surfaces, plates, lighting fixtures and similar items in contact with painted surfaces and not to be painted shall be removed, masked, or otherwise protected prior to surface preparation and painting operations.
- C. Before commencing work, the painter must make certain that surfaces to be covered are in perfect condition. Should the painter find such surfaces impossible of acceptance, he shall report such fact to the Engineer. The application of paint shall be held as an acceptance of the surfaces and working conditions and the painter will be held responsible for the results reasonably expected from the materials and processes specified.
- D. Program the cleaning and painting so contaminants from the cleaning process will not fall onto wet, newly-painted surfaces.
- E. Prepare cementitious surfaces of concrete, concrete block, cement plaster and cement-asbestos board to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.
- F. Clean ferrous substances, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning. All welds, blisters, etc., shall be ground and sanded smooth. All pits and dents shall be filled and all imperfections shall be corrected so as to provide a smooth surface for painting.
- G. Surface profile as obtained from sandblasting shall be as recommended by the coating manufacturer.

3.02 MATERIALS PREPARATION

- A. Mix and prepare painting materials in strict accordance with manufacturer's recommendations and directions, stirring materials before and during application to maintain a mixture of uniform density, free of film, dirt and other foreign materials.
- B. No thinners shall be used except those specifically mentioned and only in such quantity as directed by the manufacturer in his instructions. If thinning is used, sufficient additional coats shall be applied to assure the required dry film thickness is achieved. The manufacturer's recommended thinner or cleanup solvent shall be used for all clean-up. Application by brush, spray, airless spray or roller shall be as recommended by the manufacturer for optimum performance and appearance.

3.03 APPLICATIONS

- A. Paint all exposed surfaces in rooms scheduled for painting whether or not colors are designated in schedules, except where the natural finish of material is obviously intended and specifically noted as a surface not be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color or finish is not designated, the Engineer will select these from standard colors available for the materials systems as specified.
- B. All painting shall be done by skilled and experienced craftsmen and shall be of highest quality workmanship.
- C. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied.
- D. All paint shall be at room temperature and the surface to be painted shall be dry and clean.
- E. Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance.
- F. Paint shall be applied in a neat manner with finished surfaces free of runs, sags, ridges, laps and brush marks. Each coat shall be applied in a manner that will produce an even film of uniform and proper thickness.
- G. Paint surfaces behind moveable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
- H. Paint back sides of access panels and removable or hinged covers to match the exposed surfaces.
- I. Sand lightly between each succeeding enamel or varnish coat.
- J. Omit the first coat (primer) on metal surfaces which have been shop primed and touch-up painted, unless otherwise specified.

- K. The prime and intermediate coats as specified for the various coating systems may be applied in the shop by the manufacturer. The shop coats shall be of the type specified and shall be compatible with the field coat or coats. Such items as pumps, motors, equipment, electrical panels, etc. shall be given at least one touch up coat with the intermediate coat material and one complete finish coat in the field.

3.04 APPLICATIONS RESTRICTIONS

- A. Application of materials shall be done only on properly prepared surfaces as herein specified, and all exterior painting shall be done only in dry weather. Any surface coating damaged by moisture or rain shall be removed and redone as directed by the Engineer.
- B. In no case shall paint be applied to surfaces which show a moisture content greater than 15 percent.

3.05 MINIMUM COATING THICKNESS

- A. Coatings shall be applied in accordance with the manufacturer's recommendations. Minimum coating millage shall be as specified above.
- B. Apply a prime coat to material which is required to be painted or finished, and which has not been prime coated by others.
- C. Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

3.06 FINISHES

- A. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.
- B. Complete Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specific requirements.

3.07 FIELD QUALITY CONTROL

- A. All completed surfaces will be checked by the Engineer, and the Contractor shall provide the necessary properly calibrated gauges. All nonferrous surfaces shall be checked for number of coats and thickness by use of a Tooke gauge. All ferrous surfaces shall be checked for film thickness by use of an Elcometer or Micro-Test magnetic dry film gauge properly calibrated. In addition, submerged tank linings and metals shall be tested for

freedom from holidays and pinholes by use of a Tinker-Rasor or K-D Bird Dog Holiday Detector. All defects shall be corrected to the satisfaction of the Engineer. The presence of moisture shall be determined prior to coating by testing with a moisture detection device such as a Delmhors Model DB.

3.08 PROTECTION

- A. All other surfaces shall be protected while painting equipment, piping, etc.
- B. Protection of furniture and other movable objects, equipment, fittings, and accessories shall be provided throughout the painting operation. Remove all electric plates, surface hardware, etc., before painting, protect and replace when completed. Mask all machinery nameplates and all machined parts not to receive paint. Lay drop cloths in all areas where painting is being done to adequately protect structures, flooring, piping, equipment, and other work from all damage.

3.09 CLEANING

- A. The Contractor shall perform the work under this Section while keeping the premises free from accumulation of debris and rubbish and shall remove all scaffolding, paint cloths, paint, and brushes from the building and project site when completed.
- B. Cleaning: All paint brushed, splattered, spilled or splashed on any surface not specified to be painted shall be removed.

3.10 EXTRA STOCK

- A. Paint To Be Supplied To Owner: Upon completion of painting work, the Owner shall be furnished at no additional cost, one gallon of each type and color of finish paint for touching up. Paint container labels shall be complete with manufacturer's name, generic type, number, color and location where used.

END OF SECTION

SECTION 12000

PREVENTION, CONTROL AND ABATEMENT OF EROSION AND WATER POLLUTION

PART I - GENERAL

1.01 DESCRIPTION

- A. Prevention, control and abatement of erosion and water pollution shall conform to the requirements of this Section 12000 as described in the attached "Storm Water Management for Construction Activities - Developing Pollution Prevention Plans and Best Management Practices - Summary Guidance" document (37 pages, including cover, Forward and table of contents), hereinafter called the "Summary Guidance," and shall produce end results as required by the rules and regulation of the FDEP, SWFWMD and all other regulatory agencies having jurisdiction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONTRACTOR REQUIREMENTS

- A. The Contractor is required to present his schedules for the construction of the project at the preconstruction conference as required. This schedule shall include a complete outline for the proposed construction of and/or all of the pollution control and erosion abatement items detailed in the Summary Guidance. The Contractor is responsible for the implementation of the schedule after approval by the Engineer.
- B. The Contractor shall prepare a Storm Water Pollution Prevention Plan (SWPPP) in accordance with Section 402(p) of the clean Water Act. The SWPPP shall be presented to the Engineer at the preconstruction conference. The SWPPP shall conform to the guidelines contained in the Summary Guidance.

END OF SECTION

SECTION 13000

SHALLOW MONITOR WELLS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work described here consists of drilling, casing, gravel packing, cementing, developing and completing four pad monitor wells in accordance with these specifications, in the locations and in the manner shown on the figures in the Drawings. The principal purpose of the work is to establish a shallow well network for monitoring potential saltwater spillage into the surficial aquifer, during the drilling of the test injection well and the two deep monitoring wells. In the event of a spill or groundwater contamination resulting from construction or drilling operations, the Contractor may be financially responsible for the cost of all cleanup activities at the site.
- B. The construction of the shallow monitor wells shall be performed by a State of Florida licensed water well contractor and the wells must meet all standards set by the Florida Department of Environmental Protection, the Southwest Florida Water Management District, American Water Works Association, and applicable Sarasota County Health Department and City of Sarasota regulations.
- C. The Contractor shall be responsible for providing to the Owner's Engineer proof of all secured permits and operating licenses as required by local and state agencies. No construction shall commence until such permits and licenses are obtained and until the drilling pad (see Technical Specifications for Test Injection Well) has been completed.

1.02 EQUIPMENT, PERSONNEL AND STANDBY TIME

- A. The Contractor shall furnish the services of well drillers and an adequate number of competent helpers capable of performing the work described herein.
- B. The Contractor shall furnish well drilling equipment, which is adequate to satisfactorily perform all phases of well construction described herein.
- C. The Contractor should coordinate with the Engineer so that standby time is kept to a minimum.

1.03 WELL LOCATIONS

- A. The four monitor wells shall be located at the sites shown on the Drawings. The location of each well site will be clearly marked by the Engineer on the land surface. The Contractor shall accept these locations as they are and it is his responsibility to acquaint himself with the actual site conditions prior to submitting a bid to do the work. The Owner reserves the right

to change the location of any hole to another similar site; however, proposal unit prices shall remain unchanged.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. Well Casing and Screen:

1. The 2-inch diameter PVC pipe used in the fabrication of the well casing and screen shall be Schedule 40 that conforms to requirements of ASTM Designation D 1785 (PVC 1120, PVC 1220 or PVC 2120). The well screen shall be 0.01-inch slot size.
2. The well casing and screen shall be joined by threaded couplings, which shall meet the strength requirements of the PVC casing as specified above.
3. Drilling of the wells and casings shall be paid at the unit prices set in the Contract. For the purpose of payment, the following lengths shall be considered:
 - a. wells, from the bottom of the hole to the ground level;
 - b. casings, from the bottom of the casing as placed and cemented in the hole to the permanent top of the casing.

B. Cement - All cement used on the work shall be standard brand Portland cement conforming to the requirements of ASTM Designation C150, Type II. The neat cement shall contain no more than 6 gallons of water per bag of cement. After a well is cemented, casing and well must remain undisturbed for at least 24 hours for setting up of the cement.

C. Gravel Pack - The gravel pack installed in the annulus space surrounding the well screen shall consist of clean 20/30 graded silica sand.

PART 3 - EXECUTION

3.01 - MONITOR WELL DESCRIPTION

A. The four monitor wells shall be drilled into the water table aquifer and shall be drilled to an approximate depth of ± 15 feet. They shall be constructed in the following manner:

1. Casing:

- a. An 8-inch diameter hole shall be drilled by rotary drilling or by hollow stem auger method or by other suitable method approved by the Engineer to the required depth. The Engineer will determine the exact depth to which the hole shall be drilled.

- b. The well casing shall be fabricated in accordance with the details shown in the Drawings and described in Paragraph D.
 - c. The 2-inch diameter well casing and screen shall then be set in the drilled hole. The casing shall be securely anchored to maintain plumbness within the open hole. Special care should be exercised to insure a straight and plumb casing by blocking it in place prior to gravel packing and cementing. The screen shall be 10 feet long and shall be attached at the end of the well casing in conjunction with a 1-foot blind casing installed for sediment accumulation from the bottom of the screen to the bottom of the hole.
 - d. The top of the casing shall extend approximately 2 feet above land surface.
2. Annular Gravel Pack and Cementing
- a. The annulus space surrounding the well screen shall be filled with clean 20/30 graded silica sand to two feet above the top of the well screen. This gravel pack shall be installed by tremie pipe or any other suitable method as approved by the Engineer from the bottom of the annulus upwards so as to ensure that the well screen is not in contact with native soils. If a protective casing is used, it shall be withdrawn as gravel is installed.
 - b. The sand in the annular space around the screen shall be sealed off by a bentonite seal. This bentonite seal shall be made up of bentonite pellets. The bentonite seal shall be no more than 12 inches in thickness and shall be installed by tremie pipe, or any other suitable methods as approved by the Engineer, from the top of gravel upwards.
 - c. The remaining annular space shall be filled with Type II neat cement installed by tremie pipe from the top of the bentonite seal up to land surface completely filling the annular space between the hole and the casing. The protective casing (if used) shall be withdrawn as cementing takes place.
 - d. If the casing should collapse or break or the screen becomes plugged, it shall be withdrawn and replaced at the Contractor's expense.

3.02 - WELL DEVELOPMENT

- A. The intent of this paragraph of the specifications is to provide for the development of the four shallow monitor wells. The purpose of the development work is to remove effectively from each well and the formation opposite the well screen material like mud, fine particles of sand and/or shell, and any other type of fine materials.
- 1. Equipment - The Contractor shall furnish all necessary pumps, compressors, tools, piping, hoses and any other equipment needed for the purpose of developing wells.

2. Development - The Contractor shall develop each of the four monitor wells to obtain the maximum yield of water per foot of drawdown under a sand-free and turbidity-free condition while pumping each well continuously during the development phase. The well development of each well shall not be carried out until the well casing has been set in place and cemented for a period of at least 24 hours. Each well shall be developed for a minimum period of two hours or until the water is clear. Surging by varying the pumping rate should be utilized as part of the well development. Two one-liter split samples shall be collected for each well and properly labeled. One split sample shall be provided to the Engineer immediately after labeling and the second split sample shall be submitted by the Contractor to a laboratory for analyses. No work other than pad construction may be performed until the monitor wells have been completed and the water quality results for chloride concentration (mg/L), conductivity ($\mu\text{mhos/cm}$), temperature ($^{\circ}\text{F}$), and water table altitude referenced to NGVD are received by the Engineer, who in turn will deliver the results to the TAC. The Engineer may require the Contractor to properly plug and abandon the monitor wells after all construction has ceased and equipment is removed from the site.

3.03 RECORDS

- A. One complete set of the following records and reports shall be delivered to the Engineer.
 1. Record of Casing Pipe - The Contractor shall keep an accurate record, as assembled on size and length of the individual pieces of casing and screen pipe installed in all the wells.
 2. Daily Reports - The Contractor shall prepare a daily drilling report once the drilling is started and until completed describing the work done each day, items of work accomplished (such as depth drilled, casing set, etc.), and other pertinent data as required by the Engineer.

3.04 CLEANUP

- A. The Wells - After each well has been completely constructed, it shall be thoroughly cleaned of all foreign substances, including but not limited to tools, timbers, rope, debris of any kind, cement, oil, grease and scum.
- B. The Sites - The Contractor shall at all times keep the premises free from accumulation of waste materials caused by his employees or work and shall clean up as often and as directed by the Engineer. After each well has been completed and the development conducted, the sites shall be cleaned up, any ditches dug shall be filled up, all drilling materials and any other imported substances shall be removed and the site returned to its original condition.

3.05 CAPPING

- A. After each well has been completed and developed, the Contractor shall furnish and install suitable connections and materials for capping the wells. The well capping shall consist of a 2-inch PVC diameter cap, as shown in the Drawings. The PVC cap and casing shall have a device that can be securely locked with a padlock. All hardware and fasteners shall be stainless steel. All four locks shall be keyed alike and a total of three keys shall be furnished to the Owner. The Contractor shall submit shop drawings on the interlocking device for the Engineer's approval.

3.06 SAMPLING

- A. Throughout the period of time during which the Test/Injection Well and the Monitor Wells are under construction, the four shallow monitor wells will be sampled weekly by the Contractor and submitted to a state-certified laboratory for conductivity, temperature and chloride analysis with results provided to the Engineer no later than 48 hours after sample collection. The Contractor may utilize Teflon or PVC bailers and low flow pumps during the sampling procedure that shall meet the requirements of the Contractor's QCAP (see Technical Specifications Section 13200).

END OF SECTION

SECTION 13100

LOWER ZONE MONITOR WELL

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work described herein consists of drilling, casing, cementing, developing, testing and completing the Lower Zone monitor well (LZMW) in the Floridan aquifer in accordance with these specifications in the location and in the manner shown on the Drawings.
- B. The principal purpose of the work is to install a well that will monitor the first permeable zone overlying the injection zone within the Floridan aquifer to determine if any injected water migrates from the injection zone to the aquifer above it.
- C. The construction of the well must be performed by a State of Florida licensed Water Well Contractor, and the well must meet all standards set by the Florida Department of Environmental Protection (FDEP), the Southwest Florida Water Management District (SWFWMD), the American Water Works Association (AWWA), Sarasota County Health Department (SCHD) and City of Sarasota codes.
- D. The drilling Contractor shall be responsible for providing to the Owner's Engineers proof of all secured permits and operating licenses as required by local and state agencies. No construction may begin until such permits are obtained and the drilling pad (temporary or permanent) is constructed.

1.02 EQUIPMENT, PERSONNEL AND STANDBY TIME

- A. The Contractor shall furnish capable personnel and equipment to construct the well as specified. The work shall be performed with equipment which is adequate to perform all phases of well construction. The bidder shall submit with his bid information on the equipment to be used in this project as requested on the Equipment Schedule. He shall also submit with the above information a statement indicating ownership or lease agreement on this equipment.

If, in the opinion of the Engineer, the Contractor's equipment is not capable of satisfactorily performing the work provided for in these specifications, the Contractor shall substitute equipment satisfactory to the Engineer.

- B. The Contractor in addition to furnishing the services of skilled and experienced drillers in the type of formations to be encountered shall also furnish an adequate number of competent helpers.

- C. The Contractor should coordinate with the Engineer so that standby time is kept to a minimum. Standby time is payable as defined within the Schedule of Prices.

