THREE OAKS WATER RECLAMATION FACILITY DEEP INJECTION WELL IW-2 DOWNHOLE CONSTRUCTION AND ABOVE SURFACE FACILITIES

Project Technical Specifications

ISSUED FOR BID – NOT FOR CONSTRUCTION

BV PROJECT NO. 414567

PREPARED FOR

1500 Monroe Street
Fort Myers, FL 33902
Phone (239) 533-8845

Lee County Utilities

6 MAY 2024

LEE COUNTY UTILITIES
THREE OAKS WATER RECLAMATION FACILITY
DEEP INJECTION WELL IW-2
TECHNICAL SPECIFICATIONS

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INDEX OF DRAWINGS

PART 1 GENERAL

1.01 CONTRACT PLANS/DRAWINGS

A. Contract plans, also referred to as Drawings, are listed below, dated May 2024 and any subsequent revision thereto introduced by Addenda prior to negotiations, showing the work of the Contract are hereby made a part of the Contract Documents and are listed as follows:

THREE OAKS WATER RECLAMATION FACILITY
DEEP INJECTION WELL IW-2

Sheet No.	Title
G-001	COVER SHEET AND GENERAL LOCATION MAP
G-002	DRAWING LIST, NOTES, SYMBOLS AND LEGENDS
G-601	PROCESS FLOW DIAGRAM
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S-001	STANDARD NOTES AND LOADING CRITERIA
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M-503	INJECTION WELL WELLHEAD DETAILS
E-001	LEGENDS
E-002	ABBREVIATIONS AND NOTES
E-101	ELECTRICAL SITE PLAN
E-102	PARTIAL SITE PLAN – DEMOLITION
E-103	PARTIAL SITE PLAN
E-601	EXISTING SINGLE LINE DIAGRAM, DETAILS AND PANEL SCHEDULE
I-001	P&ID – LEGENDS & ABBREVIATIONS
I-501	P&ID – INSTRUMENTATION INSTALLATION DETAILS

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I-601 P&ID – EFFLUENT PUMPS

B. Due to the possibility of typing errors or omissions, the above list shall not be considered as necessarily complete, nor shall the Standard Details which may be included elsewhere herein be considered as forming a complete listing of all Standard Details which may apply to this Project. Perform all work shown on all sheets of the Plans, as specified herein or necessary for a complete functional installation and no extra compensation will be made due to the omission or incorrect listing of a Drawing in this Section. All County Standard Details are incorporated in these Contract Documents by reference and all work shall be performed in accordance with all applicable County Standard Details.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

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SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of Work

B. Qualifications of CONTRACTOR

C. Constraints

D. Work by Others

E. CONTRACTOR's Use of Site

F. Work Sequence

G. Owner Occupancy

H. Outage Plan and Requests

1.2 DESCRIPTION OF WORK

A. General: The Work to be done under this Contract consists of the construction of one (1) injection well approximately 2,860 feet deep, four (4) pad monitoring wells and all necessary drilling pads, containments pads, site work, and temporary wellhead piping as shown and specified in Contract Documents entitled Three Oaks Water Reclamation Facility Deep Injection Well IW-2. The Work to be done under this Contract terminates at the temporary blind flange in accordance with the Drawings. Permanent piping and concrete pads are not included in the work of this Contract.

B. The Work includes:

1. Furnishing of all labor, material, superintendence, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies, services and other means of construction necessary or proper for performing and completing the Work.

2. Sole responsibility for adequacy of plant and equipment.

3. Maintaining the Work area and site in a clean and acceptable manner.

4. Maintaining existing facilities in service at all times except where specifically provided for otherwise herein.

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5. Protection of finished and unfinished Work.

6. Repair and restoration of Work damaged during construction.

7. Furnishing as necessary proper equipment and machinery, of a sufficient capacity, to facilitate the Work and to handle all emergencies normally encountered in Work of this character.

8. Furnishing, installing, and protecting all necessary guides, track rails, bearing plates, anchor and attachment bolts, and all other appurtenances needed for the installation of the devices included in the equipment specified. Make anchor bolts of appropriate size, strength and material for the purpose intended. Furnish substantial templates and shop drawings for installation.

C. Implied and Normally Required Work: It is the intent of these Specifications to provide the OWNER with complete operable systems, subsystems and other items of Work. Any part or item of Work which is reasonably implied or normally required to make each installation satisfactorily and completely operable is deemed to be included in the Work and the Contract Amount. All miscellaneous appurtenances and other items of Work incidental to meeting the intent of these Specifications are included in the Work and the Contract Amount even though these appurtenances may not be specifically called for in these Specifications.

D. Quality of Work: Regard the apparent silence of the Contract Documents as to any detail, or the apparent omission from them of a detailed description concerning any Work to be done and materials to be furnished as meaning that only the best general practice is to prevail and that only materials and workmanship of the best quality are to be used. Interpretation of these specifications will be made upon this basis.

E. The Specifications included in these Contract Documents establish the minimum performance and quality requirements for materials and equipment together with the minimum standards for quality of workmanship and appearance. Generally, there has been no attempt to separate the Specification sections into groups for the work of separate SUBCONTRACTORS, or for work to be performed by the various trades. Should there be any question as to the interpretation of any particular Specification Section or part of Specification Section, such question should be directed to the OWNER prior to the submittal of a proposal for the Work under this Contract.

F. It is the intent of the OWNER to obtain a complete functional, and satisfactory installation under this Project, and any items of labor, equipment or materials which may be reasonably assumed as necessary to accomplish this end shall be supplied whether or not they are specifically shown on any plans which may be supplied or stated herein. The CONTRACTOR shall provide all materials for the Project unless they are specifically called out in these specifications as being supplied by the OWNER. The CONTRACTOR shall also supply all sheeting, shoring, bracing and all other labor, material or equipment required to preclude damage to, or loss of functionality of, any existing facility or system.

G. No request for additional compensation or Contract time resulting from encountering utilities or structures not shown, or differing in location or elevation from that shown, will be

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considered. The CONTRACTOR shall explore sufficiently ahead of the Work to allow time for any necessary adjustments without delay to the progress of the installation. Costs due to delays caused by encountering underground utilities or structures which could have or should have been discovered by timely exploration ahead of the Work shall rest solely with the CONTRACTOR.

1.3 QUALIFICATIONS OF CONTRACTOR

A. The CONTRACTOR shall submit the name of the proposed Superintendent, Driller, Geophysical Logger, and detailed information identifying the above mentioned and as well as all personnel to be utilized on this Project and written evidence with respect to the following:

1. Personnel Requirements

a. All employees First Aid and CPR certified.

b. All Superintendents and Drillers OSHA Outreach 30-hour and HAZWOPER 24-hour certified.

c. Superintendents, Drillers and Geophysical Loggers' resumes' must be submitted and approved before commencement of work and shall be updated throughout the life of the Project. General requirements shall include but not be limited to experience drilling deep injection wells in the State of Florida.

d. Geophysical Logging Firm: All geophysical logs shall be performed by a company licensed and experienced in the performance and interpretation of such logs. The geophysical logging firm and the personnel must be pre-approved by the ENGINEER.

e. The CONTRACTOR must hold a license from the Florida HRS Bureau of Radiation Control for the required geophysical logging that will be performed under this Contract; the driver of the logging vehicle shall have a Commercial Driver's License with an 'H' endorsement for radioactive material. The logging vehicle shall be a licensed, placated FDOT vehicle for the transportation of radioactive material.

B. Administrative Code 12 of the Lee County, Chapter 489 of the Florida Statutes, and the rules of the State of Florida Department of Professional Regulation shall govern the qualification for the CONTRACTOR and SUBCONTRACTORS. No CONTRACTOR or SUBCONTRACTOR shall be required to possess any other professional designation or affiliation in order to be eligible to bid on this Project, except those stated in this solicitation. Unless prohibited by law, nothing shall prevent the OWNER from requiring proof of sufficient expertise and skill to qualify for the subject Project.

C. CONTRACTORs are directed to Section 013300 – Shop Drawings, Product Data, and Samples for more information and additional submittals required for this Solicitation. CONTRACTOR shall submit to the ENGINEER the following information as part of the bid package, but not limited to: references, resumes, list of equipment, list of SUBCONTRACTORS, and other information required by this solicitation.

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1.4 CONSTRAINTS

Not Used

1.5 WORK BY OTHERS

A. Work on the Project, which may take place concurrently with this CONTRACT and which is excluded from this CONTRACT, is as follows:

1. Deep Injection Well IW-2. Surface facilities for the new Deep Injection Well IW-2 including one injection well pad, expansion of existing effluent pump station pad, all suction piping and connections to new IW-2, miscellaneous yard piping, and all associated electrical and instrumentation.
2. Three Oaks Water Reclamation Facility Expansion.

1.6 CONTRACTOR'S USE OF SITE

A. In addition to the requirements of the General Conditions, limit use of site and premises for work and storage to allow for the following:

1. Coordination of the Work under this CONTRACT with the work of the other contractors where Work under this CONTRACT encroaches on the Work of other contractors.

2. OWNER occupancy and access to operate existing facilities.

3. Coordination of site use with ENGINEER.

4. Responsibility for protection and safekeeping of products under this CONTRACT.

5. Providing additional off site storage at no additional cost to OWNER as needed.

6. The CONTRACTOR's use of the Site shall be limited to its construction operations, including onsite storage of materials, onsite fabrication facilities, and field offices.

7. The approved CONTRACTOR's Superintendent shall be able to live onsite throughout the life of the project.

1.7 WORK SEQUENCE

A. Construct Work in stages to accommodate OWNER's use of premises during construction period and in accordance with the limitations on the sequence of construction specified. Coordinate construction schedules and operations with ENGINEER.

B. Coordinate Work of all subcontractors.

C. General:

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1. There will be no additional compensation for remobilization in the event that relocation of a well within the Plant is necessary for any particular reason.

   The CONTRACTOR and the ENGINEER may at times discuss and mutually agree to conduct one or more of the steps described on this sequence in a different order (either advance or defer a task). In the Event that one or more of these agreements are reached, this shall not warrant or require a Change Order to the Contract under any circumstance and shall be done at no additional cost the County.

2. Construction activities shall be scheduled and sequenced to ensure continuous operation of the existing treatment facilities. The CONTRACTOR's scheduling shall develop construction sequencing so that the WORK will not adversely impact the quantity or quality of treatment. The CONTRACTOR shall be responsible for development of the construction sequencing.

3. CONTRACTOR shall submit, revise/correct and complete to the satisfaction and approval of the ENGINEER, the Project Base-Line, Construction Schedule and Project Schedule of Values. CONTRACTOR shall not commence work until the Base Line Construction Schedule has been approved.

4. The CONTRACTOR shall mobilize at the locations designated by the ENGINEER on the jobsite. The Mobilization shall include setting up the CONTRACTOR's, ENGINEER's and County's field office facilities and designation of the CONTRACTOR's Project Management and Supervisory personnel.