1.03 WELL LOCATION

- A. The LZMW site is to be located as shown on the Drawings. The specific monitor well location is also shown in the Drawings. The location of the well shall be clearly marked on the land surface. The Contractor shall accept this location as is and it is his responsibility to acquaint himself with the actual site conditions prior to submitting a bid to do the work. Clearing, drainage, and other work required to provide access to the work site shall be performed as described in the Technical Specifications.
- B. The Contractor shall ensure that the location of all his equipment and tools shall be such as to not interrupt the access to any private property or to road traffic, or to the work of others.

PART 2 - PRODUCTS

2.01 CASINGS

- A. Well Casings:
 - 1. The well casings shall be fabricated in accordance with Section 15070 and the details shown on the Drawings.
 - 2. The Contractor (at his option) can install a protective pit casing with an inside diameter sufficient to accommodate a 22-inch diameter drilling bit. The pit casing is required to protect the holes from caving or raveling prior to, during and after construction of the holes. This casing shall remain in place until the first permanent casings are set according to the specifications herein.
 - a. The cost of furnishing and installing the protective pit casing shall be included in the price of mobilization.
 - 3. Drilling of the wells and casings shall be paid at the unit prices set in the Contract. For the purpose of payment, the following lengths shall be considered:
 - a. well, from the bottom of the hole to the ground level;
 - b. casings, from the bottom of the casing as placed and cemented in the hole to the permanent top of the casing.
- B. Cement:
 - 1. All cement used on the LZMW shall be standard brand Portland cement conforming to the "Specifications for Portland Cement" (ASTM Designation C150) Type II Moderate Sulfate Resistant - Class 10A (API) (Florida Class H) except that the

requirement contained in said ASTM Specification regarding insoluble residue is waived. The neat cement shall contain no more than 5.5 gallons of water per bag of cement.

2. Cementing of casings shall be accomplished in the presence of the Engineer or his representative, and filling the annular space between hole and casings as shown in the Drawings. Prior to grouting, water or other drilling fluid must be circulated in the annular space sufficiently to clear obstructions as part of borehole conditioning. Unless otherwise specified, the method used shall be optional with the Contractor among those described in Appendix C - "Grouting and Sealing-Methods of Placement," (AWWA Standard for Water Wells: AWWA A100-97) and provided there is no conflict with requirements of these Specifications. After cementing a well, it must remain undisturbed for at least 24 hours for setting up of the cement.
3. Cement additives required to cement in zones of high permeability (cavities) must be approved by the Engineer from among those previously receiving approval. They are calcium chloride, gilsonite, fiocene, cellophane flakes, filsonite, kaolite or equivalent, and bentonite. The cement grout may be composed of between 4 to 12 percent additives if the need for such additives can be justified. A maximum 12 percent of additives may be added to the cement grout with an average of no more than 10 percent additives when 4 percent accelerators are used. In the cementing of the upper 100 feet of the inner casing only, 4 percent bentonite may be added. In the lower 100 feet of the inner casing, cementing must be attempted with no additives. Should this prove to be impractical, a mixture up to 12 percent of bentonite may be used if approved by the FDEP in advance.
4. Samples of each lift (three samples per lift at start, middle, and at the end) of cement grout installed around each of the casings shall be retained by the driller. Each sample shall be labeled and forwarded to the Engineer.
5. The Contractor shall furnish the services of an approved company to provide cementing services. At the time he submits his bid, the Contractor must provide for Engineer's approval the name and address of the cement company that he will use. The Engineer may, at his discretion, and at any time, reject a firm and request other choices of firms. Prior to any cementing, the Contractor shall use the caliper log to calculate cement requirements.
6. Cementing of the well casings is sometimes required to be witnessed by an official of SWFWMD and FDEP and also by an official of the SCHD. It shall be the responsibility of the Contractor to notify the officials with sufficient lead time (minimum 48 hours).
7. Prior to cementing each casing, the Contractor will complete a cement program as required by FDEP rules using the forms and procedures selected for such a purpose.

Both cement volumes and additives must be shown, and the forms must be signed by the Contractor.

D. Drilling Fluid and Testing and Handling Facilities

1. When drilling mud is used in drilling, only high-grade approved clays in common usage for oil field drilling shall be used in the makeup of the drilling fluid. Drilling with a mixture of water and unprocessed mud, clay, or other objectionable material will not be permitted. The drilling fluid shall possess such characteristics as are required to adequately condition the walls of the hole to prevent caving of the walls as drilling progresses.
2. The Contractor shall maintain complete control over drilling mud characteristics during the entire operation of well construction. If proper control of the drilling mud is not maintained to the satisfaction of the Engineers, the Contractor shall be required to retain or employ on the job during all operations an individual recognized in the industry as an experienced mud engineer to supervise and maintain drilling fluid characteristics to the satisfaction of the Engineer.
3. The Contractor shall provide his own mud tanks or provide other means for handling the drilling fluid. Upon completion of the mud drilling operation, mud and cuttings from the well shall be removed immediately from the site and disposed of by the Contractor. Mud and fluids displaced while cementing will also be immediately disposed of at an approved offsite location by the Contractor. If mud sumps are used, the Contractor shall clean all mud and cuttings from the sumps, backfilling the sumps with clean earth, which shall be thoroughly compacted, and restore the ground to its original conditions as soon as mud drilling is completed.
4. The Contractor is cautioned to maintain the minimum viscosity of the drilling fluid that will raise cuttings and adequately condition the walls of the hole. He is also cautioned that, prior to cementing casings, he must circulate fluid through the annular space to clear any obstructions. All mud cakes must be thoroughly removed from the walls.
5. The Contractor is required to have on site at all times under protective cover, a sufficient quantity of salt to control any potential positive heads encountered in the hole. Salt, however, should not be used except as a last resort to control flow. Mud should be the first option. The Contractor is responsible for providing to the Engineer a daily running log of volumes of salt used.
6. Since the wells are expected to be under flowing artesian conditions, the water level will have to be controlled at all times if artesian flow is encountered to prevent spills of high chloride water on the ground surface. The deep monitor wells will be drilled by mud rotary or some other suitable method down to approximately 300 feet such that there should be no well flow during that portion of the drilling. The Contractor

will be responsible for ensuring that the viscosity of the mud will be high enough to prevent any artesian flow from the wells. If any artesian flow should occur from the wells, the Contractor shall be responsible for handling all excess water. Discharge of fluids will not be allowed on the land or adjacent bodies of water and the fluids must be self-contained in leak-proof settling tanks provided by the Contractor prior to disposal. Below ± 300 feet, the deep monitor well will be drilled by reverse air circulation. The purpose of this is to obtain representative water samples from the well below ± 300 feet, and the Contractor is cautioned that he must circulate enough fluid at the end of each drill rod to obtain a good sample. The driller must submit for Engineer's approval the shop drawings for his proposed circulation system. This system must be a system where the returning fluid is allowed to discharge into a settling tank system prior to re-injection into the well. Sufficient settling capacity must be provided to avoid excessive solids re-entering the well. The driller should be prepared to install flow restriction collars in the wellheads or mud plugs to prevent overloading the well. At peak times of flow, the Contractor shall be prepared to truck out the fluids if necessary. Cuttings from the high chloride zones will not be disposed of or stored on the ground and must be trucked away to an approved disposal site. Any spill of high chloride water must be removed from the shallow aquifer at the Contractor's expense.

7. A blowout and flow preventor shall be installed temporarily on top of the casing to control any flow which might be encountered while drilling the open holes below the 300-foot level.

PART 3 - EXECUTION

3.01 FLORIDAN AQUIFER DEEP MONITOR WELL DESCRIPTIONS

- A. The LZMW shall be drilled into the base of the Ocala Formation of the Upper Floridan aquifer and shall be constructed as follows:
 1. Drill nominal 10-inch diameter pilot hole to approximately 300 feet below land surface (bls) using the conventional mud rotary method. Conduct inclination surveys at 90 foot intervals.
 2. Conduct geophysical logging as per Table 3-1.
 3. Ream pilot hole to 22-inch diameter to approximately 300 feet bls.
 4. Set and cement in-place 16-inch diameter, 0.375-inch wall thickness steel surface casing to approximately 300 feet bls. Conduct temperature log after each stage of cementing.
 5. Drill 10-inch nominal diameter pilot hole to selected monitor well total depth (TD) estimated to be 950 feet bls. Conduct inclination surveys at 90-foot intervals.

6. Conduct geophysical logging according to Table 3-1.
7. Set single packer approximately 50 feet above TD and test to confirm lower zone productivity and water quality. If not sufficiently productive (specific capacity >0.4 gpm/ft), move packer up hole 25 feet and conduct another packer test. If the zone still does not have a specific capacity of at least 0.4, move packer uphole another 25 feet and retest. A decision will be made at that time as to the appropriate specific capacity.
8. Ream the pilot hole to a nominal 16-inch diameter hole to the top of the previously determined lower monitor zone, estimated to be at about 900 feet bls. Conduct inclination surveys at 90 feet intervals.
9. Tag bottom of hole. If reamer cuttings do not fill pilot hole to top of lower monitor zone, fill hole with sand/gravel by the tremie method up to a depth determined by the Engineer.
10. Conduct caliper and gamma ray logging.
11. Set and cement in place 6-inch (ID) diameter, FRP casing to an approximate depth of 900 feet bls. Individual cement stages shall not exceed 500 feet in vertical height. Conduct temperature log after each stage of cementing and a sector bond log following completion of final cement stage.
12. Conduct 1-hour pressure test on 6-inch diameter FRP casing.
13. Clean pilot hole to TD employing a nominal 6-inch diameter bit.
14. Develop monitor zone to the satisfaction of the Engineer.
15. Collect and analyze background water quality sample.
16. Disinfect monitor zone.

TABLE 3-1. Geophysical Logging Program for LZMW*									
	Gamma Ray	Caliper	Dual Induction	Temperature	BHC Sonic- VDL	Fluid Conductivity**	Fluid Velocity**	Sector Bond Log	TV Survey
Drill 10-inch pilot hole to 300 feet	X	X	X		X				
Ream 22-inch hole to 300 feet	X	X							
Cement 16-inch casing to 300 feet				X					
Drill nominal 10-inch pilot hole to a point below base of USDW (≈ 950 ft.)	X	X	X	X	X	X	X		X
Ream 16-inch hole to ≈ 900 feet	X	X							
Cement 6-inch casing to 900 feet				X				X	

Note:

* Logs will be conducted after completion of each task, except temperature logs which will be conducted during operations.

** This log should be conducted under pumping conditions if at all possible. Water produced from this logging process must be contained and disposed of in a manner acceptable to the Engineer. If the Contractor believes it is not possible to conduct this logging under pumping conditions, he must submit a written statement to the Consultant describing his position.

B. Drilling - Surface Casing:

1. Ten-inch (10") or smaller diameter pilot holes shall be drilled by mud rotary or some other suitable method approved by the Engineers to an approximate depth of +300 feet. Cuttings shall be collected every 10 feet for classification of geological formations encountered.
2. Twenty-two inch (22") diameter hole will then be reamed to an approximate depth of ± 300 feet and a sixteen-inch (16") diameter surface casing will be centered and cemented in the reamed hole with neat cement around the annulus from the bottom of the hole to land surface. The exact depth to which the hole shall be drilled and cased will be determined by the Engineer.
3. Each section of the sixteen-inch (16") steel surface casings shall be joined to another section by lap welding in the field in accordance with Section 15070. Special care shall be exercised to ensure straight and plumb casings.
4. If a casing should break or collapse and/or the grout emplacement is of poor quality, it shall be withdrawn and replaced at the Contractor's expense. If a casing cannot be removed, the Contractor will plug and abandon the well at his own expense, and the Contractor will move to another location and bring the well to the same level of completion at no additional cost.

C. Final Casing

1. After the surface casing has been cemented for a period of 24 hours, 10-inch diameter pilot hole shall be drilled by reverse air or some other suitable method approved by the Engineer.
2. The 10-inch diameter pilot hole for well shall be drilled to an approximate depth of ± 950 feet and lithologic samples shall be collected as described in Section 3.02 for classification of geological formations encountered. The handling of the excess fluid from the drilling operations shall be carried out as specified in Section D.1. The Engineer may order the drilling to a greater or lesser depths if found advisable after examining the boring logs, and the water/formation samples for the holes.
3. At least 24 hours prior to the completion of the lower monitor well pilot hole, the Contractor shall notify the Engineer and the geophysical logging crew to ensure minimum delays in the start of logging operations. Following the completion of the geophysical logs, the lower deep monitor well pilot hole shall be reamed to sixteen inches (16"). After the lower deep monitor well has been reamed, the setting of the final casing will take place.

4. The 6-inch diameter FRP final casing will be set within the open hole. Centralizers shall be installed in accordance with Section 15070. The final casing will be set at ± 900 feet. The decision for the final casing setting depth will be made by the Engineer.
5. The annulus between the 6-inch FRP casing and 16-inch borehole shall be filled with Type II neat cement from the bottom up to land surface. The grout placement will be carried out in a series of lifts (500 feet maximum vertical height). The first lift should be accomplished by pressure cementing from the inside of the casing. The grout placement for other lifts will be carried out in a series of lifts using a tremie pipe to ensure an effective seal around the casing. The Contractor shall measure the depth to the top of the grout for each lift after the grout has been allowed to cure for a period of no less than 12 hours. The handling of the excess fluid from the grouting operation shall be carried out as specified in Section D.1. During grouting, the specified gravity of the grout should be taken into consideration and precautions taken to ensure that the pressures in the well are not allowed to exceed the collapsible strength.
6. If the final casing should break or collapse and/or the grout emplacement is of poor quality and/or the integrity of the casing and cement grout is unsatisfactory, it shall be withdrawn and replaced at the Contractor's expense. If the casing cannot be removed, the Contractor will move to another location, build a new drilling pad, and bring the well to the same level of completion at no additional cost.
7. Once the casings have been set and cemented and before the cement plugs are drilled out, pressure tests shall be run on the final casing. The casings shall be tested at a pressure of 50 psi for one hour.
8. Once the pressure test is successfully completed, the open hole at the bottom of the well shall be drilled out. The nominal 6-inch diameter open hole must be drilled/cleaned out to a depth of approximately 50 feet beyond the bottom of the final casing.

D. Fluid Handling:

1. The excess water obtained from the LZMW during the drilling, reaming, grouting, and the developing operations shall be disposed of by discharge to settling tanks for later disposal by tanker truck. At all times, the Contractor shall avoid spillage of any excess fluid in the area.
2. The settling tanks will be used to separate the cuttings from the return fluid prior to transportation by tanker truck from the site. The capacity of the settling tank(s) shall be sufficiently large so that all excess fluid disposed of into the tank(s) shall be retained in the tanks long enough to accomplish settling. The Contractor shall be responsible for installing sufficient storage capacity for the excess water based on the

expected kelly discharge and the required settling time. The Contractor should submit his proposed fluid handling layout for approval by the Engineer. Mud, cuttings, and other materials settled in the tank shall be trucked away to an approved disposal site.

3. The Contractor shall exercise care to prevent solids from entering the wells while recirculating the fluids.

E. Plumbness and Alignment - The wells shall be true, round straight and vertical throughout. If, in the opinion of the Engineers, a well might be out of plumb or alignment, it shall be tested at the Contractor's expense in accordance with Section "Testing for Plumbness and Alignment," of the AWWA Standard A100-97. Should the wells fail to meet the requirements established by standards, the plumbness and/or alignment of the wells shall be corrected by the Contractor at his own expense; and should he fail to correct such faulty alignment or plumbness, the Owner may refuse to accept a well.

1. During drilling of the pilot hole and reaming of the full size hole for each deep monitor well from land surface to full depth, a straight hole (drift indicator shur-shot, with 3 degree targets or equivalent) survey will be made every 90 feet. If any reading taken indicates a deviation from vertical of more than one degree, the Contractor shall immediately notify the Engineer. The mechanical drift indicator surveys taken to and including that point shall then be analyzed by the Contractor and the Engineer; and if it is found to be more than one degree of vertical or if in the opinion of the Engineer or his representative the alignment is not acceptable, the Contractor will be required to correct the alignment or abandon and plug the hole at his expense as directed by the Engineer and to drill at this expense another hole and bring it to the same level of completion. Any extra time required by the Engineer or others beyond that time required to field analyze the shur-shot will be paid for by the Contractor.
2. In case of disagreement between the Contractor and the Engineer as to the mechanical drift indicator disc interpretations, the mechanical drift indicator discs shall be analyzed by a service company acceptable to both and two copies of the service company's interpretation of the survey shall be supplied to the Engineer. This interpretation shall be binding on both parties. The selection of the service company making the interpretation shall be by agreement of both the Engineer and the Contractor. No standby time will be paid during this procedure.
3. Records of deflection readings and all other pertinent information shall be kept and made part of the permanent well log record. The original disk will be kept by the Engineer. The Engineer may modify the requirements for plumbness in this Article if in his judgment:
 - a. The Contractor has exercised all possible care in constructing the well and the defect is due to circumstances beyond his control; and

- b. The utility of the completed well will not be materially affected and is acceptable to the regulatory agencies.

F. Pressure Measuring Devices:

1. During the 12-hour duration of the injection test and the 24-hour duration of recovery, two downhole pressure transducers will be required. The Contractor must provide the transducers and the data acquisition unit. The transducer will be installed in the monitor well and must remain at the well during injection and recovery. It must be cable connected at land surface to the required electronic data acquisition unit that will show a true pressure reading throughout the injection and recovery test. At the end of the test, the transducer will be removed from the well by the driller. The transducer's required pressure range will be determined by the Engineer after the final depth is known.

3.02 SAMPLING

A. Formation Samples:

1. Two formation samples shall be collected and labeled from the LZMW pilot hole at each change of formation and at 10-foot intervals between changes of formations. Two large representative samples of each interval or new formation shall be collected by the Contractor and stored in containers (sample bags) supplied by the Contractor. The size and type of container shall be approved by the Engineer.
2. The Contractor shall send at his expense one set of formation samples and necessary well completion forms for each well to the Florida Geological Survey. Additional copies of the completion forms shall be provided to the Engineers, to SWFWMD, to the City of Sarasota and to FDEP. The Contractor shall also deliver to the Engineers the additional set of formation samples collected.

B. Water Samples:

1. The Contractor shall collect one 16-ounce sample of drilling fluids from the discharge of the rig's circulation system every 30 feet during reverse air drilling. These samples shall be given to the Engineer as soon as they are collected for field measurements of pH, conductivity, and temperature to identify changes in water quality. Following the field measurements, the samples will be returned to the Contractor for immediate (less than 12 hours) forwarding to the approved water quality testing laboratory selected by the Contractor. These samples shall be tested in the laboratory for the following parameters: chloride, pH, sulfate, TDS, and conductivity. The analysis of these water samples shall be paid at the unit rate shown in the Bid Schedule of Prices.
2. The samples shall be collected from the discharging stream in perfectly clean new and unused plastic bottles (16-ounce) with Teflon caps. Each bottle shall be rinsed

twice with the water being discharged from the well before the corresponding sample is collected. It is the Contractor's responsibility to provide bottles acceptable to the Engineer. Sample collection will be corrected for lag time. That is corrected to take into account the time it takes for the water from the sampled zone to rise to the surface. Calculation of lag time will be based on the pumping rate. Sample bottles shall be clearly labeled in an indelible way with the description of the well, depth, time, and date of collection, person collecting the sample, and the appearance of the water (clear, turbid or colored). It shall be the Contractor's sole responsibility to collect, protect, and deliver the water samples, properly labeled after collection, to the Engineer. After the Engineer's field testing is completed, the sample bottles will be returned by the Engineer to the Contractor who will then ship the samples at his own expense to the approved water quality laboratory. The Engineer reserves the right to collect additional samples at stratigraphic areas of interest.

3. A final background water quality sample shall be collected from the monitor zone after the final casing has been installed. Prior to collecting water quality samples or developing the sampling zone, the piezometric head shall be measured. The water quality sample shall be collected only after the selected sampling zone has been thoroughly evacuated of extraneous fluids by the driller.
4. The water samples shall be collected in specially prepared collection bottles as provided by an approved water quality testing laboratory. The Contractor shall be responsible for giving satisfactory advance notice of the well development to both the approved water quality testing laboratory and the Engineer so that the former may send the specially prepared collection bottles and that the latter may be present when the required samples are obtained. All the parameters shown in Table I in Section 13200 – TEST/INJECTION WELL must be analyzed to establish background levels in addition to those parameters specified in the Construction Permit. Also, should FDEP so request it, a 5-gallon sample will be collected and shipped to FDEP/Tallahassee by the Contractor as provided for in the regulations. A one-gallon sample will also be delivered by the Contractor to the USGS. Payment for this sampling will be made at the unit rate shown in the Bid Schedule of Prices.
5. Sample bottles shall be clearly labeled in an indelible way with the description of the well, depth, time and date of collection, person collecting the sample, and the appearance of the water (clear, turbid or colored).
6. The water quality testing laboratory selected by the Contractor shall be a State of Florida certified testing laboratory and shall be identified within the bid submitted prior to approval by the Engineer. The Engineer, at this discretion, may reject a laboratory and request other choices of laboratories.
7. The analyses of the final background complete series of water samples shall be paid at a unit rate that shall cover testing for all of the parameters shown in Table I in Section 13200. The unit rate shall be shown on the Bid Schedule of Prices.

8. The Contractor shall furnish through the water quality laboratory four copies of all the test results on the water samples. The Contractor is responsible for the timely shipping of all the water samples to the laboratory.

3.03 GEOPHYSICAL LOGGING

A. General:

1. The Contractor shall furnish the services of an approved company to provide geophysical logs for the LZMW. At the time he submits his bid, the Contractor must provide for Engineer's approval the name and address of the logging company that he will use. The Engineer may, at his discretion, reject a firm and request other choices of firms.
2. The Contractor shall retain full responsibility for notifying the geophysical logging crew, as nominated within his bid submittal, of the need to conduct the geophysical logging as specified in Section B.1 below. The Contractor shall notify the Engineer and appropriate regulatory agencies at least 48 hours prior to logging operations.
3. Prior to each logging or TV surveying, the Contractor shall prepare the hole to ensure that it is open and can be logged and/or TV surveyed with a minimum of delay. During each geophysical logging phase, the Contractor shall not charge for his standby time.
4. The cost of the logging phases specified in Section B.1 below shall be included in the lump sum bid price for the Item. No payment will be made for logs, which are unusable or inaccurate due to poor performance of logging equipment.

B. Geophysical Logs:

1. The logs specified in Table 3-1 shall be run in the well at the construction stages indicated.
2. Temperature logs shall be run following each cementing operation (lift) to confirm cement coverage.
3. The Contractor shall perform caliper and gamma ray logs on all reamed portions of the borehole prior to setting casings.

- C. Reporting - The Contractor shall furnish five high quality field copies of the various logs to the Engineer. Twenty (20) final copies prepared by the logging company shall be delivered to the Engineer by the Contractor. All final copies for dual induction, sonic and caliper logs run on the pilot hole to be submitted with scales of 1 inch equals 100 feet, 2 inches equals 100 feet and 5 inches equals 100 feet. All final copies of TV surveys should be submitted in DVD format.

3.04 SINGLE PACKER DRILL STEM TEST

- A. The Contractor shall perform one single-packer test in the deep monitor well as directed by the Engineer. To perform the single-packer drill stem test, the Contractor shall employ the services of an approved company recognized as expert in this form of testing, such as, but not limited to, Baker Tools or TAM International. The open-hole single-packer drill stem test shall be conducted such that the hydrologic properties of the formation can be determined and a representative water sample can be collected for analysis. The Engineer will select the depth interval to be tested during the drilling of the pilot holes.
- B. The specific depth at which the test will be performed will be chosen during drilling. The test proposed in the monitor well will be performed across the following approximate interval: 900-950 feet. This interval is subject to change based on data collected during drilling.
- C. Prior to conducting the packer test, the Contractor shall perform caliper and gamma ray logs on the open hole section of the pilot hole. The drill stem test shall be performed using an inflatable packer installed on drill pipe. The upper 200 feet of drill pipe should consist of drill pipe with a six-inch inside diameter to facilitate the installation of a four-inch diameter submersible pump which shall be set at a depth of approximately 150 feet bls. The submersible pump shall have the capability of pumping at rates between 10 and 100 gpm (gallons per minute). The Contractor shall provide an in-line propeller-type flow meter capable of recording total flow and discharge. The internal surfaces of drill pipe, casings, and other fittings used for the packer tests shall be free of rust, scale, and other material that could be dislodged and interfere with a test. Should a test fail because of the presence of any of these materials in the tools or pipe, the Contractor will not be reimbursed for the test and he will be required to clean the pipe, re-set it and the packer, and re-run the test successfully at his own cost as part of the contract requirements.
- D. After successfully inflating and setting the packer and before the Contractor conducts a pumping test and recovery test for the single-packer drill stem test, he shall develop each zone so that it is free of any drilling mud/fluids and producing representative formation water. Additionally, he shall allow the water leveling the pipes to return to static conditions to the satisfaction of the Engineer. It is anticipated that rates of between 10 and 100 gpm will be obtained during the pumping test. The Contractor shall be responsible for providing all necessary pumps, equipment, pipelines, meters, gauges, and appurtenances necessary for testing as described and will provide access for water-level measurements using M-scope, tape, or electronic probe.
- E. Just prior to completion of each pumping test, the Contractor shall collect a water sample from the discharge. These samples shall be given to the Engineer as soon as it is collected for field measurements of pH, conductivity, and temperature to identify changes in water quality. Following the field measurements, the samples will be returned to the Contractor for immediate (less than 12 hours) forwarding to the approved water quality testing laboratory selected by the Contractor. These samples shall be tested in the laboratory for

the following parameters: chloride, pH, sulfate, TDS, and conductivity. The analysis of these water samples shall be paid at the unit rate shown in the Bid Schedule of Prices.

3.05 RECORDS

A. Copies of the following records and reports shall be delivered to the Engineers:

1. Records of Formation - The Contractor shall identify and keep an accurate record of the location of the top and bottom of each stratum penetrated and the depths from which formation samples are collected. This record will also describe the ease and/or difficulty of drilling, noting the time required for each 10 feet of penetration. A copy of this record shall be delivered to the Engineer.
2. Record of Casing Pipe and Cementing - The Contractor shall keep an accurate record, as assembled, on size and length of the individual pieces of pipe installed in all the wells. A copy of this record shall be delivered to the Engineer. A log of cement volumes used will also be kept. At the time pipes or cement are delivered to the site, the Contractor shall furnish original signed copies of the manufacturer's mill certificates for the pipes and the chemical analysis for the cement.
3. Daily Reports - The Contractor shall keep a daily report once the drilling is started and until completed, describing the nature of material encountered, the work done during each day, items of work accomplished (such as depth drilled, casing set, etc.), the water level in the well at the beginning and end of each shift, and other pertinent data as required by the Engineer.

3.06 WELL DEVELOPMENT AND TESTING

A. The intent of this paragraph of the Specifications is to provide for the development and testing of the LZMW. The purpose of the development work is to remove effectively from the well, well walls, and the formation immediately adjacent to each well, material like mud, clay, fine particles of sand and/or shell, and any other type of fine materials.

1. Pumps and Equipment - The Contractor shall furnish all necessary pumps, compressors, tools, piping, hoses, and any other equipment needed to develop each monitor well. The pumping unit shall be complete with prime mover of ample power, controls and appurtenances, to enable a discharge rate of up to appropriate pumping rates from the well for a period of two hours at a time. The Contractor shall install and operate the pumping equipment and piping capable of pumping the discharge away from each monitor well and temporarily discharging the flow into the empty settling tanks.
2. Development - The Contractor shall develop the monitor wells to obtain the maximum yield of water per foot of drawdown under a sand-free and turbidity-free condition while pumping each well at the pumping rate specified below. This shall be carried out after the final casing has been set in place and cemented. The monitor

wells shall be pumped at 300 gpm for a period of two hours at a time for up to 24 hours with a turbine, submersible or reactivating pump to complete development. Surging by varying the pumping rate should be utilized as part of the well development. Care shall be taken to ensure that the surging be done in a controlled manner so that excessive pressures do not develop within the well. After the completion of the pumping, the Contractor shall remove by bailing, pumping or other approved methods any sand, stones or other foreign material that may have become deposited in either well.

3. Duration of Development - Time stated for the duration of the pumping is an estimate only and the Owner reserves the right to require the Contractor to extend or reduce such period of pumping. Payment for pumping will be made according to the Schedule of Prices.

3.07 CLEAN UP

- A. The Wells - After the wells have been completely constructed, they shall be thoroughly cleaned of all foreign substances, including tools, timbers, rope, debris of any kind, cement, oil, grease, joint dope and scum.
- B. The Site - The Contractor shall at all times keep the premises free from accumulations of waste materials caused by his employees or work and shall clean up as often and as directed by the Engineer. After each well has been completed and the pumping test conducted, the sites shall be cleaned up, any ditches dug should be filled in, any ditches filled should be returned to normal, all mud, drilling materials, and any other imported substances shall be removed and the site returned to its original condition.

3.08 PROTECTION OF QUALITY OF WATER

- A. Precautions to be Taken - The Contractor shall take precautions as necessary, or as required, to permanently prevent contaminated water or water having undesirable physical, bacteriological, or chemical characteristics from entering through the opening made by the Contractor in the stratum where a potable water source exists. He shall take all necessary precautions during the construction period to prevent contaminated water, gasoline, etc. from entering the wells either through the opening or by seepage through the ground surface.
- B. Corrective Work - In the event that either well becomes contaminated or water having undesirable physical or chemical characteristics does enter a well due to the neglect of the Contractor, he shall at his own expense, perform such work or supply such casings, seals, sterilizing agents or other material as may be necessary to eliminate or shut off the undesirable water.
- C. Freedom From Sand and Turbidity - The Contractor shall exercise extreme care in the performance of his work to prevent the breakdown or caving in of strata overlying that to which the water is to be injected. He shall develop, pump, or bail the wells by methods

approved by the Engineer until the water pumped from the wells shall be substantially free from sand.

3.09 CAPPING

- A. Temporary Capping - At all time during the progress of the work, the Contractor shall protect the well to effectively prevent either tampering with the well or the entrance of foreign matter into it; and upon completion, he shall provide and set substantial caps satisfactory to the Engineer.
- B. Final Capping - After the well has been tested, the Contractor shall furnish and install suitable materials for capping the well in the following manner: Contractor shall furnish PVC Flanges meeting all the requirements of ANSI/AWWA-C115/A21.15 for attachment to the top of the final well casing. The Contractor shall furnish a minimum ¾-inch thick PVC capping plate for each flange, and stainless steel nuts and bolts for attaching the plate to the flange. Flange shall have a 1-inch diameter valve to allow for pumping in of salt kill solution. Top of the inner casing shall be not less than 12 inches above ground level. The Contractor is responsible for any objectionable material that may fall into the well and its consequences until the completion and acceptance by the Engineer of all the work. Unit price set in the Contract shall cover all the necessary work and material to rustproof and paint the wells, including any additional temporary casing required.

3.10 ABANDONMENT OF WELL

- A. In the event the Contractor is directed to abandon a well for failure to sink a well to the depth specified or for failure to meet other requirements of the specifications, or should a well be abandoned because of loss of tools or for any other cause, he shall remove salvageable casing and equipment and fill the abandoned hole with concrete or other materials approved by the Engineer and by the State of Florida regulatory agencies. The Contractor should then move over to a new site as selected by the Owner and shall drill a new well to the same specifications. No additional compensation in time or monies will be allowed. Salvaged material cannot be used again in this project but shall remain the Contractor's property.

3.12 NOISE

- A. The Contractor is responsible for insuring that the City of Sarasota Regulations on Noise are adhered to. The Contractor shall be prepared to install at his expense any muffler, hay barrier, sound curtains or whatever other remedy is necessary to complete the work without violating the City regulations. The Contractor shall submit a noise abatement plan as a project shop drawing.

END OF SECTION

SECTION 13150

UPPER ZONE MONITOR WELL

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work described herein consists of drilling, casing, cementing, developing, testing and completing the Upper Zone monitor well (UZMW) in the Floridan aquifer in accordance with these specifications in the location and in the manner shown on the Drawings.
- B. The principal purpose of the work is to install a well that will monitor the Ocala Limestone formation of the Floridan aquifer to determine if any injected water migrates from the injection zone to the artesian aquifer above it.
- C. The construction of the well must be performed by a State of Florida licensed Water Well Contractor, and the well must meet all standards set by the Florida Department of Environmental Protection (FDEP), the Southwest Florida Water Management District (SWFWMD), the American Water Works Association (AWWA), Sarasota County Health Department (LCHD) and City of Sarasota codes.
- D. The drilling Contractor shall be responsible for providing to the Owner's Engineers proof of all secured permits and operating licenses as required by local and state agencies. No construction may begin until such permits are obtained and the drilling pad constructed.