5. CONTRACTOR shall submit and correct as to the approval and satisfaction of the ENGINEER, a submittal log with all Submittal Data and Shop Drawings for all long lead material and equipment items which, in the opinion of the ENGINEER, need immediate submission for coordination, timely fabrication and/or delivery.

6. Apply for and obtain all necessary Permits as required or necessary to complete the Work.

7. The following potential construction sequence is not a requirement of the contract but is provided by the ENGINEER to aid the CONTRACTOR in schedule development.

8. The listing of schedule constraints below does not mean that every constraint or special condition has been identified. The list does not substitute for the CONTRACTOR's coordination and planning for completion of the WORK within the Contract Times.

9. The CONTRACTOR is hereby advised that the suggested well sequencing may be changed by the ENGINEER.

10. All radioactive tracer surveys and Short-Term Injection Testing shall be conducted at the end of the Work, after the injection well have been constructed.

B. Mobilization and Site Preparation: The CONTRACTOR is hereby advised that the following construction related activities are representative of the Work, but their sequence may be changed by the ENGINEER relative to order of occurrence, or deletion. The proposed Work

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sequence is as follows:

1. Install temporary water, sewer, electrical, wireless internet services.

2. Conduct a video survey of the site to document existing site conditions.

3. Remove asphalt as necessary and establish vertical and horizontal control with reference to NAVD 1988 and NAD 1983, respectively.

4. Install silt fence and synthetic bale type erosion control barrier if required.

5. Construction of temporary concrete or steel drilling fluid containment pad (or equal) and, for the construction of the injection well, install and cement a 54-inch OD (wall thickness to be determined by CONTRACTOR) surface pit casing to a final setting depth to be selected by the CONTRACTOR as shown in **Section 33 26 05 – Well Casing**.

6. Install, develop, and sample four (4) 4-inch diameter PVC shallow water table pad monitoring wells prior to the beginning of construction as shown on the **Drawing M-502** and **Section 33 26 03 – Pad Monitoring Wells**. Sample the wells in accordance with **Section 33 26 13 – Water Quality Analyses**, List C.

7. Mobilize drilling and other required materials and equipment required for construction.

C. Municipal Injection Well Drilling and Testing Sequence of Construction for one (1) municipal injection wells: The CONTRACTOR is hereby advised that the following construction related activities are representative of the Work, but the sequence of testing such as coring, straddle-packer testing, and geophysical logging, etc., may be changed by the ENGINEER relative to order of occurrence, or deletion, or additional testing that may be added. No drilling or testing on the injection well shall take place until Part 1.01 C., above is complete to the satisfaction of the ENGINEER.

1. Drill a pilot hole with a 12.25-inch diameter bit to approximately 515 feet below land surface (bls) using mud rotary methods in accordance with **Section 33 26 04 – Well Drilling.**

2. Conduct geophysical logging in accordance with **Section 33 26 06 – Geophysical Logging.**

3. Ream the pilot hole to a nominal 52-inch diameter borehole with a step-reaming bit to approximately 490 feet bls using mud rotary method in accordance with **Section 33 26 04 – Well Drilling**.

4. Conduct geophysical logging in accordance with **Section 33 26 06 – Geophysical Logging.**

5. Install the 44-inch diameter steel casing to approximately 490 feet bls in accordance with **Section 33 26 05 – Well Casing** and cement to surface in accordance with **Section 33 26 07 – Grouting**.

6. Install the artesian flow control device, as approved by the ENGINEER, to control flow

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at the artesian head pressures within the Floridan Aquifer System during reverse-air circulation drilling in accordance with **Section 33 26 04 – Well Drilling and Section 33 26 01 – Fluid Management.**

7. Drill out cement plug and drill a pilot hole centered at the bottom of the 44-inch diameter steel casing with a 12.25-inch diameter bit to approximately 1,425 feet bls using the reverse-air circulation method in accordance with **Section 33 26 04 – Well Drilling**.

8. Collect up to four (4) rock cores during pilot hole drilling below the 44-inch diameter casing at depths selected by the ENGINEER in accordance with **Section 33 26 08 – Coring.**

9. Conduct static and dynamic geophysical logging in the pilot hole in accordance with **Section 33 26 06 – Geophysical Logging**. Dispose of produced water in accordance with **Section 33 26 01 – Fluid Management.**

10. Conduct up to four (4) packer tests at depths selected by the ENGINEER in accordance with **Section 33 26 09 – Packer Testing**. Collect water quality samples in accordance with **Section 33 26 13 – Water Quality Analysis, List B.** Dispose of produced settled water in accordance with **Section 33 26 01 – Fluid Management.**

11. Back-plug the pilot hole with cement in accordance with **Section 33 26 04 – Well Drilling** to the base of the 44-inch diameter steel casing**.**

12. Ream the pilot hole to a nominal 42-inch diameter borehole to approximately 1,400 feet bls using the reverse-air circulation method in accordance with **Section 33 26 04 – Well Drilling**.

13. Conduct geophysical logging in accordance with **Section 33 26 06 – Geophysical Logging**.

14. Install the 34-inch diameter steel casing to approximately 1,400 feet bls in accordance with **Section 33 26 05 – Well Casing** and cement to surface in accordance with **Section 33 26 07 – Grouting**. After each cement stage, perform static temperature and natural gamma ray logs to confirm the top of cement in conjunction with measurement from tremie pipe hard tags in accordance with **Section 33 26 06 – Geophysical Logging.**

15. Drill out cement plug and drill a pilot hole centered at the bottom of the 34-inch diameter steel casing with a 12.25-inch diameter bit to approximately 2,150 feet bls using the reverse-air circulation method in accordance with **Section 33 26 04 – Well Drilling**. Collect water quality samples in accordance with **Section 33 26 13 – Water Quality Analysis, List A.**

16. During drilling of the pilot hole collect up to four (4) rock cores at depths selected by the ENGINEER in accordance to **Section 33 26 08 - Coring.**

17. Conduct static and dynamic geophysical logging on the pilot hole in accordance to **Section 33 26 06 – Geophysical Logging**. Dispose of produced settled water in accordance with **Section 33 26 01 – Fluid Management**.

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18. Conduct up to four (4) packer tests in the pilot hole in accordance with **Section 33 26 09 – Packer Testing**. Collect water quality samples in accordance with **Section 33 26 13 – Water Quality Analysis**, List B. Dispose of produced settled water in accordance with **Section 33 26 01 – Fluid Management.**

19. If required, install drillable bridge plug approximately 25 feet below the 24-inch diameter steel casing setting depth in accordance to **Section 33 26 07 - Grouting**.

20. Back-plug the pilot hole with cement in accordance with **Section 33 26 07 - Grouting** to the base of the 34-inch diameter steel casing.

21. Ream the pilot hole to a nominal 32-inch diameter borehole to approximately 2,100 feet bls using the reverse-air circulation method in accordance with **Section 33 26 04 – Well Drilling.**

22. Conduct geophysical logging in accordance with **Section 33 26 06 – Geophysical Logging.**

23. Install the 24-inch diameter final steel casing to approximately 2,100 feet bls in accordance to **Section 33 26 05 – Well Casing** and conduct a standard cement bond log on the casing, before cementing, in accordance with **Section 33 26 06 – Geophysical Logging.**

24. Cement the 24-inch diameter final steel casing in accordance with **Section 33 26 07 - Grouting**. After each cement stage, perform static temperature and natural gamma ray logs to confirm the top of cement in conjunction with measurement from tremie pipe hard tags in accordance with **Section 33 26 06 – Geophysical Logging**. Logging may be waived by the ENGINEER if poor fill-up is encountered.

25. Conduct a standard cement bond log following completion of cementing of the 24-inch diameter final steel casing to within 200 feet of land surface in accordance to **Section 33 26 06 – Geophysical Logging**. Complete cementing of 24-inch diameter final steel casing following logging in accordance with **Section 33 26 07 - Grouting**.

26. Conduct internal mechanical integrity testing of the 24-inch diameter final steel casing by performing a casing pressure test in accordance with **Section 33 26 11 – Mechanical Integrity Testing.**

27. Ream the pilot hole to a nominal 22-inch diameter borehole to approximately 2,860 feet bls using the reverse-air circulation method in accordance with **Section 33 26 04 – Well Drilling.**

28. Conduct geophysical logging in accordance with **Section 33 26 06 – Geophysical Logging.**

29. Conduct mechanical integrity testing of the 24-inch OD seamless steel final casing by performing geophysical logging (color video survey) in accordance **with Section 33 26 06 – Geophysical Logging.**

30. Develop the well (injection zone) in accordance with **Section 33 26 10 – Well Development**. Dispose of produced settled water in accordance with **Section 33 26**

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01 – Fluid Management. Purge well so that the water quality is returned to background conditions so that well is not only alive, but enough water has been purged to ensure that the salt kill has been removed and the well is ready to be sampled if needed.

31. Collect water quality sample from the injection zone for laboratory analysis of parameters in accordance with **Section 33 26 13 – Water Quality Analyses**, List B.

32. Complete installation of wellhead fittings and valves in accordance with **Drawing M-503.**

33. Conduct external mechanical integrity testing of the 24-inch OD seamless steel final casing by performing a High-Resolution Temperature Log and a Radioactive Tracer Survey in accordance with **Section 33 26 11 – Mechanical Integrity Testing**.

34. Run a short-term injection test as approved by the FDEP UIC permit in accordance with **Section 33 26 12 – Injection Testing**.

D. Final Cleanup and Demobilization

1. Remove drill rig and related equipment from the site.

2. CONTRACTOR shall leave wellhead protected with jersey barriers or other movable protection for the wellheads and any above ground structure left at the end of the job.

3. Demobilize all remaining equipment and materials, including all temporary piping.

4. Restore landscaping and sod impacted by the CONTRACTOR’s work.

5. Cleanup, property restoration and paving repairs shall follow as closely behind the completion of testing as possible, followed by a final inspection and cleanup when all other work is completed.

6. Restore site, walks, asphalt and concrete paving, to original or better condition.

7. Perform final cleanup and testing and remove all debris and excess material from site.

8. Submit all final Record (As-Built) Drawings along with spare parts, supplies, and tools.

9. Perform all work required in punch list items as of Substantial Completion.

10. Request Final Inspection and submit final Requisition for Payment.

11. While performing the Work in the above-described sequence, all requirements of the Specifications shall be strictly followed. Perform prompt cleanup and removals as the work progresses.

1.8 OWNER OCCUPANCY

A. OWNER will occupy premises during entire period of construction in order to maintain normal operations. Cooperate with OWNER's representative in all construction operations

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to minimize conflict, and to facilitate OWNER usage.

B. Conduct operations so as to inconvenience the general public in the least.

1.9 OUTAGE PLAN AND REQUESTS

A. Unless the Contract Documents indicate otherwise, the CONTRACTOR shall not remove from service, de-energize, or modify settings for any existing operating tank pipeline, valve, channel, equipment, structure, road, or any other facility without written permission from the OWNER.