1.02 EQUIPMENT, PERSONNEL AND STANDBY TIME

- A. The Contractor shall furnish capable personnel and equipment to construct the wells as specified. The work shall be performed with equipment that is adequate to perform all phases of well construction. The bidder shall submit with his bid information the equipment to be used in this project as requested on the Equipment Schedule. He shall also submit with the above information a statement indicating ownership or lease agreement on this equipment.

If, in the opinion of the Engineer, the Contractor's equipment is not capable of satisfactorily performing the work provided for in these specifications, the Contractor shall substitute equipment satisfactory to the Engineer.

- B. The Contractor in addition to furnishing the services of skilled and experienced drillers in the type of formations to be encountered shall also furnish an adequate number of competent helpers.

- C. The Contractor should coordinate with the Engineer so that standby time is kept to a minimum. Standby time is payable as defined within the Schedule of Prices.

1.03 WELL LOCATION

- A. The UZMW site is to be located as shown on the Drawings. The specific monitor well location is also shown in the Drawings. The location of the well shall be clearly marked on the land surface. The Contractor shall accept this location as is and it is his responsibility to acquaint himself with the actual site conditions prior to submitting a bid to do the work. Clearing, drainage, and other work required providing access to the work site shall be performed as described in the Technical Specifications.
- B. The Contractor shall ensure that the location of all his equipment and tools shall be such as to not interrupt the access to any private property or to road traffic, or to the work of others.

PART 2 - PRODUCTS

2.01 CASINGS

A. Well Casings:

1. The well casings shall be fabricated in accordance with Section 15070 and the details shown on the Drawings.
2. The Contractor (at his option) can install a protective pit casing with an inside diameter sufficient to accommodate a 22-inch diameter drilling bit. The pit casing is required to protect the holes from caving or raveling prior to, during and after construction of the holes. This casing shall remain in place until the first permanent casings are set according to the specifications herein.
 - a. The cost of furnishing and installing the protective pit casing shall be included in the price of mobilization.
3. Drilling of the wells and casings shall be paid at the unit prices set in the Contract. For the purpose of payment, the following lengths shall be considered:
 - a. well, from the bottom of the hole to the ground level;
 - b. casings, from the bottom of the casing as placed and cemented in the hole to the permanent top of the casing.

B. Cement:

1. All cement used on the UZMW shall be standard brand Portland cement conforming to the "Specifications for Portland Cement" (ASTM Designation C150) Type II Moderate Sulfate Resistant - Class 10A (API) (Florida Class H) except that the

requirement contained in said ASTM Specification regarding insoluble residue is waived. The neat cement shall contain no more than 5.5 gallons of water per bag of cement.

2. Cementing of casings shall be accomplished in the presence of the Engineer or his representative, and filling the annular space between hole and casings as shown in the Drawings. Prior to grouting, water or other drilling fluid must be circulated in the annular space sufficiently to clear obstructions as part of borehole conditioning. Unless otherwise specified, the method used shall be optional with the Contractor among those described in Appendix C - "Grouting and Sealing-Methods of Placement," (AWWA Standard for Water Wells: AWWA A100-97) and provided there is no conflict with requirements of these Specifications. After cementing a well, it must remain undisturbed for at least 24 hours for setting up of the cement.
3. Cement additives required to cement in zones of high permeability (cavities) must be approved by the Engineer from among those previously receiving approval. They are calcium chloride, gilsonite, fiocene, cellophane flakes, filsonite, kaolite or equivalent, and bentonite. The cement grout may be composed of between 4 to 12 percent additives if the need for such additives can be justified. A maximum 12 percent of additives may be added to the cement grout with an average of no more than 10 percent additives when 4 percent accelerators are used. In the cementing of the upper 100 feet of the inner casing only, 4 percent bentonite may be added. In the lower 100 feet of the inner casing, cementing must be attempted with no additives. Should this prove to be impractical, a mixture up to 12 percent of bentonite may be used if approved by the FDEP in advance.
4. Samples of each lift (three samples per lift at start, middle, and at the end) of cement grout installed around each of the casings shall be retained by the driller. Each sample shall be labeled and forwarded to the Engineer.
5. The Contractor shall furnish the services of an approved company to provide cementing services. At the time he submits his bid, the Contractor must provide for Engineer's approval the name and address of the cement company that he will use. The Engineer may, at his discretion, and at any time, reject a firm and request other choices of firms. Prior to any cementing, the Contractor shall use the caliper log to calculate cement requirements.
6. Cementing of the well casings is sometimes required to be witnessed by an official of SWFWMD and FDEP and also by an official of the SCHD. It shall be the responsibility of the Contractor to notify the officials with sufficient lead time (minimum 48 hours).
7. Prior to cementing each casing, the Contractor will complete a cement program as required by FDEP rules using the forms and procedures selected for such a purpose.

These forms are enclosed at the end of this section. Both cement volumes and additives must be shown, and the forms must be signed by the Contractor.

D. Drilling Fluid and Testing and Handling Facilities

1. When drilling mud is used in drilling, only high-grade approved clays in common usage for oil field drilling shall be used in the makeup of the drilling fluid. Drilling with a mixture of water and unprocessed mud, clay, or other objectionable material will not be permitted. The drilling fluid shall possess such characteristics as are required to adequately condition the walls of the hole to prevent caving of the walls as drilling progresses.
2. The Contractor shall maintain complete control over drilling mud characteristics during the entire operation of well construction. If proper control of the drilling mud is not maintained to the satisfaction of the Engineers, the Contractor shall be required to retain or employ on the job during all operations an individual recognized in the industry as an experienced mud engineer to supervise and maintain drilling fluid characteristics to the satisfaction of the Engineer.
3. The Contractor shall provide his own mud tanks or provide other means for handling the drilling fluid. Upon completion of the mud drilling operation, mud and cuttings from the well shall be removed immediately from the site and disposed of by the Contractor. Mud and fluids displaced while cementing will also be immediately disposed of at an approved offsite location by the Contractor. If mud sumps are used, the Contractor shall clean all mud and cuttings from the sumps, backfilling the sumps with clean earth, which shall be thoroughly compacted, and restore the ground to its original conditions as soon as mud drilling is completed.
4. The Contractor is cautioned to maintain the minimum viscosity of the drilling fluid that will raise cuttings and adequately condition the walls of the hole. He is also cautioned that, prior to cementing casings, he must circulate fluid through the annular space to clear any obstructions. All mud cakes must be thoroughly removed from the walls.
5. The Contractor is required to have on site at all times under protective cover, a sufficient quantity of salt to control any potential positive heads encountered in the hole in the event of an emergency. Salt, however, should not be used except as a last resort to control flow. Mud should be the first option. The Contractor is responsible for providing to the Engineer a daily running log of volumes of salt used.
6. Since the wells are expected to be under flowing artesian conditions, the water level will have to be controlled at all times if artesian flow is encountered to prevent spills of high chloride water on the ground surface. The shallow monitor well will be drilled by mud rotary or some other suitable method down to approximately 300 feet such that there should be no well flow during that portion of the drilling. The

Contractor will be responsible for ensuring that the viscosity of the mud will be high enough to prevent any artesian flow from the wells. If any artesian flow should occur from the wells, the Contractor shall be responsible for handling all excess water. Discharge of fluids will not be allowed on the land or adjacent bodies of water and the fluids must be self-contained in leak-proof settling tanks provided by the Contractor prior to disposal. Below ± 300 feet, the shallow monitor well will be drilled by reverse air circulation. The purpose of this is to obtain representative water samples from the well below ± 300 feet, and the Contractor is cautioned that he must circulate enough fluid at the end of each drill rod to obtain a good sample. The driller must submit for Engineer's approval the shop drawings for his proposed circulation system. This system must be a system where the returning fluid is allowed to discharge into a settling tank system prior to re-injection into the well. Sufficient settling capacity must be provided to avoid excessive solids re-entering the well. The driller should be prepared to install flow restriction collars in the wellheads or mud plugs to prevent the well to prevent overloading the well. At peak times of flow, the Contractor shall be prepared to truck out the fluids if necessary. Cuttings from the high chloride zones will not be disposed of or stored on the ground and must be trucked away to an approved disposal site. Any spill of high chloride water must be removed from the shallow aquifer at the Contractor's expense.

7. A blowout and flow preventer shall be installed temporarily on top of the casing to control any flow that might be encountered while drilling the open holes below the 300-foot level.

PART 3 - EXECUTION

3.01 FLORIDAN AQUIFER SHALLOW MONITOR WELL DESCRIPTIONS

- A. The UZMW shall be drilled into the Ocala Limestone Formation and shall be constructed as follows:
 1. Drill nominal 10-inch diameter pilot hole to approximately 300 feet below land surface (bls) using the conventional mud rotary method. Conduct inclination surveys at 90 feet intervals.
 2. Conduct geophysical logging as per Table 3-1.
 3. Ream pilot hole to nominal 22-inch diameter to approximately 300 feet bls.
 4. Set and cement in-place 16-inch diameter, 0.375-inch wall thickness steel surface casing to approximately 300 feet bls. Conduct temperature log after each stage of cementing.
 5. Drill nominal 10-inch diameter pilot hole to approximately 850 feet bls using the reverse air drilling method. Develop open interval.

TABLE 3-1 Geophysical Logging Program UZMW*		Gamma Ray	Caliper	Dual Induction	Temperature	BHC Sonic- VDL	Fluid Conductivity	Fluid Velocity**
Drill 10-inch pilot hole to 300 feet		X	X	X		X		
Ream 22-inch hole to 300 feet		X	X					
Cement 16-inch casing to 300 feet					X			
Drill 10-inch pilot hole to TD (est. 850 ft.)		X	X	X	X	X	X	X
Ream pilot hole to 16-inch to 800 feet		X	X					
Cement 6-inch casing to 800 feet					X			

Note:

* Logs will be conducted after completion of each task, except temperature logs which will be conducted during operations.

** This log should be conducted under pumping conditions if at all possible. Water produced from this logging process must be contained and disposed of in a manner acceptable to the Engineer. If the Contractor believes it is not possible to conduct this logging under pumping conditions, he must submit a written statement to the Consultant describing his position.

6. Set a single packer at the approximate depth of 800 feet and conduct specific capacity and water quality tests to verify monitor zone is above the USDW.
7. Conduct geophysical logging according to Table 3-1.
8. Ream the pilot hole to nominal 16-inch diameter to the top of the monitoring zone, which is estimated to be approximately 800 feet bls. Make sure existing pilot hole is filled with reamer cuttings or sand/gravel is added so fill level is approximately five feet below bottom of casing depth.
9. Conduct caliper and gamma ray logging.
10. Set and cement in place 6-inch (ID) diameter, FRP casing to an approximate depth of 800 feet bls. Individual cement stages shall not exceed 500 feet in vertical height. Conduct temperature log after each stage of cementing.
11. Conduct 1-hour pressure test on FRP casing.
12. Clean pilot hole to TD employing a nominal 6-inch diameter bit.
13. Develop monitor zone to the satisfaction of the Engineer.
14. Collect and analyze background water quality sample.
15. Disinfect monitor zone.

B. Drilling-Surface Casing

1. After the pit casing has been cemented for a period of 24 hours, a ten-inch (10") diameter or smaller pilot hole shall be drilled by mud rotary to an approximate depth of ± 300 feet. Cuttings shall be collected for classification of geological formations encountered.
2. The pilot hole will then be reamed to a nominal 22 inches to an approximate depth of ± 300 feet and a sixteen-inch (16") diameter surface casing will be centered in the reamed hole. The casing shall be cemented with neat cement (Type II) around the annulus from the bottom of the hole to land surface. The exact depth to which the hole shall be drilled and cased will be determined by the Engineer.
3. Each section of the 16" diameter surface casing shall be assembled at the site. The setting of the surface casing will be at the approximate depth of ± 300 feet. Special care should be exercised to ensure straight and plumb casings by blocking them in place prior to cementing. Centering guides will be placed and aligned in accordance

with Section 15070. These centering guides should not in any way interfere with the integrity of the casing or its strength capabilities.

4. The annulus shall be filled with Type II neat cement. The neat cement shall be installed around the entire perimeter of a casing. The first lift should be accomplished by pressure cementing from the inside of the casing. The grout placement for other lifts will be carried out in a series of lifts using a tremie pipe to ensure an effective seal around a casing. The Contractor shall measure the depth to the top of the grout for each lift after the grout has been allowed to cure for a period of no less than 12 hours. The handling of the excess fluid from the grouting operation shall be carried out as specified in Section D.1. During grouting, the specific gravity of the grout should be taken into consideration and precautions taken to ensure that the pressures in the wells are not allowed to exceed the collapsible strength of the casings.
5. If a surface casing should break or collapse and/or the grout emplacement is of poor quality and/or the integrity of the casing and cement grout is unsatisfactorily, it shall be withdrawn and replaced at the Contractor's expense. If the casing cannot be removed, the Contractor will move to another location, building a new drilling pad, install new shallow monitor wells, and bring the well to the same level of completion at no additional cost.

C. Final Casing

1. After the surface casing has been cemented for a period of 24 hours, a 10-inch diameter pilot hole shall be drilled by reverse air or some other suitable method approved by the Engineer.
2. The 10-inch diameter pilot hole shall be drilled to an approximate depth of ± 850 feet and lithologic samples shall be collected as described in Section 3.02 for classification of geological formations encountered. The handling of the excess fluid from the drilling operations shall be carried out as specified in Section D.1. The Engineer may order the drilling to a greater or lesser depths if found advisable after examining the boring logs, and the water/formation samples for the holes.
3. At least 24 hours prior to the completion of the lower monitor well pilot hole, the Contractor shall notify the Engineer and the geophysical logging crew to ensure minimum delays in the start of logging operations. Following the completion of the geophysical logs, the pilot hole shall be reamed to nominal 16-inches in diameter to an estimated depth of 800 feet.
4. The 6-inch diameter FRP casing will be set within the open hole. Centralizers shall be installed in accordance with Section 15070. The final casing will be set at ± 800 feet. The decision for the final casing setting depth will be made by the Engineer.

5. The annulus between the 6-inch final casing and 16-inch borehole shall be filled with Type II neat cement from the bottom up to land surface. The grout placement will be carried out in a series of lifts (500 feet maximum vertical height). The first lift should be accomplished by pressure cementing from the inside of the casing. The grout placement for other lifts will be carried out in a series of lifts using a tremie pipe to ensure an effective seal around the casing. The Contractor shall measure the depth to the top of the grout for each lift after the grout has been allowed to cure for a period of no less than 12 hours. The handling of the excess fluid from the grouting operation shall be carried out as specified in Section D.1. During grouting, the specified gravity of the grout should be taken into consideration and precautions taken to ensure that the pressures in the well are not allowed to exceed the collapsible strength.
6. If the final casing should break or collapse and/or the grout emplacement is of poor quality and/or the integrity of the casing and cement grout is unsatisfactory, it shall be withdrawn and replaced at the Contractor's expense. If the casing cannot be removed, the Contractor will move to another location, build a new drilling pad, and bring the well to the same level of completion at no additional cost.
7. Once the casings have been set and cemented and before the cement plugs are drilled out, pressure tests shall be run on the final casing. The casings shall be tested at a pressure of 50 psi for one hour.
8. Once the pressure test is successfully completed, the open hole at the bottom of the well shall be drilled out. The nominal 6-inch diameter open hole must be drilled/cleaned out to a depth of approximately 50 feet beyond the bottom of the final casing.

D. Fluid Handling:

1. The excess water obtained from the UZMW during the drilling, reaming, grouting, and the developing operations shall be disposed of by discharge to settling tanks for later disposal by tanker truck. At all times, the Contractor shall avoid spillage of any excess fluid in the area.
2. The settling tanks will be used to separate the cuttings from the return fluid prior to transportation by tanker truck from the site. The capacity of the settling tank(s) shall be sufficiently large so that all excess fluid disposed of into the tank(s) shall be retained in the tanks long enough to accomplish settling. The Contractor shall be responsible for installing sufficient storage capacity for the excess water based on the expected kelly discharge and the required settling time. The Contractor should submit his proposed fluid handling layout for approval by the Engineer. Mud, cuttings, and other materials settled in the tank shall be trucked away to an approved disposal site.

3. The Contractor shall exercise care to prevent solids from entering the wells while recirculating the fluids.

E. Plumbness and Alignment - The wells shall be true, round straight and vertical throughout. If, in the opinion of the Engineers, a well might be out of plumb or alignment, it shall be tested at the Contractor's expense in accordance with Section "Testing for Plumbness and Alignment," of the AWWA Standard A100-97. Should the wells fail to meet the requirements established by standards, the plumbness and/or alignment of the wells shall be corrected by the Contractor at his own expense; and should he fail to correct such faulty alignment of plumbness, the Owner may refuse to accept a well.

1. During drilling of the pilot hole and reaming of the full size hole for each deep monitor well from land surface to full depth, a straight hole (drift indicator shur-shot, with 3 degree targets or equivalent) survey will be made every 90 feet. If any reading taken indicates a deviation from vertical of more than one degree, the Contractor shall immediately notify the Engineer. The mechanical drift indicator surveys taken to and including that point shall then be analyzed by the Contractor and the Engineer; and if it is found to be more than one degree of vertical or if in the opinion of the Engineer or his representative the alignment is not acceptable, the Contractor will be required to correct the alignment or abandon and plug the hole at his expense as directed by the Engineer and to drill at this expense another hole and bring it to the same level of completion. Any extra time required by the Engineer or others beyond that time required to field analyze the shur-shot will be paid for by the Contractor.
2. In case of disagreement between the Contractor and the Engineer as to the mechanical drift indicator disc interpretations, the mechanical drift indicator discs shall be analyzed by a service company acceptable to both and two copies of the service company's interpretation of the survey shall be supplied to the Engineer. This interpretation shall be binding on both parties. The selection of the service company making the interpretation shall be by agreement of both the Engineer and the Contractor. No standby time will be paid during this procedure.
3. Records of deflection readings and all other pertinent information shall be kept and made part of the permanent well log record. The original disk will be kept by the Engineer. The Engineer may modify the requirements for plumbness in this Article if in his judgment:
 - a. The Contractor has exercised all possible care in constructing the well and the defect is due to circumstances beyond his control; and
 - b. The utility of the completed well will not be materially affected and is acceptable to the regulatory agencies.

F. Pressure Measuring Devices:

1. During the 12-hour duration of the injection test and the 24-hour duration of recovery, two downhole pressure transducers will be required. The Contractor must provide the transducers and the data acquisition unit. The transducer will be installed in the monitor well and must remain at the well during injection and recovery. It must be cable connected at land surface to the required electronic data acquisition unit that will show a true pressure reading throughout the injection and recovery test. At the end of the test, the transducer will be removed from the well by the driller. The transducer's required pressure range will be determined by the Engineer after the final depth is known.

3.02 SAMPLING

A. Formation Samples:

1. Two formation samples shall be collected and labeled from the UZMW pilot hole at each change of formation and at 10-foot intervals between changes of formations. Two large representative samples of each interval or new formation shall be collected by the Contractor and stored in containers (sample bags) supplied by the Contractor. The size and type of container shall be approved by the Engineer.
2. The Contractor shall send at his expense one set of formation samples and necessary well completion forms for each well to the Florida Geological Survey. Additional copies of the completion forms shall be provided to the Engineers, to SWFWMD, to City of Sarasota and to FDEP. The Contractor shall also deliver to the Engineers the additional set of formation samples collected.

B. Water Samples:

1. The Contractor shall collect one 16-ounce sample of drilling fluids from the discharge of the rig's circulation system every 30 feet during reverse air drilling. These samples shall be given to the Engineer as soon as they are collected for field measurements of pH, conductivity, and temperature to identify changes in water quality. Following the field measurements, the samples will be returned to the Contractor for immediate (less than 12 hours) forwarding to the approved water quality testing laboratory selected by the Contractor. These samples shall be tested in the laboratory for the following parameters: chloride, pH, sulfate, TDS, and conductivity. The analysis of these water samples shall be paid at the unit rate shown in the Bid Schedule of Prices.
2. The samples shall be collected from the discharging stream in perfectly clean new and unused plastic bottles (16-ounce) with Teflon caps. Each bottle shall be rinsed twice with the water being discharged from the well before the corresponding sample is collected. It is the Contractor's responsibility to provide bottles acceptable to the Engineer. Sample collection will be corrected for lag time. That is corrected to take into account the time it takes for the water from the sampled zone to rise to the surface. Calculation of lag time will be based on the pumping rate. Sample bottles

shall be clearly labeled in an indelible way with the description of the well, depth, time, and date of collection, person collecting the sample, and the appearance of the water (clear, turbid or colored). It shall be the Contractor's sole responsibility to collect, protect, and deliver the water samples, properly labeled after collection, to the Engineer. After the Engineer's field testing is completed, the sample bottles will be returned by the Engineer to the Contractor who will then ship the samples at his own expense to the approved water quality laboratory. The Engineer reserves the right to collect additional samples at stratigraphic areas of interest.

3. A final background water quality sample shall be collected from the monitor zone after the final casing has been installed. Prior to collecting water quality samples or developing the sampling zone, the piezometric head shall be measured. The water quality sample shall be collected only after the selected sampling zone has been thoroughly evacuated of extraneous fluids by the driller.
4. The water samples shall be collected in specially prepared collection bottles as provided by an approved water quality testing laboratory. The Contractor shall be responsible for giving satisfactory advance notice of the well development to both the approved water quality testing laboratory and the Engineer so that the former may send the specially prepared collection bottles and that the latter may be present when the required samples are obtained. All the parameters shown in Table I in Section 13200 must be analyzed to establish background levels in addition to those parameters specified in the Construction Permit. Also, should FDEP so request it, a 5-gallon sample will be collected and shipped to FDEP/Tallahassee by the Contractor as provided for in the regulations. A one-gallon sample will also be delivered by the Contractor to the USGS. Payment for this sampling will be made at the unit rate shown in the Bid Schedule of Prices.
5. Sample bottles shall be clearly labeled in an indelible way with the description of the well, depth, time and date of collection, person collecting the sample, and the appearance of the water (clear, turbid or colored).
6. The water quality testing laboratory selected by the Contractor shall be a State of Florida certified testing laboratory and shall be identified within the bid submitted prior to approval by the Engineer. A certified water quality testing laboratory such as the PBS&J Environmental Laboratory based in Orlando, Florida or equal will be acceptable. The Engineer, at this discretion, may reject a laboratory and request other choices of laboratories.
7. The analyses of the final background complete series of water samples shall be paid at a unit rate that shall cover testing for all of the parameters shown in Table I in Section 13200. The unit rate shall be shown on the Bid Schedule of Prices.

8. The Contractor shall furnish through the water quality laboratory four copies of all the test results on the water samples. The Contractor is responsible for the timely shipping of all the water samples to the laboratory.

3.03 GEOPHYSICAL LOGGING

A. General:

1. The Contractor shall furnish the services of an approved company to provide geophysical logs for the UZMW. At the time he submits his bid, the Contractor must provide for Engineer's approval the name and address of the logging company that he will use. The Engineer may, at his discretion, reject a firm and request other choices of firms.
2. The Contractor shall retain full responsibility for notifying the geophysical logging crew, as nominated within his bid submittal, of the need to conduct the geophysical logging as specified in Section B.1 below. The Contractor shall notify the Engineer and appropriate regulatory agencies at least 48 hours prior to logging operations.
3. Prior to each logging or TV surveying, the Contractor shall prepare the hole to ensure that it is open and can be logged and/or TV surveyed with a minimum of delay. During each geophysical logging phase, the Contractor shall not charge for his standby time.
4. The cost of the logging phases specified in Section B.1 below shall be included in the lump sum bid price for the Item. No payment will be made for logs, which are unusable or inaccurate due to poor performance of logging equipment.

B. Geophysical Logs:

1. The logs specified in Table 3-1 shall be run in the well at the construction stages indicated.
2. Temperature logs shall be run following each cementing operation (lift) to confirm cement coverage.
3. The Contractor shall perform caliper and gamma ray logs on all reamed portions of the borehole prior to setting casings.

- C. Reporting - The Contractor shall furnish five high quality field copies of the various logs to the Engineer. Twenty (20) final copies prepared by the logging company shall be delivered to the Engineer by the Contractor. All final copies for dual induction, sonic and caliper logs run on the pilot hole to be submitted with scales of 1 inch equals 100 feet, 2 inches equals 100 feet and 5 inches equals 100 feet. All final copies of TV surveys should be submitted in DVD format.

3.04 SINGLE PACKER DRILL STEM TEST

- A. The Contractor shall perform one single-packer tests in the upper zone monitor well as directed by the Engineer. To perform the single-packer drill stem test, the Contractor shall employ the services of an approved company recognized as expert in this form of testing, such as, but not limited to, Baker Tools or TAM International. The open-hole single-packer drill stem tests shall be conducted such that the hydrologic properties of the formation can be determined and a representative water sample can be collected for analysis. The Engineer will select the depth intervals to be tested during the drilling of the pilot holes.
- B. The specific depths at which the test will be performed will be chosen during drilling. The test proposed to the monitor well will be performed across the following approximate interval: 800-850 feet. This interval is subject to change based on data collected during drilling.
- C. Prior to conducting the packer test, the Contractor shall perform caliper and gamma ray logs on the open hole section of the pilot holes. The drill stem tests shall be performed using an inflatable packer installed on drill pipe. The upper 200 feet of drill pipe should consist of drill pipe with a six-inch inside diameter to facilitate the installation of a four-inch diameter submersible pump which shall be set at a depth of approximately 150 feet bls. The submersible pump shall have the capability of pumping at rates between 10 and 100 gpm (gallons per minute). The Contractor shall provide an in-line propeller-type flow meter capable of recording total flow and discharge. The internal surfaces of drill pipe, casings, and other fittings used for the packer tests shall be free of rust, scale, and other material that could be dislodged and interfere with a test. Should a test fail because of the presence of any of these materials in the tools or pipe, the Contractor will not be reimbursed for the test and he will be required to clean the pipe, re-set it and the packer, and re-run the test successfully at his own cost as part of the contract requirements.
- D. After successfully inflating and setting the packer and before the Contractor conducts a pumping test and recovery test for each single-packer drill stem test, he shall develop each zone so that it is free of any drilling mud/fluids and producing representative formation water. Additionally, he shall allow the water leveling the pipes to return to static conditions to the satisfaction of the Engineer. It is anticipated that rates of between 10 and 100 gpm will be obtained during the pumping test. The Contractor shall be responsible for providing all necessary pumps, equipment, pipelines, meters, gauges, and appurtenances necessary for testing as described and will provide access for water-level measurements using M-scope, tape, or electronic probe.
- E. Just prior to completion of each pumping test, the Contractor shall collect a water sample from the discharge. These samples shall be given to the Engineer as soon as it is collected for field measurements of pH, conductivity, and temperature to identify changes in water quality. Following the field measurements, the samples will be returned to the Contractor for immediate (less than 12 hours) forwarding to the approved water quality testing laboratory selected by the Contractor. These samples shall be tested in the laboratory for

the following parameters: chloride, pH, sulfate, TDS, and conductivity. The analysis of these water samples shall be paid at the unit rate shown in the Bid Schedule of Prices.

3.05 RECORDS

A. Copies of the following records and reports shall be delivered to the Engineers:

1. Records of Formation - The Contractor shall identify and keep an accurate record of the location of the top and bottom of each stratum penetrated and the depths from which formation samples are collected. This record will also describe the ease and/or difficulty of drilling, noting the time required for each 10 feet of penetration. A copy of this record shall be delivered to the Engineer.
2. Record of Casing Pipe and Cementing - The Contractor shall keep an accurate record, as assembled, on size and length of the individual pieces of pipe installed in all the wells. A copy of this record shall be delivered to the Engineer. A log of cement volumes used will also be kept. At the time pipes or cement are delivered to the site, the Contractor shall furnish original signed copies of the manufacturer's mill certificates for the pipes and the chemical analysis for the cement.
3. Daily Reports - The Contractor shall keep a daily report once the drilling is started and until completed, describing the nature of material encountered, the work done during each day, items of work accomplished (such as depth drilled, casing set, etc.), the water level in the well at the beginning and end of each shift, and other pertinent data as required by the Engineer.

3.06 WELL DEVELOPMENT AND TESTING

A. The intent of this paragraph of the Specifications is to provide for the development and testing of the UZMW. The purpose of the development work is to remove effectively from the well, well walls, and the formation immediately adjacent to each well, material like mud, clay, fine particles of sand and/or shell, and any other type of fine materials.

1. Pumps and Equipment - The Contractor shall furnish all necessary pumps, compressors, tools, piping, hoses, and any other equipment needed to develop each monitor well. The pumping unit shall be complete with prime mover of ample power, controls and appurtenances, to enable a discharge rate of up to appropriate pumping rates from the well for a period of two hours at a time. The Contractor shall install and operate the pumping equipment and piping capable of pumping the discharge away from each monitor well and temporarily discharging the flow into the empty settling tanks.

2. Development - The Contractor shall develop the monitor wells to obtain the maximum yield of water per foot of drawdown under a sand-free and turbidity-free condition while pumping each well at the pumping rate specified below. This shall be carried out after the final casing has been set in place and cemented. The monitor wells shall be pumped at 300 gpm for a period of two hours at a time for up to 24 hours with a turbine, submersible or reactivating pump to complete development. Surging by varying the pumping rate should be utilized as part of the well development. Care shall be taken to ensure that the surging be done in a controlled manner so that excessive pressures do not develop within the well. After the completion of the pumping, the Contractor shall remove by bailing, pumping or other approved methods any sand, stones or other foreign material that may have become deposited in either well.
3. Duration of Development - Time stated for the duration of the pumping is an estimate only and the Owner reserves the right to require the Contractor to extend or reduce such period of pumping. Payment for pumping will be made according to the Schedule of Prices.

3.07 CLEAN UP

- A. The Wells - After the wells have been completely constructed, they shall be thoroughly cleaned of all foreign substances, including tools, timbers, rope, debris of any kind, cement, oil, grease, joint dope and scum.
- B. The Site - The Contractor shall at all times keep the premises free from accumulations of waste materials caused by his employees or work and shall clean up as often and as directed by the Engineer. After each well has been completed and the pumping test conducted, the sites shall be cleaned up, any ditches dug should be filled in, any ditches filled should be returned to normal, all mud, drilling materials, and any other imported substances shall be removed and the site returned to its original condition.

3.08 PROTECTION OF QUALITY OF WATER

- A. Precautions to be Taken - The Contractor shall take precautions as necessary, or as required, to permanently prevent contaminated water or water having undesirable physical, bacteriological, or chemical characteristics from entering through the opening made by the Contractor in the stratum where a potable water source exists. He shall take all necessary precautions during the construction period to prevent contaminated water, gasoline, etc. from entering the wells either through the opening or by seepage through the ground surface.
- B. Corrective Work - In the event that either well becomes contaminated or water having undesirable physical or chemical characteristics does enter a well due to the neglect of the Contractor, he shall at his own expense, perform such work or supply such casings, seals, sterilizing agents or other material as may be necessary to eliminate or shut off the undesirable water.

- C. Freedom From Sand and Turbidity - The Contractor shall exercise extreme care in the performance of his work to prevent the breakdown or caving in of strata overlying that to which the water is to be injected. He shall develop, pump, or bail the wells by methods approved by the Engineer until the water pumped from the wells shall be substantially free from sand.

3.09 CAPPING

- A. Temporary Capping - At all time during the progress of the work, the Contractor shall protect the well to effectively prevent either tampering with the well or the entrance of foreign matter into it; and upon completion, he shall provide and set substantial caps satisfactory to the Engineer.
- B. Final Capping - After the well has been tested, the Contractor shall furnish and install suitable materials for capping the well in the following manner: Contractor shall furnish PVC Flanges meeting all the requirements of ANSI/AWWA-C115/A21.15 for attachment to the top of the final well casing. The Contractor shall furnish a minimum 3/4-inch thick PVC capping plate for each flange, and stainless steel nuts and bolts for attaching the plate to the flange. Flange shall have a 1-inch diameter valve to allow for pumping in of salt kill solution. Top of the inner casing shall be not less than 12 inches above ground level. The Contractor is responsible for any objectionable material that may fall into the well and its consequences until the completion and acceptance by the Engineer of all the work. Unit price set in the Contract shall cover all the necessary work and material to rustproof and paint the wells, including any additional temporary casing required.

3.10 ABANDONMENT OF WELL

- A. In the event the Contractor is directed to abandon a well for failure to sink a well to the depth specified or for failure to meet other requirements of the specifications, or should a well be abandoned because of loss of tools or for any other cause, he shall remove salvageable casing and equipment and fill the abandoned hole with concrete or other materials approved by the Engineer and by the State of Florida regulatory agencies. The Contractor should then move over to a new site as selected by the Owner and shall drill a new well to the same specifications. No additional compensation in time or monies will be allowed. Salvaged material cannot be used again in this project but shall remain the Contractor's property.

3.12 NOISE

- A. The Contractor is responsible for insuring that the City of Sarasota Regulations on Noise are adhered to. The Contractor shall be prepared to install at his expense any muffler, hay barrier, sound curtains or whatever other remedy is necessary to complete the work without violating the County regulations. The Contractor shall submit a noise abatement plan as a project shop drawing.