B. Where the Work requires modifications to existing facilities, construction of new facilities and/or connection of new facilities to existing facilities, the CONTRACTOR shall submit a detailed outage plan and schedule for the OWNER's and ENGINEER'S approval a minimum of two (2) weeks in advance of the time that such outage is required.

C. A completed System Outage Request form (blank form furnished by the ENGINEER) shall accompany each outage plan. The outage plan shall be coordinated with the construction schedule and shall meet the restrictions and conditions of the Contract Documents. The outage plan shall describe the CONTRACTOR's method to prevent bypassing of other treatment units; the length of time required to complete said operation; any necessary temporary power, controls, instrumentation or alarms required to maintain control monitoring, and alarms for the treatment plant processes; and the manpower, plant, and equipment, which the CONTRACTOR will furnish for proper operation of associated treatment units. All costs for preparing and implementing the outage plans shall be at no increase in cost to the OWNER.

D. The ENGINEER shall be notified in writing at least one (1) week in advance of the required outage if the schedule for performing the Work has changed or if revisions to the outage plan are required.

E. The CONTRACTOR shall provide written confirmation of the shutdown date and time to the ENGINEER two (2) work days prior to the actual shutdown.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

A. Starting Work: Start Work within 10 days following the mutually agreeable Notice to Proceed date and execute with such progress as may be required to prevent delay to other contractors or to the general completion of the project. Execute Work at such items and in or on such parts of the project, and with such forces, material and equipment, as to complete the Work in the time established by the Contract. At all times, schedule and direct the Work so that it provides an orderly progression to completion within the specified time for completion.

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

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SITE CONDITIONS

PART 1 GENERAL

1.01 SITE INVESTIGATION AND REPRESENTATION

A. The CONTRACTOR acknowledges that he has satisfied himself as to the nature and location of the work, the general and local conditions, particularly those bearing upon availability of transportation; disposal, handling and storage of materials; availability of labor, water, electric power, roads; disposal of water from construction; uncertainties of weather; the conformation and conditions at the ground; the type of equipment and facilities needed preliminary to and during the prosecution of the work and all other matters which can in any way affect the work or the cost thereof under this Contract.

B. The CONTRACTOR further acknowledges that he has satisfied himself as to the character, quality, and quantity of surface and subsurface materials to be encountered from inspecting the site, making whatever site investigations he deems diligent or prudent, and from evaluating information derived from exploratory work that may have been done by the County or included with these Contract Documents. Any failure by the CONTRACTOR to acquaint himself with all the available information will not relieve him from responsibility for properly estimating the difficulty or cost thereof under this Contract.

C. The CONTRACTOR acknowledges that by personal field observation or other means satisfactory to himself, performed prior to negotiations, he has included in the prices all costs for dealing with all construction problems created by observable above or on grade features on or adjacent to the site of the work whether or not these features are shown on the Plans or described in the Specifications. In instances where the observable features indicate subsurface conditions which may affect the Project work, as for example, a pavement patch or catch basin gratings indicating respectively a utility or storm sewer not shown on the Plans, the CONTRACTOR acknowledges that he has made timely, diligent, inquiry of the ENGINEER or by other means fully satisfied himself prior to negotiations as to the nature of, and costs created by, the subsurface condition and included all costs therefore in the unit or lump sum prices.

1.02 INFORMATION ON SITE CONDITIONS

A. All information obtained by the County regarding the site conditions, topography, subsurface information, ground water elevations, existing construction of site facilities as applicable, and similar data will be available for inspection at the office of the ENGINEER upon request. Such information is offered as supplementary information only. Neither the ENGINEER nor the County assumes any responsibility for the completeness or for the CONTRACTOR's interpretation of such supplementary information. Prior to negotiations and after written approval from the County, CONTRACTOR may make his own survey investigations to satisfy himself with site conditions at his own cost.

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1.03 DIFFERING SUBSURFACE CONDITIONS

A. In the event subsurface or latent physical conditions are found materially different from those indicated in these Documents and differing materially from those ordinarily encountered and generally recognized as inherent in the character of work covered in these Contract Documents, promptly, and before such conditions are disturbed, notify the ENGINEER in writing of such changed conditions.

B. The ENGINEER will investigate such conditions promptly and following this investigation, the CONTRACTOR shall proceed with the work, unless otherwise instructed by the ENGINEER. If the ENGINEER and/or the Engineer of Record finds that such conditions do so materially differ as to cause an increase or decrease in cost and time considered reasonable by the ENGINEER, the County will make the final decision regarding any adjustment in cost or time for completion.

C. In the event that site conditions differ from those expected by the CONTRACTOR, the CONTRACTOR shall proceed to complete the work as contemplated by the Plans and Specifications at his own cost and expense. If in the discretion of the ENGINEER, the difference in site conditions renders completion of the work as described by the Plans and Specifications impossible, the ENGINEER may alter the work, whereupon the CONTRACTOR shall be compensated for any extra work pursuant to "EXTRA WORK AND PAYMENT THEREFORE" of the Special Provisions; the ENGINEER shall not alter the work where the site conditions render the work more difficult or costly to perform.

1.04 EXISTING UTILITIES AND LOCATION SERVICES

A. Known utilities and structures adjacent to or encountered in the work are shown on the Drawings. The locations shown are taken from existing records and the best information available from existing plans; however, it is expected that there may be some discrepancies and omissions in the locations and quantities of utilities and structures shown. Those shown are for the convenience of the CONTRACTOR only, and no responsibility is assumed by the County, the ENGINEER, and/or the Engineer of Record for their accuracy or completeness.

B. No request for additional compensation or Contract time (except for a non-compensable time extension at the sole discretion of the ENGINEER, whose decision shall be final) resulting from encountering utilities or structures not shown, or differing in location or elevation from that shown, will be considered. The CONTRACTOR shall explore sufficiently ahead of the Work to allow time for any necessary adjustments without delay to the progress of the installation. Costs due to delays occasioned by encountering underground utilities or structures which could have or should have been discovered by timely exploration ahead of the Work shall rest solely with the CONTRACTOR.

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1.05 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTIES AND SERVICE

A. Where the CONTRACTOR's operation could cause damage or inconvenience to railway, telephone, fiber optic, television, electrical power, oil, gas, water, sewer, irrigation system, or any other utility, the CONTRACTOR shall make all arrangements necessary for the protection of these utilities and services.

B. Notify all utility companies that are affected by the construction operation at least 48 hours in advance. Under no circumstance expose any utility without first obtaining permission from the appropriate agency. Once permission has been granted, locate, expose, and provide temporary support for all existing underground utilities and utility poles where necessary. Absolutely no extra compensation will be allowed for construction problems created by utility poles of whatever size, overhead electric, telephone or other lines, whether shown on the Plans or not. The CONTRACTOR is solely responsible for discerning such items in the field prior to mobilizing and including all costs for such work in the unit or lump sum prices.

C. The CONTRACTOR and his SUBCONTRACTORS shall be solely and directly responsible to the owner and operators of such properties for any damage, injury, expense, loss, inconvenience, delay, suits, actions, or claims of any character brought because of any injuries or damage which may result from the construction operations under this Contract.

D. Neither the County nor its officers or agents shall be responsible to the CONTRACTOR for damages as a result of the CONTRACTOR's failure to protect utilities encountered in the work.

E. In the event of interruption to domestic water, sewer, storm drain, or other utility services as a result of accidental breakage due to construction operations, promptly notify the proper authority. Cooperate with said authority in restoration of service as promptly as possible and bear all costs of repair. In no event shall interruption of any utility service be allowed unless granted by the owner of the utility.

F. In the event water service lines that interfere with trenching are encountered, the CONTRACTOR may, by obtaining prior approval of the water utility, cut the service, dig through, and restore the service with similar and equal materials at the CONTRACTOR's expense and as approved by the ENGINEER.

G. Replace, with material approved by the ENGINEER, at CONTRACTOR's expense, any and all other laterals, existing utilities or structures removed or damaged during construction, unless otherwise provided for in these Contract Documents and as approved by the ENGINEER.

1.06 INTERFERING STRUCTURES

A. Take necessary precautions to prevent damage to existing structures whether on the surface, above ground, or underground. An attempt has been made to show major structures on the Drawings. While the information has been compiled from

PART 1 - DOWNHOLE CONSTRUCTION

the best available sources, its completeness and accuracy cannot be guaranteed, and is presented as a guide. The CONTRACTOR is solely responsible for field verification of all locations and information provided and to determine the type, location, elevation and extent of any utilities which may not have been shown on the Plans.

1.07 FIELD RELOCATION

A. During the process of construction, it is expected that minor relocations of the work may be necessary. Such relocations shall be made only by the direction of the ENGINEER at the CONTRACTOR's expense. If existing structures are encountered that will prevent construction as shown, notify the ENGINEER before continuing with the work in order that the ENGINEER may make such field revisions as necessary to avoid conflict with the existing structures. If the CONTRACTOR fails to notify the ENGINEER when an existing structure is encountered, and proceeds with the work despite this interference, the CONTRACTOR does so at his own risk.

B. Representatives of utility companies, the railroad companies, the traffic and transportation authorities, etc., shall be notified in accordance with the provisions set forth in the relevant sections of the Specifications and the permitting Documents.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

SECTION 01 11 60

SAFETY REQUIREMENTS AND PROTECTION OF PROPERTY

PART 1 GENERAL

1.01 CONTRACTOR'S RESPONSIBILITY FOR SAFETY

A. Conduct whatever work is necessary for safety and be solely and completely responsible for conditions of the job site, including safety of all persons (including employees) and property during the Contract period. This requirement shall apply continuously and not be limited to normal working hours.

B. Neither the Professional activities of the Design Professional, nor the presence of the Design Professional nor his or her employees and subconsultants at a construction site, shall relieve the CONTRACTOR and any other entity of their obligations, duties and responsibilities including but not limited to, construction means, methods, sequence techniques or procedures necessary for performing, superintending, or coordinating all portions of the Work of construction in accordance with the Contract Documents and any health and safety precautions required by any regulatory agencies.

1.02 FEDERAL, STATE, AND LOCAL SAFETY REQUIREMENTS

A. Safety provisions shall conform to the Federal and State Departments of Labor Occupational Safety and Health Act (OSHA), and all other applicable Federal, State, County, and local laws, ordinances, codes, the requirements set forth herein, and any regulations that may be specified in other parts of these Contract Documents. Where any of these are in conflict, the more stringent requirements shall be followed. CONTRACTOR's failure to thoroughly familiarize himself with the aforementioned safety provisions shall not relieve him from compliance with the obligations and penalties set forth therein.

B. The CONTRACTOR shall be in compliance with all applicable provisions of the Occupational Safety and Health Act of 1970.

C. For trench excavations in excess of five (5) feet in depth, the CONTRACTOR shall comply with the provisions of the State of Florida "Trench Safety Act", See the Section titled, "Trench Safety Act" of the "Instruction to Contractors".