END OF SECTION

SECTION 13200

TEST/INJECTION WELL

PART 1

1.01 GENERAL

- A. The work described herein consists of installing a drilling pad, drilling, casing, cementing, developing, testing, logging and completing a Class I deep injection test/injection well in the lower zones of the Floridan aquifer in accordance with these specifications, in the location and in the manner shown on the Drawings. Incidental to the well, this work also includes construction of an access shell road, clearing, grubbing, filling, leveling and compaction of the construction site in accordance with the Drawings.
- B. The principal purpose of the work is to test the formations of the Floridan aquifer to determine if an injection horizon capable of accepting reject water generated from the reverse osmosis water treatment plant and reclaimed water from the WWTP and also to determine the effect of the injected water on the artesian aquifer system.
- C. The construction of the well must be performed by a State of Florida licensed water well contractor, and the well must meet all standards set by the Florida Department of Environmental Protection (FDEP), the Southwest Florida Water Management District (SWFWMD), the American Water Works Association (AWWA), the Sarasota County Health Department (SCHD), and City of Sarasota regulations.
- D. Work on the drill pad may not begin until that area is filled and leveled. Filling and leveling is to be done by the Contractor in time for it to be inspected and approved by the Owner prior to beginning construction of the drilling pad.
- E. The Owner will provide the FDEP injection well construction permit, but the Contractor shall be responsible for paying for and providing to the Owner's Engineer proof of all other secured permits and operating licenses as required by local and state agencies for both the well drilling and for the disposal of drilling fluids and cuttings off site. No construction shall begin until such permits and licenses are obtained.

1.02 EXPERIENCE, EQUIPMENT, PERSONNEL AND STANDBY TIME

- A. The Contractor shall furnish detailed descriptions of previous work and experience related to the elements of these specifications.
- B. The Contractor shall furnish capable personnel and equipment to construct the well as specified. The work shall be performed with equipment that is adequate to perform all phases of well construction. The bidder shall submit with his bid information on the

equipment he plans to use in this project as requested on the Equipment Schedule. He shall also submit with the above information a statement indicating ownership or lease agreement on this equipment.

1. If, in the opinion of the Engineer, the Contractor's equipment is not capable of satisfactorily performing the work provided for in these specifications, the Contractor shall substitute equipment satisfactory to the Engineer.
- C. The Contractor in addition to furnishing the service of skilled and experienced drillers in the type of formations to be encountered shall also furnish an adequate number of competent helpers.
- D. The Contractor should coordinate with the Engineer so that standby time is kept to a minimum. Standby time is defined in the Supplementary Conditions.

1.03 WELL LOCATION

- A. The well location is shown on the Drawings and the location of the well will be marked by the Owner at land surface. The Contractor shall accept this location as is and it is his responsibility to acquaint himself with the actual site conditions prior to submitting a bid to do the work. The Owner reserves the right to change the location of the hole to another similar site within the general location shown on the Drawings. Unit prices will remain the same at the new location. Clearing, drainage and other work required to provide access to the work site shall be performed as described in the Technical Specifications.
- B. The Contractor shall ensure that the location of all his equipment and tools shall be such as not to interrupt access to any private property or to road traffic or to the work of others.

PART 2

2.01 PRODUCTS

- A. Well Casings:
 1. The well casings shall be fabricated in accordance with Section 15070 and the details shown on the Drawings.
 2. The Contractor shall install a protective pit casing with an inside diameter sufficient to accommodate a 54-inch diameter drilling bit to protect the hole from caving or raveling prior to, during and after construction of the hole. The protective casing, if installed, shall remain in place at least until the first permanent casing is set according to the specification herein. The Contractor has the option for constructing the drilling pad around the protective casing. In which case, the protective casing shall remain in place permanently.

3. The cost of furnishing and installing the protective pit casing shall be included in the cost of the drilling pad at the time the bids are submitted.
- A. The Contractor shall install a surface casing, which shall be new, unused, steel, random length, 48-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 joined together by certified welders. The Contractor must provide the Engineer mill certificates and proof of welders' certifications before any welding may be started.

The Contractor shall install an intermediate casing, which shall be new, unused steel, random length, 40-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 joined together by certified welders.

The Contractor shall install a final casing, which shall be new, unused, seamless steel, random length, 28-inch diameter, 0.5-inch wall thickness, and shall conform to API 5L Grade B, ASTM A53 Grade B standards. The casing shall be plain end and beveled for welding and shall be joined together by certified welders.

The Contractor shall install final injection tubing, which shall be new, unused FRP, random length, 18-inch diameter, 0.76-inch wall thickness, and shall conform to ASTM Specification D2996 and ASTM Classification D2310.

Drilling and casing shall be paid at the unit prices set in the Contract. For the purpose of payment, the following lengths shall be considered:

1. Drilling, from the bottom of the hole to the ground level;
2. Casing, from the bottom of the casing as placed and cemented in the hole to the permanent top of the casing.

B. Centralizers:

All casings of the injection well shall be fitted with Halliburton-type centralizers with steel straps at 0, 90, 180 and 270 degrees as specified in Section 15070 (2.04).

C. Cement:

1. All cement used on all work except on the drilling pad shall be Florida Class H sulfate resistant cement (ASTM C150, Type II) conforming to the "Specifications for Oil-Well Cements and Cement Additives" (API Standard 10A). The neat cement shall contain no more than 5.5 gallons of water per bag of cement.
2. Cementing of casings shall be accomplished in the presence of the Engineer or his representative, and filling completely the annular space between hole and casing, and

casing and casing, and from the bottom of the hole up to top of the ground, and from the bottom of the casing to the top of the ground, respectively. All cement, mixtures shall be approved by the Engineer in advance of placement. Prior to commencement of cementing operations, the Contractor shall submit a written cementing procedure, which includes calculations of the theoretical volume of cement required and materials proposed for each stage of every casing. The written procedure shall be updated prior to emplacement of additional stages of cement. Prior to grouting, water or other drilling fluid must be circulated in the annular space sufficiently to clear obstructions. Unless otherwise specified, the method used shall be optional with the Contractor among those described in Appendix C- "Grouting and Sealing-Methods of Placement," (AWWA Standard for Water Wells: AWWA A100-97) and provided there is no conflict with requirements of these specifications. After a well is cemented, it must remain undisturbed for at least 24 hours for setting up of the cement, except during the cementing operations of the shallowest protective pit casing (if needed), in which case the setting time shall be 24 hours. Up to four percent CaCl_2 may be used as a hardening accelerant, in which case setting times can be reduced by one half.

3. Cement additives required to cement in zones of high permeability (cavities) must be approved by the Engineer from among those previously receiving approval. They are: calcium chloride, gilsonite, cellophane flakes, kaolite or equivalent, and bentonite. Organic polymers, peanut shells, cotton seed hulls may not be used as lost circulation materials. The cement grout may be composed of between 4 to 12 percent additives if the need for such additives can be justified. A maximum 12 percent of additives may be added to the cement grout, with an average of not more than 10 percent additives when four percent accelerators are used. In the cementing of the upper 100 feet of the final casing only, four percent bentonite may be added. In the lower 100 feet of the final casing, cementing must be attempted with no additives. Should this prove to be impractical, a mixture up to 12 percent bentonite may be used if approved by the FDEP in advance.
4. Samples of each lift (three samples per lift at start, middle, and at the end) of cement grout installed around each of the casings shall be retained by the driller. Each sample shall be labeled and forwarded to the Engineer. Cement reports shall be submitted to the Engineer for each cementing stage.

5. The Contractor shall furnish the services of an approved company to provide cementing services. At the time he submits his bid, the Contractor must provide for Engineer's approval the name and address of the cement company that he will use. The Engineer may, at his discretion and at any time, reject a firm and request other choices of firms. Prior to any cementing, the Contractor shall use the caliper log to calculate cement requirements.
6. Cementing of the well casings is sometimes required to be witnessed by officials from SWFWMD, FDEP, and SCHD. It shall be the responsibility of the Contractor to notify the officials with sufficient lead time (minimum 48 hours).
7. Prior to cementing each casing, the Contractor will complete a cement program as required by FDEP rules, using the forms and procedures selected for such a purpose. Those forms are enclosed at the end of these specifications. Both cement volumes and additives must be shown, and the forms must be signed by the Contractor.

D. Drilling, Fluid and Testing and Handling Facilities:

1. When drilling mud is used in drilling, only high-grade approved clays in common usage for oil field drilling shall be used in the makeup of the drilling fluid. Drilling with a mixture of water and unprocessed mud, clay, or other objectionable material will not be permitted. The drilling fluid shall possess such characteristics as are required to adequately condition the walls of the hole to prevent caving of the walls as drilling progresses.
2. The Contractor shall maintain complete control over drilling mud characteristics during the entire operation of well construction. If proper control of the drilling is not maintained to the satisfaction of the Engineers, the Contractor shall be required to retain or employ on the job during all operations an individual recognized in the industry as an experienced mud engineer to supervise and maintain drilling fluid characteristics to the satisfaction of the Engineer.
3. The Contractor shall provide his own mud tanks or provide other means for handling the drilling fluid. Upon completion of the mud drilling operation, mud and cuttings from the well shall be removed immediately from the site and disposed of by the Contractor. Mud and fluids displaced while cementing will also be immediately disposed of at an approved offsite location by the Contractor. If mud sumps are used, the Contractor shall clean all mud and cuttings from the sumps, backfilling the sumps with clean earth, which shall be thoroughly compacted, and restore the ground to its original conditions as soon as mud drilling is completed.
4. The Contractor is cautioned to maintain the minimum viscosity of the drilling fluid that will raise cuttings and adequately condition the walls of the hole. He is also cautioned that, prior to cementing casings, he must circulate fluid through the annular space to clear any obstructions. All mud cake must be thoroughly removed from the walls.

5. The Contractor is required to have on site at all times under protective cover a sufficient quantity of salt to control, during emergencies, any potential positive heads encountered in the hole. Salt, however, should be used only as a last resort to control flow. Mud should be the first option. The Contractor is responsible for providing to the Engineer a daily running log of volumes of salt used.
6. Since the well is expected to be under flowing artesian conditions, the water level will have to be controlled at all times if artesian flow is encountered to prevent spills of high chloride water on the ground surface. The test well will be drilled by mud rotary or some other suitable method down to approximately ± 300 feet such that there should be no well flow during that portion of the drilling. The Contractor will be responsible for ensuring that the viscosity of the mud will be high enough to prevent any artesian flow from the wells. If any artesian flow should occur from the well, the Contractor shall be responsible for handling all excess water in a manner approved by the Engineer. Discharge of fluids will not be allowed on the land or adjacent bodies of water and the fluids must be self-contained in leak-proof settling tanks provided by the Contractor prior to disposal. Below ± 300 feet, the well will be drilled by reverse air circulation. The purpose of this is to obtain representative water samples from the well below ± 300 feet, and the Contractor is cautioned that he must circulate enough fluid at the end of each drill rod to obtain a good sample. The driller must submit for Engineer's approval the shop drawings for his proposed circulation system. This system must be a system where the returning fluid is allowed to discharge into a settling tank system prior to re-injection into the well. Sufficient settling capacity must be provided to avoid excessive solids re-entering the well. The driller should be prepared to install flow restriction collars in the wellhead, or mud plugs, or mud wafers, or whatever other method is feasible to control the volume of flow, out of the well to prevent overloading the well. At peak times of flow, the Contractor shall be prepared to truck out the fluids if necessary. Cuttings from the high chloride zones will not be disposed of or stored on the ground and must be trucked away to an FDEP-approved disposal site. Any spill of high chloride water must be removed from the shallow aquifer at the Contractor's expense.
7. A drilling pad shall be constructed prior to the start of pilot hole drilling for the surface casing. The purpose of this pad is to contain any drilling fluids which might otherwise spill and contaminate the shallow aquifer. Either a permanent concrete pad or a temporary steel containment pad may be used during drilling. The drilling pad shall be equipped with curbs as shown on the drawings to keep spilled fluids from flowing from the pad. All settling tanks and fluid circulation systems will be located within the perimeters of the drilling pad.
8. A blowout and flow preventor consisting of the appropriate diameter flange and a tee with a cover and a 12-inch gate valve shall be installed temporarily on top of each casing to control any flow which might be encountered while drilling the test hole. The

total cost for installation and removal of this item will be paid at the unit price set in the bid schedule.

PART 3 - EXECUTION

3.01 FLORIDAN AQUIFER DEEP TEST/INJECTION WELL CONSTRUCTION DESCRIPTION

A. The test/injection well shall be drilled into the Avon Park Limestone of the Florida aquifer and shall be constructed as follows:

1. Drilling and Testing of Injection Well DIW-1

- a. Drill a nominal 12-inch diameter pilot hole to approximately 300 feet bls using mud rotary drilling techniques. Conduct inclination surveys at 90-foot intervals. Conduct geophysical logging according to Section 3.03.
- b. Drill nominal 54-inch diameter hole to approximately 300 feet bls using the conventional mud rotary method. Conduct inclination surveys at 90-foot intervals. Conduct geophysical logging according to Section 3.03.
- c. Set and cement in place 48-inch diameter, 0.375-inch wall thickness steel casing to approximately 300 feet bls. Conduct temperature log after each stage of cementing.
- d. Drill a nominal 12-inch diameter pilot hole to approximately 1000 feet bls using the reverse air rotary method, collecting cores and conducting packer tests as directed by the Engineer. Approximately 4 cores will be collected between 850 and 1200 feet. Conduct inclination surveys at 90-foot intervals and conduct logging as required (see Section 3.03). Up to 3 packer tests will be conducted on the open hole after logging to bracket the 10,000 mg/L TDS interval.
- e. Ream a nominal 48-inch diameter hole to approximately 1000 feet bls using the reverse air rotary or other approved method. Conduct inclination surveys at 90-foot intervals. Conduct geophysical logging according to Section 3.03.

NOTE: The final casing seat of the 40-inch diameter intermediate casing will be dependent on the USDW boundary and will also be determined through the TAC process.

- f. Set and cement in place a 40-inch diameter, 0.375-inch wall thickness steel intermediate casing to approximately 1000 feet bls. Conduct temperature log after each stage of cementing.

- g. Drill a nominal 12-inch diameter pilot hole from approximately 1000 feet bls to approximately 1700 feet bls, employing the reverse air method, conducting up to 3 packer tests, and collecting up to 2 cores as directed by the Engineer. Conduct inclination surveys at 90-foot intervals.
- h. Conduct geophysical logging according to Section 3.03.
- i. Conduct television survey of the entire open hole from bottom of 40-inch diameter casing to bottom of pilot hole. Use a borehole televiwer if clear picture is not obtained.
- j. Ream nominal 40-inch diameter hole from the bottom of the 40-inch diameter casing seat to approximately 1110 feet bls. Conduct inclination surveys at 90-foot intervals during reaming and conduct caliper and gamma ray logs upon completion.
- k. Ream final open-hole section from approximately 1,100 feet to 1,700 feet bls to a nominal diameter of 26-inches. Conduct inclination surveys at 90-foot intervals.
- l. Set 28-inch diameter, 0.5-inch wall thickness steel casing to approximately 1100 feet bls with a cement basket and cement in place from approximately 1100 feet bls to approximately 200 feet bls. Conduct temperature log after each stage of cementing.

NOTE: Selection of the depth to which the 28-inch diameter final casing will be placed will be through TAC process.

- m. Conduct cement-bond log on the 28-inch diameter casing.
- n. Cement final 200 feet of 28-inch diameter casing to land surface. Conduct temperature log after each stage of cementing.
- o. Conduct pressure test on 28-inch diameter casing.
- p. Develop the open-borehole section of the well.
- q. Collect and analyze background water quality sample.
- r. Run casing scraper inside 28-inch diameter casing.
- s. Conduct video television survey from the surface to the total depth of the well.
- t. Install packer at approximately 1080 feet bls.

- u. Install nominal 18-inch diameter injection tubing to packer assembly set at approximately 1080 feet bls.
- v. Conduct pressure test on annulus between 18-inch diameter casing and nominal 18-inch diameter injection tubing.
- w. Pump 200,000 gallons of clear water into injection well.
- x. Conduct video television survey of the tubing and packer from land surface to the base of the 28-inch diameter casing.
- y. Conduct high resolution temperature log.
- z. Conduct radioactive tracer survey (RTS).
- aa. Conduct controlled injection test.
- bb. Demobilize equipment and restore site.