D. All open excavations made in the earth shall be performed in compliance with the State of Florida Trench Safety Act, OSHA 29 CFR 1926.650, Subpart P (Chapter 90-96, Laws of Florida). The CONTRACTOR shall appoint a "competent person", in accordance with Subpart P, who shall be present at the job site. A "competent person" shall mean one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

E. The CONTRACTOR shall familiarize himself with the Underground Facility Damage Prevention and Safety Act, Florida Statute 556. The CONTRACTOR shall contact the Sunshine State One Call Center at, 1-800-432-4770, forty-eight (48) hours prior to any excavation. Failure to familiarize himself with the aforementioned safety provisions shall not relieve him from compliance with the obligations and penalties set forth herein.

1.02 SAFE ACCESS BY FEDERAL, STATE, AND LOCAL GOVERNMENT OFFICIALS

A. The CONTRACTOR shall at all times provide proper facilities for safe access to the Work by authorized government officials.

1.03 CONSTRUCTION SAFETY PROGRAM

A. Develop and maintain for the duration of this Contract, a safety program that will effectively incorporate and implement all required safety provisions. The CONTRACTOR's Manual of Safety Practices outlining the firm's policies on field safety procedures for employees shall be submitted to the County for review before "Notice to Proceed" will be issued. The CONTRACTOR shall appoint an employee who is qualified and authorized to supervise and enforce compliance with the safety program.

B. Certain products specified in these specifications contain warnings by the manufacturers that under certain conditions, if instructions for use are not followed, a hazardous condition may exist. It is the CONTRACTOR's responsibility to instruct his workmen in the safe use of the product, or any product substitution.

C. The duty of the County to conduct construction review of the CONTRACTOR's performance is not intended to include a review or approval of the adequacy of the CONTRACTOR's Safety Supervisor, the safety program, or any safety measures taken in, on, or near the construction site.

1.03 SAFETY EQUIPMENT

A. As part of the safety program, maintain at an office or other well-known place at the job site, safety equipment applicable to the Work as prescribed by the governing safety authorities, all articles necessary for giving first-aid to the injured, and establish the procedure for the immediate relocation to a hospital or a doctor's care of any person who may be injured on the job site.

B. Perform all necessary work to protect all personnel and the general public from hazards, including, but not limited to, surface irregularities or unramped grade changes, and trenches or excavations. Furnish barricades, warning lights, traffic cones, temporary fencing, lanterns, proper signs, and personnel, such as flagmen and uniformed Police officers, to safeguard all persons and work.

C. The performance of all work and all completed construction, particularly with respect to ladders, platforms, structure openings, scaffolding, shoring, logging, machinery guards and the like, shall be in accordance with the applicable governing safety authorities.

PART 1 - DOWNHOLE CONSTRUCTION

D. During construction, construct and at all times maintain satisfactory and substantial temporary chain link fencing, solid fencing, railings, barricades or steel plates, as applicable, at all openings, obstructions, or other hazards. All such barriers shall have adequate warning lights as necessary, or required, for safety.

1.04 STORAGE OF HAZARDOUS MATERIALS

A. The CONTRACTOR is hereby cautioned that he cannot store any environmentally hazardous materials such as solvents, greases, lubricants or any other type of chemical substances at the Project site in excess of the quantities needed for immediate use.

B. There shall be no oil dripping from equipment or oil spills.

C. The materials shall be stored and handled in a proper and safe manner and upon its use, immediately dispose of the containers, cans, rags and remnants of the materials in a manner approved by the Lee County Natural Resources Department (NRD) at the CONTRACTOR's sole cost. The CONTRACTOR is not allowed to store empty containers at the site. In case of any violation, such violation will be reported to Lee County's NRD and the CONTRACTOR shall be subject to all penalties and fines as required by State and County regulations.

D. Storage Areas and Requirements from the Lee County's NRD Website

In Lee County, because of the need to protect our drinking water supply, many of the storage requirements for hazardous wastes also apply to storing virgin chemicals.

- Containers shall be maintained in good condition, i.e., sound (not damaged). Containers shall be compatible with the hazardous waste stored in them and approved containers shall meet US Department of Transportation standards (DOT).
- Containers holding hazardous waste shall be maintained closed, except when adding to or emptying the container.
- Containers shall bear labels identifying their content as well as the date storage began.
- When stored outside of working bays, used oil containers shall be labeled as such, covered, and equipped with secondary containment.
- Chemical storage areas must be on an impervious surface with secondary containment or a bermed and covered area away from drainage structures (e.g. floor drains or storm drains). This containment area should be able to hold 110% of the volume of the largest single tank/drum to be stored in this area.
- In large storage areas, there must be aisle space between storage products. This will enable inspection of the container for leaks and/or corrosion.
- Incompatible chemicals or materials should be stored separately.
- Provide appropriate signs and markings so that the Hazardous Waste Storage

Area may be readily identified.

- Label each container with the type of material in it and in the case of hazardous wastes, use the words "Hazardous Waste."
- All above ground tanks and storage areas for hazardous materials and hazardous wastes shall be stored in covered, secondary containment. Design and construction details require County approval.
- Filters and batteries shall be properly stored and disposed of.
- All discharges to sewers shall meet Lee County discharge standards.
- Rags used during mechanical repairs or cleaning processes which become contaminated with waste oil or hazardous materials such as solvents, ink, etc. are considered hazardous wastes and may be handled by an approved rag service or an approved hazardous waste transporter. Used rags must not be disposed of in the trash/dumpster unless a hazardous waste profile indicates otherwise and approval is granted by this County.
- Facilities generating more than 10 spent fluorescent and/or high-intensity discharge (HID) lamps per month must have them recycled. Primarily because of the mercury that they contain, these lamps cannot be disposed of in the regular trash. Spent lamps must be stored in a safe location in order to prevent them from breaking. More information can be obtained from the FDEP Mercury Program.

1.05 ACCIDENT REPORTS

A. If death, serious injuries, or serious damages are caused, report the accident immediately by telephone or messenger to the County's 24-hour Emergency Call Center at (239) 533-8700. In addition, the CONTRACTOR must promptly report in writing to the County all accidents whatsoever arising out of, or in connection with, the performance of the work whether on, or adjacent to, the site, giving full details and statements of witnesses.

B. If a claim is made by anyone against the CONTRACTOR or any SUBCONTRACTOR on account of any accident, promptly report the facts in writing to the County, giving full details of the claim.

1.06 TRAFFIC SAFETY AND ACCESS TO PROPERTY

A. Comply with all rules and regulations of the City, State, and County authorities regarding closing or restricting the use of public streets or highways. No public or private road shall be closed, except by express permission of the County. Conduct the Work so as to assure the least possible obstruction to traffic and normal commercial pursuits. Protect all obstructions within traveled roadways by installing approved barricades, signs, and lights where necessary for the safety of the public. The convenience of the general public and residents and the protection of persons and property are of prime importance and shall be provided for in an adequate and satisfactory manner.

B. Where traffic will pass over backfilled trenches before they are paved, the top of

the trench shall be maintained with temporary asphalt that will allow normal vehicular traffic to pass over. Temporary access driveways must be provided where required. Cleanup operations shall follow immediately behind backfilling and the work site shall be kept in an orderly condition at all times.

C. Supply Flagmen and Guards or Police when they are required by regulation or when deemed necessary for safety. Flagmen and Guards shall be furnished with approved orange wearing apparel and other regulation traffic control devices.

1.07 FIRE PREVENTION AND PROTECTION

A. Perform all work in fire-safe manner. Furnish and maintain on the site adequate fire-fighting equipment capable of extinguishing incipient fires. Comply with applicable Federal, local, and State fire-prevention regulations. Where these regulations do not apply, applicable parts of the National Fire Prevention Standard for Safeguarding Building Construction Operations (NFPA No.241) shall be followed.

1.08 HURRICANE PREPAREDNESS

A. During such periods of time as are designated by the United States Weather Bureau as being a hurricane alert, the CONTRACTOR shall perform all precautions as necessary to safeguard the Work and property, including the removal of all small equipment and materials from the site, lashing all other equipment and materials to each other and to rigid construction, and any other safety measures as may be directed by the County.

B. Upon Notification of a Hurricane Watch

1. Formal notification to all CONTRACTORS to prepare and submit for approval a Plan of Action for the specific actions to be taken on their particular Projects.

C. Upon Notification of a Hurricane Warning

1. Formal notification to the CONTRACTORS to implement their approved Plan of Action to protect the Project and the public.
2. A copy of the notifications will be provided to the Plant Superintendent. The Plant Superintendent is also requested to notify the Construction Manager of any assistance he may need from the CONTRACTOR in order to secure Plant entities.

1.09 JOINT SURVEY TO ESTABLISH AUTHENTICITY OF POSSIBLE DAMAGE CLAIMS

A. The CONTRACTOR shall maintain vertical and horizontal survey control points on all structures and improvements, located in the vicinity of the work prior to beginning work, and shall periodically check the points for movements with copies provided to the County, of the survey notes for each survey and a copy

of the layout of the survey control points.

B. After the Contract is awarded and before commencement of work, perform a thorough examination of existing buildings, structures, and other improvements in the vicinity of the work, as applicable, which might be damaged by his operations.

C. Examinations of existing structures, buildings, and other improvements in the vicinity of the work shall be done by the CONTRACTOR. The scope of the examination shall include cracks in the structures, settlement, leakage, and similar conditions. The County assumes no responsibility for pre-existing conditions of the structure.

D. Records in triplicate of all observations shall be prepared by the CONTRACTOR, photographs shall be taken by the CONTRACTOR signed and dated, with descriptive information and in the manner specified above. One signed copy of every document and photograph will kept on file in the office of the County and the ENGINEER.

E. The above records are intended to be used as indisputable evidence in ascertaining the extent of any damage which may occur as a result of the CONTRACTOR's operations and are for the protection of the CONTRACTOR and the County, and will be a means of determining whether and to what extent damage, resulting from the CONTRACTOR's operations, occurred during the Contract work.

PART 2 PRODUCTS

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PART 3 EXECUTION

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END OF SECTION

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SECTION 01 22 13

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General

B. Explanation and Definitions

C. Measurement

D. Payment

E. Schedule of Values

1.2 GENERAL

A. The CONTRACTOR shall receive and accept the compensation as provided in the Contract full payment for furnishing all labor, materials, tools and equipment, for performing all operations necessary to complete the Work under this Contract. This includes full payment for all loss or damages which may occur where the CONTRACTOR is determined by the OWNER and ENGINEER to be at fault. As requested in writing by the CONTRACTOR, and if approved by the OWNER excessive durations resulting from adverse downhole conditions will be payable at the rate identified for standby time.

B. The cost breakdown (or schedule of values) referred to herein is defined in the Contract. The cost breakdown (schedule of values) approved by the Engineer will be used as the basis for making progress payments and for determining the cost of extra work which is the same or similar (as determined by the Engineer) to that defined in the schedule of values.

C. The prices stated in the Bid include full compensation for overhead and profit, all costs and expenses for taxes, labor, equipment, furnishing and repairing small tools and ordinary equipment, mobilization, home office expenses and general supervision, materials, commissions, transportation charges and expenses, patent fees and royalties, bond, insurance, labor for handling materials during inspection, together with any and all other costs and expenses for performing and completing the Work as shown on the Drawings and specified herein. In addition, the CONTRACTOR shall include the actual cost of social security taxes, unemployment insurance, worker's compensation, fringe benefits, inclusive of life and health insurance, union dues, pension, pension plans, vacations, and insurance and CONTRACTOR 's public liability and property damage insurance involved in the work based on the actual wages paid to such labor and all other general costs and profits, prorated to each item.

D. It is the intent of the County to obtain a complete and working installation under this

PART 1 - DOWNHOLE CONSTRUCTION

Contract, and any items of labor, equipment or materials which may reasonably be assumed as necessary to accomplish this end shall be supplied whether or not they are specifically shown on the Drawings or stated herein.

E. Unless otherwise specifically stated elsewhere herein, the CONTRACTOR shall include in the bid proposal all materials, electrical supplies, fuel, lubricants, temporary equipment, temporary wiring, temporary piping and fittings, pumps, gages, and all other items of whatever nature required to completely test, balance, and put into fully operational condition all equipment and/or systems supplied by either the County or the CONTRACTOR and installed as a part of this Project. Further, any test materials supplied by the CONTRACTOR shall be completely satisfactory to the County. Any decision as to whether a particular material is suitable for test purposes shall be at the sole discretion of the Engineer whose decision shall be final. Any material considered not suitable shall be immediately replaced by the CONTRACTOR with suitable material and no extra compensation will be allowed.

F. Extra casing that is not installed, up to the contract quantities, will be paid for per the bid form and the subsequent schedule of values. Additional laydown and staging areas will not be provided for purposes of storing casing during the Work. Leftover casing will be removed by the CONTRACTOR from the facility upon completion of the Work and will remain the property of the CONTRACTOR.

1.3 EXPLANATION AND DEFINITIONS

A. The following explanation of the Measurement and Payment for the bid form items is made for information and guidance. The omission of reference to any item in this description shall not, however, alter the intent of the bid form or relieve the CONTRACTOR of the necessity of furnishing such as a part of the Contract.

1.4 MEASUREMENT

A. The quantities set forth in the bid form are approximate and are given to establish a uniform basis for the comparison of bids. The OWNER reserves the right to increase or decrease the quantity of any class or portion of the work during the progress of construction in accord with the terms of the Contract.

1.5 PAYMENT

A. Payment shall be made for the items listed on the Bid Form on the basis of the work actually performed and completed, such work including but not limited to, the furnishing of all necessary labor, materials, equipment, transportation, clean up, restoration of disturbed areas, and all other appurtenances to complete the construction and installation of the work as shown on the drawings and described in the specifications.

B. Unit prices are used as a means of computing the final figures for bid and Contract purposes, for periodic payments for work performed, for determining value of additions or deletions and wherever else reasonable.

1.6 SCHEDULE OF VALUES

PART 1 - DOWNHOLE CONSTRUCTION

A. Approval of Schedule: Submit for approval a preliminary schedule of values, in duplicate, for all of the Work. Prepare preliminary schedule in accordance with the General Conditions. Submit preliminary schedule of values within 10 calendar days after the Effective Date of the Agreement. Submit final schedule of values in accordance with the General Conditions.

B. Format: Utilize a format similar to the Table of Contents of the Project Specifications. Identify each line item with number and title of the major specification. Identify site mobilization, bonds and insurance. Include within each line item, a direct proportional amount of CONTRACTOR's overhead profit.

C. Revisions: With each Application for Payment, revise schedule to list approved Change Orders.

1.7 APPLICATION FOR PAYMENT

A. Required Copies: Submit three copies of each application on EJCDC Form No. 1910-8-E (1990) or approved equal. Present required information in typewritten form or on electronic media printout.

B. Execute certification by signature of authorized officer.

C. Use data from approved Schedule of Values.

D. Stored Materials: When payment for materials stored is permitted, submit a separate schedule for Materials Stored showing line item, description, previous value received, value incorporated into the Work and present value.

E. Change Orders: List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original item of work.

F. Final Payment: Prepare Application for Final Payment as required in the General Conditions.

G. Submit an updated construction schedule for each Application for Payment.

PART 2 EXECUTION

2.1 MEASUREMENT AND PAYMENT

A. Payment shall be made on the basis of work actually performed completing each item in the Bid, such work including, but not limited to, the furnishing of all necessary labor, materials, equipment, transportation, cleanup, and all other appurtenances to complete the construction and installation of the work to the configuration and extent as shown on the drawings and described in the specifications.

B. It is intended that all work required to complete this Contract will be included in the various bid items as listed in the bid form and as further described below. Bid items I-4 through I-

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6 shall be reserved for use as needed as directed and approved in advance by the County. Any unused portions of bid items I-4 through I-6 shall be returned to the County through a final change order.

1. Item No. I-1. For General Requirements, or Home/Field Office Overhead, which include costs associated with and delineated in the Contract costs which are costs not associated with a specific project, but account for the Contractor's business operating expenses including estimating and preconstruction services, accounting, marketing, etc., which are reasonably allocated to this specific project's base duration. The lump sum value bid divided by the project's base duration stated in the contract will be used to determine a monthly amount to be included in each pay application.

2. Item No. I-2. For initial mobilization for one (1) municipal injection well and for performing preparatory work including setting up temporary facilities, preparing shop drawing submittals, conducting pre-construction video, coordination with the Surface Facilities contractor, and the mobilization to the Project site of the Contractor's field office, storage sheds, construction equipment, supplies, materials, personnel, safety equipment and first aid supplies, and other items required to initiate construction, such as temporary power, potable water and fencing. This item shall include the costs of bonds, required insurance, and other preconstruction expenses.

    1. No actual construction or physical preparatory work may be performed at the site until the work of this item has been successfully achieved unless specific written approval by the Engineer is granted for said work. Such permission by the Engineer will only be granted if all bond and insurance is in place and a complete Schedule of Values and Baseline Construction Schedule has been supplied by the Contractor and approved by the Engineer.

    2. The mobilization item will be paid for in the first four (4) payments, each equal to twenty-five (25) percent of the amount bid for this item, which will be made conditioned upon progress satisfactory to the Engineer being made pursuant to the accepted Project schedule.

    3. One mobilization will be paid.

    4. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

3. Item No. I-3. For all costs incurred for demobilization and cleanup will be paid as a lump sum bid. The Contractor will be responsible for removing all equipment, excess materials, and debris from site. The amount bid shall include cleanup, the removal of all trash and debris, load, transport, and discard in a lawful manner, including all tipping fees, and post-construction video; the Contractor shall also restore the site to original or better including restoring any disturbed sodding, sidewalks, paving, and landscaping that is the responsibility of the Contractor as define herein. Demobilization will be paid at the lump sum bid and as measured as required by and satisfactory to the Engineer.

4. Item No. I-4. Lost circulation zone gravel will be used as needed to aid in filling large voids during cementing operations. A total of 1,000 cubic feet has been allocated in the Proposal/Bid Form. Payment will be in accordance with the cost per cubic foot bid times

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the number of cubic feet installed and accepted by the Engineer.

5. Item No. I-5. For standby time for the drilling rig equipment and rig crew during the progress of work under these Specifications, it may be necessary for the Engineer to perform additional work of an experimental nature or consult with regulatory agencies. During such time it may be necessary for the drilling equipment and rig crew to standby during normal working hours. In such an event the representative of the Engineer shall order the Contractor to cease operations and will state the anticipated duration of the standby period. Approval for any drill rig equipment and rig crew standby time to be paid to the Contractor must be made in writing by the Engineer. A total of 2,000 hours has been allocated in the Proposal/Bid Form. Payment will be in accordance with the rate price per hour bid times the number of hours of waiting and standby time approved and accepted by the Engineer.

6. Item No. II-1. For all costs incurred for construction of one (1) temporary concrete drilling pad or steel enclosure pad, as shown on the Drawings, including furnishing and installation of materials, equipment and supplies, and other miscellaneous cost. This item will be paid at the price stated in the Contractor's bid. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

7. Item No. II-2. For all costs incurred for construction of each of the four (4) water table monitoring wells required for the injection well including furnishing and installation of materials, equipment and supplies, other miscellaneous cost. This item will be paid at the unit price bid for each well as stated in the Contractor 's bid.

8. Item No. II-3. For all costs incurred for weekly sampling of the four (4) water table monitoring wells for the injection well including labor, equipment, supplies and NELAP-Certified Laboratory fees. This item will be paid as a lump sum stated in the Contractor 's bid and as provided in the approved schedule of values.

9. Item No. II-4. For furnishing and installing 54-inch steel pit casing in the injection well. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

10. Item No. II-5. For all costs and labor incurred in drilling a nominal 12.25-inch diameter pilot hole using standard mud-rotary drilling methods to approximately 515 feet bls. Payment will be in accordance with the unit price bid per linear foot as approved by the Engineer.

11. Item No, II-6. For all costs and labor incurred in performing geophysical logging to approximately 515 feet bls. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

12. Item No. II-7. For all costs and labor incurred in reaming a nominal 54-inch diameter borehole using standard mud-rotary drilling methods to approximately 490 feet bls. Payment will be in accordance with the unit price bid per linear foot as approved by the Engineer.

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13. Item No. II-8. For all costs and labor incurred in performing geophysical logging to approximately 490 feet bls. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

14. Item No. II-9. For purchase and delivering to the COUNTY 44-inch steel casing. Payment will be in accordance with the unit price bid per linear foot as approved by the Engineer.

15. Item No. II-10. For all labor and costs associated with the installation of the 44-inch diameter steel casing. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

16. Item No. II-11. For all costs of furnishing and installing the ASTM C150 Type II or ASTM C595M-21 Type 1L cement for the installation of the 44-inch diameter steel casing. Payment will be in accordance with the unit price bid per cubic foot as approved by the Engineer.

17. Item No. II-12. For all cost and labor incurred for furnishing and installation of a flow prevention device and transition cost to reverse-air drilling techniques in addition to formation water fluid management. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

18. Item No. II-13. For all costs and labor incurred in drilling a nominal 12.25-inch diameter pilot hole using reverse-air circulation techniques from approximately 490 feet to 1,425 feet bls. Payment will be in accordance with the unit price bid per linear foot as approved by the Engineer.

19. Item No. II-14. For all costs and labor associated with drilling and collecting each of the four (4) formation cores between the approximate depth of 490 feet and 1,425 feet bls. This item will be paid at the unit price bid for each well as stated in the Contractor 's bid with an estimated total of four (4) between the approximate depth of 490 feet and 1,425 feet bls.