2. Drilling Pad:

- a. A drilling pad (either temporary or permanent) shall be constructed prior to the start of drilling for the surface casing.
- b. The drilling pad (either temporary or permanent) shall be of sufficient size to accommodate all the drilling equipment, including pumps, engines, generators, tanks, fluid handling devices, etc. The perimeter of the pad shall have an 8-inch high curb. The pad dimensions shall meet the minimum dimensions shown in the drawings (60'x40'). The pad shall be maintained watertight throughout all operations.
- c. The Owner will provide a permitted site and the Contractor shall provide a suitable compacted, leveled and drained limerock base to construct the pad. The Contractor's furnished base must be rated for a 3,000 psi bearing capacity and shall be considered part of the pad design, and requirements for this construction shall be included in the Shop Drawings.
- d. All vegetative matter, trash and other deleterious matter shall be cleaned from the site prior to the delivery of any fill material. All fill material utilized for base of drilling pad shall be properly compacted with clean sand or rock and sand free from muck, clays, organic matter or other deleterious matter.
- e. The fill material at the drilling pad site shall be compacted prior to forming of the drilling pad.

- f. The drilling pad shall include a drainage sump for collection of spillage and drilling fluid. All fluid collected in the sump is to be treated as excess drilling fluid and handled accordingly. The drilling pad shall be formed and sloped to permit all pad drainage to flow toward the drainage sump. Well drilling shall not proceed until the pad has been allowed to cure for at least seven days.
- g. The Contractor shall, if so requested by the Engineer, submit Shop Drawings of any alternate drilling pad and the foundation requirements signed and sealed by a professional engineer registered in the State of Florida and engaged by the Contractor.
- h. The drilling pad shall be maintained watertight until all drilling, well construction and testing is completed and accepted.

3. Surface Casing:

- a. A nominal 54-inch diameter hole shall be drilled by mud rotary or other suitable method approved by the Engineer to an approximate depth of ± 300 feet and rock cuttings shall be collected during drilling for classification of geological formations encountered. At this point, the geophysical logs in Section 3.03 will be run. Conduct inclination surveys at 90-foot intervals.
- b. A 48-inch diameter surface casing shall then be centered and cemented in the hole with neat cement around the annulus from the bottom of the hole to land surface. The exact depth to which the hole shall be drilled and cased will be determined by the Engineer. Cement volumes shall be calculated, recorded and submitted to the Engineer.
- c. Each section of the 48-inch steel surface casing shall as specified in Section 15070 be joined to another section by butt welding in the field in accordance with Section 15070. Special care shall be exercised to ensure a straight and plumb casing.

Cementing of the well casings is sometimes required to be witnessed by an official of the SCHD and the SWFWMD. It shall be the responsibility of the Contractor to notify SCHD and SWFWMD with sufficient time (48 hours) to obtain an inspector on site prior to cementing. Conduct temperature log after each stage of cementing.

- d. If the casing should break or collapse or its integrity is not satisfactory, and/or the grout emplacement is of poor quality, it shall be withdrawn and replaced at the Contractor's expense. If the casing cannot be removed, the Contractor will plug and abandon the well at his own expense, and the Contractor will move to another location and bring the well to the same level of completion at no additional cost.

4. Intermediate Casing:

- a. After the outer casing has been cemented for a period of 24 hours and the temporary flow control device has been installed on the 48-inch casing, a nominal 12-inch diameter pilot hole shall be drilled by mud circulation or some other suitable method. The pilot hole will be drilled to provide an indication, classification, and soil samples of geologic formations encountered. The exact depth to which the hole shall be drilled will be determined by the Engineer but is estimated to be down to a depth of ± 1000 feet. Conduct inclination surveys at 90-foot interval. Conduct geophysical logging as per Table 2.
- b. The pilot hole will be reamed out to a nominal 48-inch diameter. The 40-inch diameter intermediate casing will then be set in the reamed hole. The casing shall be securely anchored to prevent it from falling in the hole. It is estimated that the setting will be to the approximate depth of ± 1000 feet; however, the Engineer may order the setting at a greater or lesser depth if found advisable after examining the logs for the hole and obtaining TAC approval. Conduct inclinations at 90-foot intervals after reaming.
- c. Each section of the 40-inch diameter steel intermediate casing shall be of the same material and joined together by butt welding in the field in accordance with Section 15070. In order to center and hold the well casing in its proper position until the cement has been placed, centralizers shall be placed as specified in Section 15070. Special care shall be exercised to ensure a straight and plumb casing.

Cementing of the well casings is sometimes required to be witnessed by an official of the regulatory agencies. It shall be the responsibility of the Contractor to notify the agencies with sufficient time (48 hours) to obtain an inspector on site prior to cementing. Temperature logs will be conducted after each stage of cementing.

- d. The annulus shall be filled with neat cement by forcing a column of cement (pressure grout) through the center of the casing and up the annulus around the entire perimeter of the casing. If required, the annular space shall be filled to land surface by tremie pipe. A minimum of 8 hours shall lapse between cement lifts to allow the cement to harden and to reduce the possibility of collapsing the pipe. The seal shall be effective against infiltration of the surface water and groundwater down to the bottom of the well casing and against interchange of water between water-bearing zones. Cement volumes and additives shall be calculated, recorded, and submitted to the Engineer.

- e. After the grout of the last lift has been cured for a period of at least 24 hours but not more than 48 hours, a cement bond log, as specified in Part 3.03, shall be made in the borehole to determine the quality of the grout emplacement.
 - f. If the casing should break or collapse and/or the grout emplacement is of poor quality, or if the integrity of the casing is not satisfactory, it shall be withdrawn and replaced at the Contractor's expense. If the casing cannot be removed, the Contractor shall plug and abandon the well at his own expense, and the Contractor will move to another location, build a new drilling pad, and bring the well to the same level of completion at no additional cost to the Owner.
5. Final Casing:
- a. After the intermediate casing has been cemented for a period of 24 hours, a 12-inch diameter (or smaller) pilot hole shall be drilled. The pilot hole shall be drilled by reverse air circulation. The artesian flow will be controlled by a suitable method (approved by the Engineer) that is capable of controlling artesian flow and simultaneously permit collection of water quality samples. The handling of all excess water shall be in the manner specified. The pilot hole shall be drilled to an approximate depth ± 1700 feet below land surface to provide an indication, classification, core collection, and soil samples of geologic formations encountered. The purpose of these samples is to help the Engineer in determining the actual depth to which the hole shall be drilled. Core barrel samples will be required during drilling of the pilot hole, as specified in Section 3.02. Also, drill stem tests will be conducted. The Engineer may order the drilling to a greater or lesser depth if found advisable after examining the logs, cores, and the water and formation samples for the hole. Conduct inclinations at 90-foot intervals.
 - b. Collect water samples from the injection zone after sufficient development.
 - c. At least 48 hours prior to completion of the pilot hole, the Contractor shall notify the Engineer and the geophysical logging crew to ensure minimum delays in the start of logging operations. The geophysical logs, as specified in Paragraph 3.03, shall be made. Also, conduct television survey of the entire open hole from bottom of 40-inch diameter casing to bottom of pilot hole.
 - d. The pilot hole will be reamed out to a nominal 40-inch diameter to an approximate depth of ± 1100 feet. While the pilot hole is being reamed, copies of the geophysical logs will be provided to the TAC members. The TAC will then meet to discuss the setting of the inner casing. The Owner and the Engineer will request FDEP to convene the TAC within 24 hours of receipt of the logs, but his schedule cannot be guaranteed to the Contractor. During this waiting period, the Contractor will not receive any standby compensation on his services but will continue to protect the well as necessary during this waiting period. The final

open-hole interval will then be reamed to a diameter of 26-inches from a depth of approximately 1100 feet bls to 1700 feet bls. A caliper log and gamma ray log, as specified in Paragraph 3.03, shall be run. An inclination survey shall also be run. At least 48 hours notice is required. The 28-inch final casing shall then be set in the reamed hole with a cement basket. The casing shall be securely anchored to prevent it from falling in the hole. It is estimated that the setting will be to the approximate depth of ± 1100 feet; however, the Engineer may order the setting at a greater or lesser depth if found advisable after examining the logs, cores, and the water and formation samples for the hole and after TAC review.

- e. Each section of the 28-inch diameter steel casing shall be joined to another section by butt welding in the field, in accordance with Section 15070. Special care should be exercised to ensure a straight and plumb casing by blocking it in place prior to cementing. Centering guides will be placed and aligned as specified in Section 15070. Cementing of the well casings is sometimes required to be witnessed by an official of the permitting agencies. It shall be the responsibility of the Contractor to notify the agencies with sufficient time (48 hours) to obtain an inspector on site prior to cementing.
- f. The annulus shall be filled with Type II neat cement. The neat cement shall be installed around the entire perimeter of the inner casing. The grout placement for all lifts will be carried out in a series of lifts using a tremie pipe to ensure an effective seal around the inner casing. The grout lifts shall then be taken up to pad level. During grouting, the specific gravity of the grout should be taken into consideration and precautions taken to ensure that the pressures in the hole are not allowed to exceed the collapsible strength of the inner casing. Cement volumes and additives shall be recorded and submitted to the Engineer by the cementing company through the Contractor. A minimum of eight hours shall be allowed between lifts. Conduct temperature logs after each stage of cementing.
- g. After the grout from the final lift has been cured for a period of no more than 48 hours, the temperature, cement bond, and gamma ray geophysical log, as specified in Section 3.03, shall be run on the inner casing. These geophysical logs shall be conducted in order to determine the quality of the grout emplacement.
- h. If the casing should break or collapse and/or the grout emplacement is of poor quality, or if the integrity of the casing is not satisfactory, it shall be withdrawn and replaced at the Contractor's expense. If the casing cannot be removed, the Contractor shall plug and abandon the well at his own expense, and the Contractor will move to another location, build a new drilling pad, and bring the well to the same level of completion at no additional cost to the Owner.
- i. No earlier than forty-eight hours after the final cement lift has set, the mechanical integrity of the inner casing shall be tested by conducting a pressure test on the

whole length of the injection casing. The pressure test shall be conducted within the final casing while it is plugged at the bottom. The pressure test shall be conducted with a pressure of 150 pounds per square inch applied within the casing. The pressure shall be monitored continuously for one hour. If the pressure drops more than 5 percent during the test period or the injection casing collapses or breaks, the integrity of the injection casing will be considered to be unsatisfactory; and the Contractor shall repair the work and retest until it is satisfactory or abandon it in the manner described previously. The pressure test will be conducted in the presence of the Engineer and regulatory agencies.

- j. After the pressure test, the bridge plug at the bottom of the injection casing shall be drilled out.

6. Open Hole:

- a. At least 48 hours prior to the completion of the open hole, the Contractor shall notify the Engineer and the geophysical logging crew to ensure minimum delays in the start of the logging operations. The geophysical logs, as specified in Paragraph 3.03, shall be run.
- b. After the completion of the drilling, the Contractor shall expel all mud, cuttings, sediments, etc. from the open hole. The Contractor shall circulate water within the hole until all particles have been expelled. It is not expected that the well will have artesian flow at this stage of construction; but if any artesian flow should occur, the well shall be controlled and all excess flow shall be disposed of. At this time, the hole shall be made ready for collection of a background water quality sample.

7. Injection Tubing:

- a. After the open hole has been completed below the inner casing and the hole logged, the entire interior of the 28-inch casing shall be conditioned using a Baker Rotovert casing scraper, or equal. Conduct video television survey from the surface to the total depth of the well. Install the tubing hanger assembly on top of the 28-inch casing. The injection tubing packer shall be retrievable polished bore receptacle (PBR) packer with seal bore like a TIW metal to metal polished bore packer (PBR) system, Baker, YBI positive seal packer, or approved equivalent. Installation of packer shall be conducted under the direct supervision of packer manufacturer.
- b. Install packer assembly and PBR as shown on the Drawings. Install injection tubing consisting of 16.60-inch inner diameter, 0.76 inch wall thickness fiberglass tubing, or other pre-approved 18-inch diameter tubing material into the well. Suspend the tubing and PBR approximately 2 feet above packer. Attaching

sections of tubing under the direct supervision of the tubing manufacturer. It is appropriate to use threading of male and female couples for joining of fiberglass tubing sections and use nitrogen/argon gas welding with corrosion resistant alloy filler metal 622 (AWS ER NiCrMo-10). Inject into the annular space a volume of fresh water equal to 110 percent of the calculated annular volume. This water shall contain 0.1 percent of Halliburton Anhib, Baracor 100, or equal as a corrosion inhibitor. No price markup above the onsite delivered price will be allowed for the annular fluid but installation costs will be paid at the unit price set in the bid schedule. After the installation of the fluid, a temperature log will be run in the well.

- c. The packers and the injection tubing shall possess a satisfactory integrity as determined by conducting a pressure test on the annular space. The annular space shall be pressurized for 1 hour at 150 pounds per square inch. If that pressure (<5% change from 150 psi) cannot be held for 1 hour, the tubing, packer and the packer installation will be determined inadequate and the Contractor shall repair or replace it at their own cost.
- d. After fluid emplacement, geophysical logs as specified in Section 3.03 shall be run on the tubing from the bottom to the top. In addition to these geophysical logs, a television (TV) survey shall be made on the liner, from bottom to top, the whole length of the well. The report on these tests shall be delivered to the Engineer or his representative for this permanent record.
- e. If the well liner should break or collapse and/or the monitor fluid emplacement is of poor quality and/or the integrity of the liner and/or packers or seals is unsatisfactory, it shall be withdrawn and replaced at the Contractor's expense. If the liner cannot be removed, the Contractor will moved to another location, build a new drilling pad, and bring the well to the same level of completion at no additional cost. Following successful completion of the pressure test, the well shall be made ready for the development phase of the construction program.

8. Fluid Handling:

- a. A closed circulation mud system or other approved system shall be used to ± 300 feet and a system of controlled reversed air closed circulation should be used from ± 300 feet and below. The Contractor is cautioned not to overload the well with unsettled cuttings and to plan his operations to coordinate offsite disposal of excess fluids. The cuttings and excess fluids and/or water obtained during the drilling, reaming, grouting, logging, casing, sampling, and the developing and testing operations shall be temporarily stored in settling tanks provided by the Contractor. It is the Contractor's responsibility to provide as much tank volume as is needed. The excess in the settling tanks shall be periodically trucked away for offsite disposal at an FDEP-approved site. Discharge of excess mud, cuttings and water will not be allowed on the land or adjacent bodies of water at any time

throughout the construction. Any contamination of the surficial aquifer by spilled or discharged fluids will have to be removed by the Contractor at his expense.

- b. The Contractor shall retain a 3-inch pump on site at all times for pumping excess water from the pad and also for collecting weekly water samples, conductivity and chloride from the four shallow monitoring wells. All rainfall trapped within the confines of the drilling pad shall be dealt with and disposed of as excess water.
- c. It shall be the Contractor's responsibility to promptly dispose of all waste material, cuttings, excess mud and water, and other contaminated matter away from the site at periodic intervals during the progress of the drilling operation and again at the end following the well development, testing and cleaning up operations. The disposal site shall be chosen by the Contractor and it is the responsibility of the Contractor to seek all necessary state and county permits for use of a site as a disposal site, depending upon the site location and as required by local and county ordinances and the Florida Administrative Code. The disposal of the wastes and excess water from the well site and all other matters in any way related to the handling of excess water including cleaning up of spills shall be included in the lump sum bid price for the Item. The contractor will, if so requested, provide the name and location of all sites (to be used by him, or by any subcontractor he employs) to dispose of the mud, water and cutting before any work can start.
- d. The Contractor shall exercise extreme care to prevent solids and highly turbid suspended sediments from entering the well during drilling, circulation, or development. During development, the well discharge must be routed to storage tanks provided by the Contractor. After development, all liquids and solids discharged to the tanks must be removed by the Contractor.

9. Pressure Measuring Devices:

- a. In the test/injection well tubing and in the annular space, two ½-inch diameter sampling taps shall be attached in place as shown on the Drawings. The tubes shall be provided with sampling valves, and the test gauges should be capable of reading pressures in intervals of tenths of a foot of water. Fully calibrated gauges are required. During the 12-hour duration of the injection test and the 12-hour recovery, a pressure transducer will be required. The Contractor must provide the transducer and the data acquisition unit. The transducer will be installed at the bottom of the well and must be anchored to remain at the bottom of the well during injection and recovery. It must be cable connected at land surface to the required electronic data acquisition unit that will show a true pressure reading throughout the injection and recovery test. At the end of the test, the transducer will be removed from the well by the Contractor. The transducer's required pressure range will be determined by the Engineer after the final well depth is known.