20. Item No. II-15. For all costs incurred for each of the two (2) laboratory analysis of each of the four (4) rock cores collected between the approximate depth of 490 feet and 1,425 feet bls. This item will be paid at the unit price bid for each well as stated in the Contractor 's bid with an estimated total of two (2) laboratory analysis per each of the four (4) between the approximate depth of 490 feet and 1,425 feet bls.

21. Item No. II-16. For all costs and labor incurred in performing geophysical logging from approximately 490 feet to 1,425 feet bls. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

22. Item No. II-17. For all costs and labor associated with performing packer tests and laboratory analysis of water samples for each of the four (4) packer tests between the approximate depth of 490 feet and 1,425 feet bls. This item will be paid at the unit price bid for each well as stated in the Contractor 's bid with an estimated total of four (4) between 490 feet and 1,425 feet bls.

23. Item No. II-18. For all costs and labor incurred in backplugging nominal 12.25-inch diameter pilot hole with up to 12% bentonite cement from approximately 1,425 feet to

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490 feet bls. Payment will be in accordance with the unit price bid per cubic foot as approved by the Engineer.

24. Item No. II-19. For all costs and labor incurred in reaming a nominal 44-inch diameter borehole using reverse air circulation techniques from approximately 490 feet to 1,400 feet bls. Payment will be in accordance with the unit price bid per linear foot as approved by the Engineer.

25. Item No. II-20. For all costs and labor incurred in performing geophysical logging from approximately 490 feet to 1,400 feet bls. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

26. Item No. II-21. For purchase and delivering to the County 34-inch steel casing. Payment will be in accordance with the unit price bid per linear foot as approved by the Engineer.

27. Item No. II-22. For all labor and costs associated with the installation of the 34-inch diameter steel casing. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

28. Item No. II-23. For all costs of furnishing and installing the ASTM C150 Type II or ASTM C595M-21 Type 1L cement for the installation of the 34-inch diameter steel casing. Payment will be in accordance with the unit price bid per cubic foot as approved by the Engineer.

29. Item No. II-24. For all costs and labor incurred in performing geophysical logging associated with installation of 34-inch diameter steel casing. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

30. Item No. II-25. For all costs and labor incurred in drilling a nominal 12.25-inch diameter pilot hole using reverse air circulation techniques from approximately 1,425 to 2,150 feet bls. Payment will be in accordance with the unit price bid per linear foot as approved by the Engineer.

31. Item No. II-26. For all costs and labor associated with drilling and collecting each of the four (4) formation cores between the approximate depth of 1,425 feet to 2,150 feet bls. This item will be paid at the unit price bid for each well as stated in the Contractor 's bid with an estimated total of four (4) between 1,425 feet to 2,150 feet bls.

32. Item No. II-27. For all costs incurred for each of the two (2) laboratory analysis of each of the four (4) rock cores collected between the approximate depth of 1,425 feet to 2,150 feet bls. This item will be paid at the unit price bid for each well as stated in the Contractor 's bid with an estimated total of two (2) laboratory analysis per each of the four (4) between the approximate depth of 1,425 feet to 2,150 feet bls.

33. Item No. II-28. For all costs and labor incurred in performing geophysical logging from approximately 1,425 feet to 2,150 feet bls. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

34. Item No. II-29. For all costs and labor associated with performing packer tests and

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laboratory analysis of water samples for each of the four (4) packer tests between the approximate depth of 1,425 feet to 2,150 feet bls. This item will be paid at the unit price bid for each well as stated in the Contractor 's bid with an estimated total of four (4) between 1,425 feet to 2,150 feet bls.

35. Item No. II-30. For all costs and labor incurred in the installation of a bridge plug approximately 25 feet below the 24-inch diameter final seamless steel casing depth (if required). Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the ENGINEER.

36. Item No. II-31. For all costs and labor incurred in backplugging nominal 12.25-inch diameter pilot hole with up to 12% bentonite cement from approximately 2,125 feet to 1,400 feet bls. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

37. Item No. II-32. For all costs and labor incurred in reaming a nominal 34-inch diameter borehole using reverse air circulation techniques from approximately 1,400 feet to 2,100 feet bls. Payment will be in accordance with the unit price bid per linear foot as approved by the Engineer.

38. Item No. II-33. For all costs and labor incurred in performing geophysical logging from approximately 1,400 feet to 2,100 feet bls. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

39. Item No. II-34. For purchase and delivering to the County 24-inch steel casing. Payment will be in accordance with the unit price bid per linear foot as approved by the Engineer.

40. Item No. II-35. For all labor and costs associated with the installation of the 24-inch diameter steel casing. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

41. Item No. II-36. For all costs of furnishing and installing the ASTM C150 Type II or ASTM C595M-21 Type 1L cement for the installation of the 24-inch diameter steel casing. Payment will be in accordance with the unit price bid per cubic foot as approved by the Engineer.

42. Item No. II-37. For all costs and labor incurred in performing geophysical logging associated with installation of 24-inch diameter steel casing. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

43. Item No. II-38. For all costs and labor incurred in reaming a nominal 24-inch diameter borehole using reverse air circulation techniques from approximately 2,100 feet to 2,860 feet bls. Payment will be in accordance with the unit price bid per linear foot as approved by the Engineer.

44. Item No. II-39. For all costs and labor incurred in performing geophysical logging from approximately 2,100 feet to 2,860 feet bls. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

PART 1 - DOWNHOLE CONSTRUCTION

45. Item No. II-40. For all costs and labor associated with well development, collection, analysis and reporting of water samples from the injection zone. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

46. Item No. II-41. For all costs and labor incurred in conducting internal and external MIT of the 24-inch diameter final seamless steel casing. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

47. Item No. II-42. For all costs and labor incurred in conducting a short-term injection test; this includes routing and design of all temporary works needed to provide injection test water. Since this item is bid as a lump sum, payment will be in accordance with the cost breakdown as approved by the Engineer.

2.2 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

A. Partial Payment : Will be made in accordance with the Contract.

B. Final Payment: Will be made only for materials incorporated in Work; remaining materials, for which partial payments have been made, shall revert to Contractor unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

2.3 FINAL APPLICATION FOR PAYMENT

A. Prior to submitting final application, make acceptable delivery of required documents and other requirements as specified in Section 01700 - Contract Closeout and other Contract requirements.

B. Final payment shall be subject to the conditions and requirements included in the Contract.

2.4 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

A. Payment will not be made for following:

1. Loading, hauling, and disposing of rejected material.
2. Quantities of material wasted or disposed of in manner not called for under Contract Documents.
3. Rejected loads of material, including material rejected after it has been placed by reason of failure of Contractor to conform to provisions of Contract Documents.
4. Material not unloaded from transporting vehicle.
5. Defective Work not accepted by County.
6. Material remaining on hand after completion of Work.

2.5 BID PRICES

A. The price for each item shall be stated in figures in the appropriate places in the Bid/Proposal Form. All blank spaces for prices must be filled in with ink, or with a typewriter. The Contractor is further directed to submit on the latest version of the Bid/Proposal Form if modified by addendum. Non-compliance by the Contractor of this directive may be grounds for rejection of his proposal.

PART 1 - DOWNHOLE CONSTRUCTION

B. In the event that the number of units multiplied by the unit price shown in numbers equals the total price for that item, the numbers shall govern over the unit price shown in words.

C. Where an error is made in the calculation of the total price of an item, the unit price shall govern.

D. If the Contractor makes an error in his addition of the total prices of the applicable items in the bid, the correct sum of its' applicable item totals shall be the Total Price.

E. It has been determined that the County is not exempt from the payment of Florida State Sales Tax under this Contract. All items of materials, equipment and supplies furnished by the Contractor and remaining a part of the completed Project are subject to this Tax. The Contractor shall include a sufficient amount of money to pay for this Tax in his Contractor price. Sufficient money to pay the Tax for all miscellaneous materials and minor items shown on the Drawings, specified herein, or necessary for the Work, and which will remain a part of the completed Project, shall also be included in the price or prices, and no other compensation will be provided.

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

SECTION 01 26 00

CHANGE ORDER AND FIELD DIRECTIVE CHANGE PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Definitions

B. Change Orders

C. Field Directive Change

1.2 DEFINITIONS

A. Change Order: Refer to the Change Order definition in Article 2 of the General Conditions.

B. Field Directive Change: Field Directive Change is a written directive to the CONTRACTOR issued on or after the effective date of the agreement; signed by the OWNER, recommended by the ENGINEER ordering an addition, deletion, or revision in the Work. A Field Directive Change will subsequently be followed by the issuance of a Change Order.

C. Overhead: Overhead is defined as the cost of administration, field office and home office costs, general superintendence, office engineering and estimating costs, other required insurance, materials used in temporary structures (not including form work), additional premiums on the performance bond of the CONTRACTOR, the use of small tools, scheduling costs, and all other costs incidental to the performance of the change or the cost of doing business.

1.3 CHANGE ORDERS

A. Initiation of Proposals:

1. From time to time, the OWNER or the ENGINEER may issue a Request for a Change Order Proposal. The Request will contain a description of the intended change with supplementary or revised Drawings and Specifications as applicable, and the projected time for accomplishing the change.

2. The CONTRACTOR may propose a change in the Work by submittal of a Change Order Request to the ENGINEER describing the proposed change with a statement of the reason for the change and the effect on the Contract time and price, along with supporting documentation.

PART 1 - DOWNHOLE CONSTRUCTION

B. Execution of Change Order Proposal:

1. When a Proposal is requested for changed work, submit proposal within 15 days following receipt of the Request from OWNER or ENGINEER. State the increase or decrease, if any, in Contract Completion time and Contract Price.

2. Explain proposal in sufficient detail to permit review by OWNER.

3. For Omitted Work the decrease in the Contract Price will be determined by the ENGINEER and will include appropriate amounts for profit and overhead.

4. The OWNER and ENGINEER will review the Proposal and may request additional information and documentation. Provide these items upon request.

5. If the OWNER decides to proceed with the change, the OWNER will issue a Change Order for signature first by the CONTRACTOR and then by the OWNER.

6. The CONTRACTOR will promptly complete the approved change in the Work on receipt of the executed Change Order.

   a. Failure to sign the Change Order does not relieve the CONTRACTOR from performing the Work if the Change Order is signed by the OWNER.

C. Compute the cost of both additive and deductive changes in the Work in accordance with Article 11 of the General Conditions and as follows:

1. Include, the costs of labor, crew foreman and general foreman performing or directly supervising the changed Work on the site. Include travel and subsistence, but only to the extent incurred.

2. To the labor cost add all net premium for Workman's Compensation, taxes pursuant to the Federal Social Security Act, and payments required under State and Federal unemployment laws.

3. Add necessary extra materials, delivered at the site.

4. Include Subcontractor's costs, determined by items 1 through 4 in the preceding subparagraphs, including a maximum of 10 percent overhead and 10 percent profit for the first $20,000; 7-1/2 percent overhead and 7-1/2 percent profit on the next $30,000; and 5 percent overhead and 5 percent profit on balance over $50,000.

PART 1 - DOWNHOLE CONSTRUCTION

5. For all subcontract work add 5 percent overhead and 5 percent profit to the subcontractor's costs as determined in paragraph 5. For work performed by the CONTRACTOR's own forces add a maximum of 10 percent overhead and 10 percent profit for the first $20,000; 7-1/2 percent overhead and 7-1/2 percent profit on the next $30,000; and 5 percent overhead and 5 percent profit on balance over $50,000.

1.4 FIELD DIRECTIVE CHANGE

A. Initiation by OWNER: OWNER may issue a Field Directive Change with a Notice to Proceed without a prior Request for a Change Order Proposal or the CONTRACTOR's signature.

B. Payment Determination: The OWNER will designate the method of determining the amount of compensation or credit, if any, based on one of the methods contained in Article 11 of the General Conditions.

C. Timing: Proceed with the change in the Work immediately upon receipt of the Field Directive Change.

D. Addition to Contract: The Field Directive Change will be incorporated into the Contract Documents via a Change Order at a later date.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 31 13

PROJECT COORDINATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Work Progress

B. Private Land

C. Work Locations

D. Open Excavations

E. Test Pits

F. Maintenance of Traffic

G. Maintenance of Flow

1.2 WORK PROGRESS

A. Furnish personnel and equipment which will be efficient, appropriate and large enough to secure a satisfactory quality of work and a rate of progress which will allow the completion of the work within the time stipulated in the Bid of these Specifications. If at any time such personnel appears to the ENGINEER to be inefficient, inappropriate or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may order the CONTRACTOR to increase the efficiency, change the character or increase the personnel and equipment, and the CONTRACTOR shall conform to such order. Failure of the ENGINEER to give such order shall in no way relieve the CONTRACTOR of his obligations to secure the quality of the work and rate of progress.

1.3 WORK LOCATIONS

Structures and pipelines shall be located substantially as indicated on the Drawings, but the ENGINEER reserves the right to make such modifications in locations as may be found desirable to avoid interference noted on the Drawings, such notation is for the CONTRACTOR's convenience and does not relieve him from laying and jointing different or additional items where required.

1.4 OPEN EXCAVATIONS

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and

PART 1 - DOWNHOLE CONSTRUCTION

damage to property. The CONTRACTOR shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by the public and workmen.

1.5 TEST PITS

A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the CONTRACTOR. Test pits shall be backfilled immediately after their purpose has been satisfied and maintained in a manner satisfactory to the ENGINEER. The costs for such test pits shall be borne by the CONTRACTOR.

1.6 MAINTENANCE OF FLOW

A. Provide for the flow of sewers, drains, courses interrupted during the progress of the work, and shall immediately cart away and remove all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the ENGINEER and OWNER well in advance of the interruption of any flow.

PART 2 PRODUCTS

2.1 PROTECTION OF CONSTRUCTION AND EQUIPMENT

A. All newly constructed work shall be carefully protected from damage in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions damaged shall be reconstructed by the CONTRACTOR at his own expense.

B. All structures shall be protected in a manner approved by the ENGINEER. Should any of the floors or other parts of the structures become heaved, cracked or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the CONTRACTOR at his own expense and to the satisfaction of the ENGINEER. Special attention is directed to substructure bracing requirements, described in Section 31 40 00. If, in the final inspection of the work, any defects, faults or omissions are found, the CONTRACTOR shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. The CONTRACTOR shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the guarantee period described in the contract.

C. Take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the OWNER.

PART 3 EXECUTION

3.1 PROTECTION OF CONSTRUCTION AND EQUIPMENT

PART 1 - DOWNHOLE CONSTRUCTION

A. Sequence and schedule work in a manner to preclude delays and conflicts between the work of various trades and contractors. Each trade shall keep informed as to the work of other trades on the project and shall execute their work in a manner that will not interfere with the work of other trades.

3.2 DIAGRAMMATIC NATURE OF DRAWINGS

A. Where layout is diagrammatic, such as pipelines, conduits, ductwork, etc., it shall be followed as closely as other work will permit. Changes from diagrams shall be made as required to conform to the construction requirements.

B. Before running lines, carefully verify locations, depths and sizes and confirm that lines can be run as contemplated without interfering with other construction. Any deviation shall be referred to the ENGINEER for approval before lines are run. Minor changes in location of the equipment, fixtures, piping, etc., from those shown on the Drawings, shall be made without extra charge if so directed by the ENGINEER before installation.

C. Determine the locations and sizes of equipment, fixtures, conduit, ducts, openings, etc., in order that there will be no interference in the installation of the work or delay in the progress of other work. In the event that interferences develop, the ENGINEER's decision regarding relocation of work will be final.

D. Any changes made necessary through failure to make proper arrangements to avoid interference shall not be considered as extras. Cooperate with those performing other work in preparation of interference drawings, to the extent that the location of piping, ductwork, etc., with respect to the installations of other trades shall be mutually agreed upon by those performing the work.

3.3 PROVISIONS FOR LATER INSTALLATION

A. Where any work cannot be installed as the construction is progressing, provide for boxes, sleeves, inserts, fixtures or devices as necessary to permit installation of the omitted work during later phases of construction. Arrange for chases, holes, and other openings in the masonry, concrete or other work and provide for subsequent closure after placing equipment. Arrangement for and closure of openings shall be subject to the approval of the ENGINEER and all costs therefor shall be included in the contract price for the work.

3.4 COORDINATION

A. The CONTRACTOR shall be fully responsible for the coordination of his work and the wok of his employees, subcontractors, and suppliers with the OWNER, and regulatory agencies, and assure compliance with schedules.

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

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SECTION 01 31 19

PROJECT MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination

B. Preconstruction Conference

C. Progress Meetings

1.2 COORDINATION

A. General: Coordinate scheduling, submittals, and Contract work to assure efficient and orderly sequence of installation of interdependent construction elements.

1.3 PRECONSTRUCTION CONFERENCE

A. General: Prior to commencement of the Work, in accordance with the General Conditions, the OWNER will conduct a preconstruction conference to be held at a predetermined time and place.

B. Delineation of Responsibilities: The purpose of the conference is to designate responsible personnel, to establish a working relationship among the parties and to identify the responsibilities of the OWNER, plant personnel and the CONTRACTOR. Matters requiring coordination will be discussed and procedures for handling such matters, established. The agenda will include:

1. Submittal procedures
2. Partial Payment procedures
3. Maintenance of Records
4. Schedules, sequences and maintenance of facility operations
5. Safety and First Aid responsibilities
6. Change Orders and Field Directive Changes
7. Use of site
8. Housekeeping
9. Equipment delivery

C. Attendees: The preconstruction conference is to be attended by the representatives of the CONTRACTOR, the OWNER and plant personnel that will be associated with the project. Representatives of regulatory agencies, subcontractors, and principal suppliers may also attend when appropriate.

PART 1 - DOWNHOLE CONSTRUCTION

D. Chair and Minutes: The preconstruction conference will be chaired by the Owner who will also arrange for the keeping and distribution of minutes to all attendees.

1.4 PROGRESS MEETINGS

A. Meeting Frequency and Format: Schedule progress meetings on at least a biweekly basis or more frequently as warranted by the complexity of the Project, to review the Work, discuss changes in schedules, maintain coordination and resolve potential problems. Invite OWNER, ENGINEER and all subCONTRACTORs. Suppliers may be invited as appropriate. Minutes of the meeting will be maintained by CONTRACTOR and reviewed by ENGINEER prior to distribution by the CONTRACTOR. Distribute reviewed minutes to attendees within 7 calendar days after each meeting.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

SECTION 01 32 16

PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Form of Schedules

B. Content of Schedules: Submit for approval, a preliminary progress schedule in accordance with the General Conditions.

C. Schedule Revisions

D. Submittal Requirements

1.2 FORM OF SCHEDULES

A. Prepare schedules in form of a horizontal bar chart.

1. Provide separate horizontal bar for each trade or operation.

2. Utilize a horizontal time scale and identify first work day of each week.

3. Utilize scale and spacings to allow space for notations and future revisions.

B. Utilize a listing format which chronologically indicates the order of start of each item of work.

C. Identify each listing by major specification section numbers.

1.3 CONTENT OF SCHEDULES

A. Completion Dates: Show the beginning and ending contract dates stated in documents. Schedules showing completion prior to the contract completion date will be accepted but in no event will they be considered basis for a claim for delay against the OWNER by the CONTRACTOR for the period between the early completion date and the completion date provided in the Contract Documents.

PART 1 - DOWNHOLE CONSTRUCTION

B. Show complete sequence of construction by activity.

C. Show dates for beginning and completion of each major element of construction and installation dates for major items of equipment. Elements shall include, but not be limited to, the following:

1. Shop drawing receipt from supplier/manufacturer submitted to ENGINEER, review and return to supplier/manufacturer

2. Material and equipment order, manufacturer, delivery, installation, and checkouts

3. Performance tests and supervisory services activity

4. Construction of various facilities

5. Demolition

6. Excavation, sheeting, shoring, dewatering

7. Concrete placement sequence

8. Structural steel erection

9. Wall and roof construction

10. Piping and equipment installation

11. Electrical work activity

12. Heating, ventilating, and air conditioning work activity

13. Plumbing work activity

14. Sewer installation

15. Connection to existing sewers

16. Water main installation

17. Miscellaneous concrete placement

18. Subcontractor's items of work

19. Backfilling, grading, seeding, sodding, landscaping, fence construction, and paving

20. Final cleanup

PART 1 - DOWNHOLE CONSTRUCTION

21. Allowance for inclement weather

22. Coordination with concurrent Work on site

D. Show projected percentage of completion for each item as of first day of each month.

1.4 SCHEDULE REVISIONS

A. As a minimum, revise construction schedule every 30 calendar days to reflect changes in progress of Work for duration of Contract.

B. Indicate progress of each activity at date of submittal.

C. Show changes occurring since previous submittal of schedule.

1. Major change in scope
2. Activities modified since previous submittal
3. Revised projections of progress and completion
4. Other identifiable changes

D. Provide a written report as needed to define:

1. Problem areas, anticipated delays, and impact on schedule
2. Corrective action recommended and its effect
3. Effect of changes on schedules of other Contractors

1.5 SUBMITTAL REQUIREMENTS

A. Schedule: Submit final progress schedule in accordance with the General Conditions.

B. For preliminary and final submittal of construction progress schedule and subsequent revisions thereof furnish three copies to ENGINEER.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 33 00

SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of Requirements

B. Submittal Procedures

C. Specific Submittal Requirements

D. Action on Submittals

E. Repetitive Review

1.2 DESCRIPTION OF REQUIREMENTS

A. This section specifies procedural requirements for Shop Drawings, product data, samples, and other miscellaneous Work-related submittals.

B. Procedures concerning items such as listing of manufacturers, suppliers, subcontractors, construction progress schedule, schedule of Shop Drawing submissions, bonds, payment applications, insurance certificates, and schedule of values are specified elsewhere.