10. Drift Indicator Surveys:

- a. During drilling of the pilot hole and reaming of the full size hole from land surface to ± 1700 feet, a straight hole survey will be made every 90 feet using a wire-line instrument equipped with an inclination unit having a range from 0 to 1.5 degrees of inclination from the vertical and with a survey record which shall be capable of reading to the nearest 10 minutes of angle. If any reading taken indicates a deviation from vertical of more than one degree, the Contractor shall immediately notify the Engineer. The maximum allowable difference between any two successive survey points shall be 0.5 degrees (30 minutes). The mechanical drift indicator surveys taken at and including that point shall then be analyzed by the Contractor and the Engineer and, if it is found to be more than 1 degree of vertical or difference greater than 0.5 degrees (30 minutes) if in the opinion of the Engineer or his representative the alignment is not acceptable, the Contractor will be required to correct the alignment or abandon and plug the hole at his expense, as directed by, the Engineer, and to drill at his expense another hole and bring it to the same stage of completion. Any extra time required by the Engineer or others beyond that time required to field analyze the shur-shot will be paid for by the Contractor.
- b. In case of disagreement between the Contractor and the Engineer as to the mechanical drift indicator disc interpretations, the mechanical drift indicator discs shall be analyzed by a service company acceptable to both and two copies of the service company's interpretation shall be binding on both parties. The selection of the service company making the interpretation shall be by agreement of both the Owner and the Contractor. No standby time will be paid during this procedure.

During the drilling operations, the Contractor shall submit the record of each inclination survey to the Engineer on the site. The Engineer shall analyze the data and shall notify the Contractor of the survey results within one hour. In the event other duties delay the Engineer from interpreting the data, the Contractor should have a qualified crew member proficient in the interpretation of the raw data. The Contractor may continue drilling during this one-hour period. In the event the survey data indicate hole drift of departure in excess of the specified limits, the Contractor shall take the following steps:

1. Run additional surveys to demonstrate that the hole is within the specified limits.
2. If instrument is indicating that the hole is not meeting the specified limits, then the Contractor shall re-ream the hole and repeat the survey. This process will be repeated or other actions taken by the Contractor to meet the specified limits.

3. If the Contractor feels that the instrument is in error, it will be his responsibility to obtain a new instrument to confirm the survey data. If a new instrument requires 24 hours or less to be shipped to the site, the Contractor may, with the Engineer's approval, continue the drilling operation. However, this does not relieve the Contractor of his responsibility of maintaining the hole within the specified limits. The Contractor shall bear all of the costs of repeated surveys, re-reaming the hole, or other steps required to meet the specified limits. No standby time will be paid for time spent during these procedures.
- c. Records of deflection readings and all other pertinent information shall be kept and made part of the permanent well log record. The original disk will be provided to and kept by the Engineer. The Engineer may modify the requirements for plumbness in this Article if in his judgment:
 1. Contractor has exercised all possible care in constructing the well and the defect is due to circumstances beyond his control; and
 2. Utility of the completed well will not be materially affected and is acceptable to the regulatory agencies.
11. Plumbness and Alignment - The well shall be drilled true, round, straight and vertical throughout. If, in the opinion of the Engineer, the well might be out of plumb or alignment, it shall be tested at the Contractor's expense in accordance with Section "Testing for Plumbness and Alignment," of the AWWA Standard A100-97. Should the well fail to meet the requirements established by standards, the plumbness and/or alignment of the well shall be corrected by the Contractor at his own expense and, should he fail to correct such faulty alignment or plumbness, the Engineer may refuse to accept the well.
12. Pressure Transducer - During the 12-hour duration of the injection test and the 24-hour duration of recovery, a pressure transducer will be required. The Contractor must provide the transducer and the data acquisition unit. The transducer will be installed at the bottom of the well and must be anchored to remain at the bottom of the well during injection and recovery. It must be cable connected at land surface to the required electronic data acquisition unit that will show a true pressure reading throughout the injection and recovery test. At the end of the test, the transducer will be removed from the well by the driller. The transducer's required pressure range will be determined by the Engineer after the final well depth is known.

3.02 SAMPLING

A. Formation Samples:

1. Two formation samples from the full length of the pilot hole (from land surface to full depth) shall be collected and labeled from the test well at each change of formation drill break and at 10-foot intervals between changes of formation. Two large representative samples of each interval or new formation shall be collected by the Contractor and stored in containers (sample bags) supplied by the Contractor. The size and type of container shall be approved by the Engineer. The samples should be collected only as new hole is advanced.
2. The Contractor shall ship at his expense one set of formation samples from the well and the necessary well completion forms to the Florida Geological Survey. Additional copies of the completion form shall be provided to the Engineer, to SWFWMD, to the City of Sarasota and to FDEP. The Contractor shall also deliver to the Engineer the additional set of formation samples collected.

B. Core Samples

1. The Contractor shall collect four core barrel samples in the injection well during the drilling of the 12-inch diameter pilot hole in the injection well between the depths of 850 and 1200 feet. These core barrel samples shall have a minimum length of 10 feet and 4-inch diameter. The actual coring depths will be selected by the Engineer. Drilling of the pilot hole shall be stopped to collect these core samples, but no standby time shall be charged for coring. A core barrel shall be advanced by being rotated its full length into the undisturbed formation. Once the core barrel has penetrated the desired interval, it shall be withdrawn and the core recovered, stored, and delivered to the Engineer for analysis and evaluation prior to shipment at Contractor's expense to an approved laboratory for analysis. Two samples from each core will be analyzed at the laboratory for vertical and horizontal permeability, porosity, specific gravity, elastic modulus, and compressive strength.
2. Should less than 50 percent core recovery be achieved, the driller will be required to core again immediately below the previously cored zone until 50 percent recovery is achieved before proceeding to core into the next strata where coring is required. Coring will be paid at the rate shown in the Schedule of Prices. No payment will be made for less than 50 percent recovery. The 50 percent recovery requires core pieces to be greater than 4 inches in length and diameter.
3. The laboratory analysis of each of the two samples from each core shall include the specific horizontal and vertical permeability, the porosity, specific gravity, elastic modulus, and compressive strength. Shipping the cores to the lab shall be the responsibility of the Contractor.
4. A core laboratory such as CORE LAB in Houston, Texas or equal will be acceptable. The proposed laboratory must be identified for approval by the Engineer. The Engineer, at his discretion, and at any time, may reject a firm and request other choices of firms.

C. Water Samples

1. The Contractor shall collect one 16-ounce sample of drilling fluids from the discharge of the rigs circulation system every 30 feet during air reverse drilling. These samples shall be given to the Engineer as soon as they are collected for field measurements of pH, conductivity, and temperature to identify changes in water quality. Following the field measurements, the samples will be returned to the Contractor for immediate (less than 12 hours) forwarding to the approved water quality testing laboratory selected by the Contractor. These samples shall be tested in the laboratory for the following parameters: chloride, pH, sulfate, TDS, and conductivity. The analysis of these water samples shall be paid at the unit rate shown in the Bid Schedule of Prices.

The samples shall be labeled and preserved before shipping. The Contractor is responsible for shipping the samples on time before any deterioration to quality can occur. At the time that the TAC meets to discuss the setting of the inner casing, the Contractor must have already provided the results of these tests. A TAC meeting cannot be held without this and the Contractor will be held responsible for any delays. Other samples will also be collected by the Engineer as he sees fit.

2. The samples shall be collected from the discharging stream in perfectly clean new and unused plastic bottles (16-ounce) with Teflon caps. Each bottle shall be rinsed twice with the water being discharged from the well before the corresponding sample is collected. It is the Contractor's responsibility to provide bottles acceptable to the Engineer. Sample collection will be corrected for lag time. That is corrected to take into account the time it takes for the water from the sampled zone to rise to the surface. Calculation of lag time will be based on the pumping rate. Sample bottles shall be clearly labeled in an indelible way with the description of the well, depth, time and date of collection, person collecting the sample, and the appearance of the water (clear, turbid or colored). It shall be the Contractor's sole responsibility to collect, protect, and deliver the water samples, properly labeled after collection, to the Engineer. After the Engineer field testing is completed, the sample bottles will be returned by the Engineer to the Contractor who will then ship the samples at his own expense to the approved water quality laboratory. The Engineer reserves the right to collect additional samples at stratigraphic areas of interest.
3. The pilot hole is being drilled to ± 1700 feet. During the drilling of the pilot hole, six water quality samples shall be collected by means of packers. The Engineer shall select the depths at which the water quality samples are to be collected based on the field samples and on the geophysical logs. Single packers shall be used to isolate the selected depths. Prior to collecting the water quality sample or developing the selected sampling zone, the piezometric head within the drill rod shall be measured by the Contractor. The pumped-out water may be temporarily stored in the tanks used for the settling system and in the tanks to be used during well development. Prior to conducting each packer test, the Contractor shall perform caliper and gamma ray logs on the open hole section of the pilot holes. The upper 200 feet of pipe should consist

of casing of drill pipe with a six-inch inside diameter to facilitate the installation of a four-inch diameter submersible pump, which shall be set at a depth of approximately 150 feet bls. The submersible pump shall have the capability of pumping at rates between 10 and 100 gallons per minute. The Contractor shall provide an in-line propeller-type flow meter capable of recording total flow and discharge. The internal surfaces of drill pipe, casings, and other fittings used for the packer tests shall be free of rust, scale, and other material that could be dislodged and interfere with a test. Should a test fail because of the presence of any of these materials in the tools or pipe, the Contractor will not be reimbursed for the test and he will be required to clean the pipe, re-set it and the packer, and re-run the test successfully at his own cost as part of the contract requirements.

After successfully inflating and setting the packer and before the Contractor conducts up to a four-hour pumping test and a three-hour recovery test for each single-packer or straddle packer test, he shall develop each zone so that it is free of any drilling mud/fluids and producing representative formation water. It is anticipated that rates of between 10 and 100 gpm will be obtained during the pumping test. The Contractor shall be responsible for providing all necessary pumps, equipment, pipelines, meters, gauges, and appurtenances necessary for testing as described and will provide access for water-level measurements using M-scope, tape, or electronic probe.

Just prior to completion of each pumping test, the Contractor shall collect a water sample from the discharge. These samples shall be given to the Engineer as soon as they are collected for field measurements of pH, conductivity, and temperature to identify changes in water quality. Following the field measurements, the samples will be returned to the Contractor for immediate (less than 12 hours) forwarding to the approved water quality testing laboratory selected by the Contractor. These samples shall be tested in the laboratory for the following parameters: chloride, pH, sulfate, TDS, and conductivity.

Inflating either or both packers in the straddled zone and pumping from above or below, or in the straddle, constitutes a single packer setting for payment. Field conductivity readings will be taken to ensure that the two packers are not leaking prior to collection of the sample. The packers will be pumped until the conductivity stabilizes and then the rate of pumpage will be changed to see if leakage occurs. The packer tests should preferably start with the lower ones and work upward in the hole.

4. In addition to the above sampling program, one final complete series of water samples shall be taken from the injection zone prior to the cessation of the development phase. Prior to sample collection, a volume equal to at least three times the volume of the drill pipe must be removed. These water samples shall be collected in specially prepared collection bottles as provided by an approved water quality testing laboratory. The Contractor shall be responsible for giving satisfactory advance notice of the well development to both the approved water quality testing laboratory and the Engineer so that the former may send the specially prepared collection bottles and the latter may be

present when the required samples are obtained. All the parameters shown in Table 1 must be analyzed to establish background levels. Also, should FDEP so request it, a 5-gallon sample will be collected and shipped to FDEP/Tallahassee by the Contractor, as provided for in the regulations. A one-gallon sample will also be delivered by the Contractor to the USGS if so requested. Payment for this sampling will be made at the unit rate shown in the Bid Schedule of Prices.

5. The water quality testing laboratory selected by the Contractor shall be a State of Florida certified testing laboratory and shall be identified within the bid submitted prior to approval by the Engineer. The Engineer, at his discretion, may reject a laboratory and request other choices of laboratories.
6. The analyses of the final complete series of water samples shall be paid at a unit rate that shall cover testing for all of the parameters shown in Table 1 at the end of this section. The unit rate shall be shown on the Bid Schedule of Prices.
7. The Contractor shall furnish, through the water quality laboratory, six copies of all the test results on the water samples. The Contractor is responsible for the timely shipping of all the water samples to the laboratory so that all sample analysis holding times are adhered to and to avoid damaging or contaminating the sample.

Table 1

PRIMARY STANDARDS DRINKING WATER STANDARD PARAMETERS

Alachlor (Polychlorinated biphenyl or PCB)*
 Aldicarb
 Aldicarb Sulfoxide
 Aldicarb Sulfone
 Aroclors (Polychlorinated Biphenyls or PCB's)
 Alpha, Gross
 Antimony
 Arsenic
 Atrazine
 Barium
 Benzene
 Benzo(a)pyrene
 Beryllium
 Bis(2-ethylhexyl) adipate (Di(2-ethylhexyl) adipate)
 Bis(2-ethylhexyl) phthalate (Di(2-ethylhexyl) phthalate)
 Cadmium
 Carbofuran
 Carbon Tetrachloride (Tetrachloromethane)
 Chlordane
 Chlorobenzene (Monochlorobenzene)
 Chloroethylene (Vinyl Chloride)
 Chromium
 Coliforms, Total
 Cyanide
 2,4-D (2,4-Dichlorophenoxyacetic acid)
 Dalapon (2,2-Dichloropropionic acid)
 Dibromochloropropane (DBCP)
 1,2-Dibromoethane (EDB, Ethylene Dibromide)
 1,2-Dichlorobenzene (o-Dichlorobenzene)
 1,4-Dichlorobenzene (p-Dichlorobenzene or Para Dichlorobenzene)
 1,2-Dichloroethane (Ethylene dichloride)
 1,1-Dichloroethylene (Vinylidene chloride)
 1,2-Dichloroethylene (cis-1,2-Dichloroethylene or trans-1,2-Dichloroethylene)
 cis-1,2-Dichloroethylene (1,2-Dichloroethylene)
 trans-1,2-Dichloroethylene (1,2-Dichloroethylene)
 Dichloromethane (Methylene chloride)
 1,2-Dichloropropane
 Di(2-ethylhexyl) adipate (Bis(2-ethylhexyl) adipate)
 Di(2-ethylhexyl) phthalate (Bis(2-ethylhexyl) phthalate)
 Dinoseb
 Diquat
 EDB (Ethylene dibromide, 1,2-Dibromoethane)
 Endothall
 Endrin
 Ethylbenzene
 Ethylene dichloride (1,2-Dichloroethane)
 Fluoride

Glyphosate (Roundup)
Gross Alpha
Heptachlor
Heptachlor Epoxide
Hexachlorobenzene (HCB)
gamma-Hexachlorocyclohexane (Lindane)
Hexachlorocyclopentadiene
Lead
Lindane (gamma-Hexachlorocyclohexane)
Mercury
Methoxychlor
Methylene chloride (Dichloromethane)
Monochlorobenzene (Chlorobenzene)
Nickel
Nitrate (as N)
Nitrite (as N)
Total Nitrate + Nitrite (as N)
Oxamyl
p-Dichlorobenzene or Para Dichlorobenzene (1,4-Dichlorobenzene)
Pentachlorophenol
Perchloroethylene (Tetrachloroethylene)
Picloram
Polychlorinated biphenyl (PCB or Aroclors)
Radium
Roundup (Glyphosate)
Selenium
Silver
Silvex (2,4,5-TP)
Simazine
Sodium
Styrene (Vinyl benzene)
Tetrachloroethylene (Perchloroethylene)
Tetrachloromethane (Carbon Tetrachloride)
Thallium
Toluene
Toxaphene
2,4,5-TP (Silvex)
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene (Trichloroethene, TCE)
Trihalomethanes, Total
Vinyl Chloride (Chloroethylene)
Xylenes (total)

SECONDARY DRINKING WATER STANDARD PARAMETERS

Aluminum
Chloride
Color
Copper

Ethylbenzene
Fluoride
Foaming Agents (MBAS)
Iron
Manganese
Odor
pH
Silver
Sulfate
Toluene
Total Dissolved Solids (TDS)
Xylenes
Zinc

MINIMUM CRITERIA FOR SEWAGE EFFLUENT

Aldrin
Ammonia
Anthracene
Antimony
Bromodichloromethane
Butylbenzylphthalate
Chloroethane
2-Chlorophenol
Dibromochloromethane
1,2 Dichloroethylene
Dieldren
Diethylphthalate
Dimethylphthalate
Naphthalene
Phenanthrene
Phenol
2,4,6-Trichlorophenol
Organic Nitrogen
Total Kjeldahl Nitrogen
Nitrite (as N)
Total nitrogen
Soluble orthophosphate
Total Phosphorus