C. Work-Related Submittals:

1. Substitution or "Or Equal" Items:

a. Includes material or equipment CONTRACTOR requests ENGINEER to accept, after Bids are received, as substitute for items specified or described in Specifications by using name of a proprietary item or name of particular supplier.

2. Shop Drawings:

a. Includes technical data and drawings specially prepared for this Project, including fabrication and installation drawings, diagrams, actual performance curves, data sheets, schedules, templates, patterns, reports, instructions, design mix formulas, measurements, and similar information not in standard printed form.

PART 1 - DOWNHOLE CONSTRUCTION

b. Standard information prepared without specific reference to the Project is not considered a Shop Drawing.

3. Product Data:

a. Includes standard printed information on manufactured products, and systems that has not been specially prepared for this Project, including manufacturer's product specifications and installation instructions, catalog cuts, standard wiring diagrams, printed performance curves, mill reports, and standard color charts.

4. Samples:

a. Includes both fabricated and manufactured physical examples of materials, products, and units of work, partial cuts of manufactured or fabricated work, swatches showing color, texture, and pattern, and units of work to be used for independent inspection and testing.

b. Mock-ups are special forms of samples which are too large or otherwise inconvenient for handling in manner specified for transmittal of sample submittals.

5. Working Drawings:

a. When used in the Contract Documents, the term “working drawings” shall be considered to mean the CONTRACTOR’S plans for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities control systems, forming and falsework for underpinning; temporary by-pass pumping and for such other work as may be required for construction but does not become an integral part of the project.

b. Copies of working drawings shall be submitted to the ENGINEER at least fourteen (14) calendar days (unless otherwise specified by the ENGINEER) in advance of the required work.

c. Working drawings shall be signed by a registered Professional Engineer currently licensed to practice in the State of Florida and shall convey, or be accompanied by, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use.

6. Miscellaneous Submittals:

a. Work-related submittals that do not fit in the previous categories, such as guarantees, warranties, certifications, experience records, maintenance agreements, Operating and Maintenance Manuals, workmanship bonds,

PART 1 - DOWNHOLE CONSTRUCTION

survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, and similar information, devices, and materials applicable to the Work.

1.3 SUBMITTAL PROCEDURES

A. Scheduling:

1. Submit for approval, a preliminary schedule of shop drawings and samples submittals, in duplicate, and in accordance with the General Conditions.

2. Prepare and transmit each submittal to ENGINEER sufficiently in advance of scheduled performance of related work and other applicable activities.

B. Coordination:

1. Coordinate preparation and processing of submittals with performance of work. Coordinate each submittal with other submittals and related activities such as substitution requests, testing, purchasing, fabrication, delivery, and similar activities that require sequential activity.

2. Coordinate submission of different units of interrelated work so that one submittal will not be delayed by ENGINEER's need to review a related submittal. ENGINEER may withhold action on any submittal requiring coordination with other submittals until related submittals are forthcoming.

C. Submittal Preparation:

1. Stamp and sign each submittal certifying to review of submittal, verification of products, field measurement, field construction criteria, coordination of information within submittal with requirements of the Work and the Contract Documents, coordination with all trades, and verification that product will fit in space provided.

2. Transmittal Form: In the transmittal form forwarding each specific submittal to the ENGINEER include the following information as a minimum.

a. Date of submittal and dates of previous submittals containing the same material.

b. Project title and number.

c. Submittal and transmittal number.

d. Contract identification.

PART 1 - DOWNHOLE CONSTRUCTION

e. Names of:

(1) Contractor
(2) Supplier
(3) Manufacturer

f. Identification of equipment and material with equipment identification numbers, model numbers, and Specification section number.

g. Variations from Contract Documents and any limitations which may impact the Work.

h. Drawing sheet and detail number as appropriate.

D. Resubmittal Preparation:

1. Comply with the requirements described in Submittal Preparation. In addition:

a. Identify on transmittal form that submittal is a resubmission.

b. Make any corrections or changes in submittals required by ENGINEER's notations on returned submittal.

c. Respond to ENGINEER's notations:

(1) On the transmittal or on a separate page attached to CONTRACTOR's resubmission transmittal, answer or acknowledge in writing all notations or questions indicated by ENGINEER on ENGINEER's transmittal form returning review submission to CONTRACTOR.

(2) Identify each response by question or notation number established by ENGINEER.

(3) If CONTRACTOR does not respond to each notation or question, resubmission will be returned without action by ENGINEER until CONTRACTOR provides a written response to all ENGINEER's notations or questions.

d. CONTRACTOR initiated revisions or variations:

(1) On transmittal form identify variations or revisions from previously reviewed submittal, other than those called for by ENGINEER.

(2) ENGINEER's responsibility for variations or revisions is established in the General Conditions.

PART 1 - DOWNHOLE CONSTRUCTION

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

A. Specific submittals required for individual elements of work are specified in the individual Specification sections. Except as otherwise indicated in Specification sections, comply with requirements specified herein for each indicated type of submittal.

B. Requests for Substitution or "Or Equal"

1. Collect data for items to be submitted for review as substitution into one submittal for each item of material or equipment in accordance with the General Conditions.

2. Submit with other scheduled submittals for the material or equipment allowing time for ENGINEER to evaluate the additional information required to be submitted.

3. If CONTRACTOR requests to substitute for material or equipment specified but not identified in Specifications as requiring submittals, schedule substitution submittal request in Submittal schedule and submit as scheduled.

C. Shop Drawings:

1. Check all drawings, data and samples before submitting to the ENGINEER for review. Each and every copy of the drawings and data shall bear CONTRACTOR's stamp showing that they have been so checked. Shop drawings submitted to the ENGINEER without the CONTRACTOR's stamp will be returned to the CONTRACTOR for conformance with this requirement. All shop drawings shall be submitted through the CONTRACTOR, including those from any subcontractors.

2. Submit newly prepared information, with graphic information at accurate scale. Indicate name of manufacturer or supplier (firm name). Show dimensions and clearly note which are based on field measurement; identify materials and products which are included in the Work; identify revisions. Indicate compliance with standards and notation of coordination requirements with other work. Highlight, encircle or otherwise indicate variations from Contract Documents or previous submittals.

3. Include on each drawing or page:

a. Submittal date and revision dates.

b. Project name, division number and descriptions.

c. Detailed specifications section number and page number.

PART 1 - DOWNHOLE CONSTRUCTION

d. Identification of equipment, product or material.

e. Name of CONTRACTOR and Subcontractor.

f. Name of Supplier and Manufacturer.

g. Relation to adjacent structure or material.

h. Field dimensions, clearly identified.

i. Standards or Industry Specification references.

j. Identification of deviations from the Contract Documents.

k. CONTRACTOR's stamp, initialed or signed, dated and certifying to review of submittal, certification of field measurements and compliance with Contract.

l. Physical location and location relative to other connected or attached material at which the equipment or materials are to be installed.

4. Provide 8-inch by 3-inch blank space for CONTRACTOR and ENGINEER stamps.

5. Submittals:

a. Submit 3 hard copies plus 1 PDF.

6. Distribution:

a. Do not proceed with installation of materials, products or systems until copy of applicable product data showing only approved information is in possession of installer.

b. Maintain one set of product data (for each submittal) at Project site.

c. Mark 5 additional copies with the date of approval and forward to the ENGINEER for use in field and for OWNER's records.

D. Product Data:

1. Preparation:

a. Collect required data into single submittal for each element of work or system. Where product data has been printed to include information on several similar products, some of which are not required for use on

PART 1 - DOWNHOLE CONSTRUCTION

Project or are not included in submittal, mark copies to clearly show such information is not applicable.

b. Where product data must be specially prepared for required products, materials or systems, because standard printed data are not suitable for use, submit data as a Shop Drawing and not as product data.

2. Submittals:

a. Submittal is for information and record, and to determine that products, materials, and systems comply with Contract Documents. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".

b. Submit 3 copies.

3. Distribution:

a. Do not proceed with installation of materials, products or systems until copy of applicable product data showing only approval information is in possession of installer.

b. Maintain one set of product data (for each submittal) at Project site, available for reference by ENGINEER and others.

c. Mark 5 additional copies with the date of approval and forward to the ENGINEER for use in field and for OWNER records.

E. Samples:

1. Preparation:

a. Where possible, provide samples that are physically identical with proposed materials or products to be incorporated into the Work. Where variations in color, pattern or texture are inherent in material or product represented by sample, submit multiple units (not less than 3 units) showing approximate limits of variations.

b. Provide full set of optional samples where ENGINEER's selection required. Prepare samples to match ENGINEER's selection where so indicated.

c. Include information with each sample to show generic description, source or product name and manufacturer, limitations, and compliance with standards.

PART 1 - DOWNHOLE CONSTRUCTION

d. Submit samples for ENGINEER's visual review of general generic kind, color, pattern, texture, and for final check of coordination of these characteristics with other related elements of work.

2. Submittals:

a. At CONTRACTOR's option, and depending upon nature of anticipated response from ENGINEER, initial submittal of samples may be either preliminary or final submittal.

b. A preliminary submittal, consisting of a single set of samples, is required where specifications indicate ENGINEER's selection of color, pattern, texture or similar characteristics from manufacturer's range of standard choices is necessary. Preliminary submittals will be reviewed and returned with ENGINEER's "Action" marking.

c. Final Submittals: Submit 3 sets of samples in final submittal, 1 set will be returned.

3. Distribution:

a. Maintain returned final set of samples at Project site, in suitable condition and available for quality control comparisons throughout course of performing work.

b. Returned samples intended or permitted to be incorporated in the Work are indicated in Specification sections, and shall be in undamaged condition at time of use.

F. Mock-Ups:

1. Mock-ups and similar samples specified in Specification sections are recognized as special type of samples. Comply with samples submittal requirements to greatest extent possible. Process transmittal forms to provide record of activity.

G. Miscellaneous Submittals:

1. Inspection and Test Reports:

a. Classify each inspection and test report as being either "Shop Drawings" or "product data", depending on whether report is specially prepared for Project or standard publication of workmanship control testing at point of production. Process inspection and test reports accordingly.

2. Guarantees, Warranties, Maintenance Agreements, and Workmanship Bonds:

PART 1 - DOWNHOLE CONSTRUCTION

a. Refer to Specification sections for specific requirements. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".

b. In addition to copies desired for CONTRACTOR's use, furnish 2 executed copies. Provide 2 additional copies where required for maintenance data.

3. Survey Data:

a. Refer to Specification sections for specific requirements on property surveys, building or structure condition surveys, field measurements, quantitative records of actual Work, damage surveys, photographs, and similar data required by Specification sections. Copies will not be returned.

(1) Survey Copies: Furnish 2 copies. Provide 10 copies of final property survey (if any).

(2) Condition Surveys: Furnish 2 copies.

4. Certifications:

a. Refer to Specification sections for specific requirement on submittal of certifications. Submit 7 copies. Certifications are submitted for review of conformance with specified requirements and information. Submittal is final when returned by ENGINEER marked "Approved".

5. Closeout Submittals:

a. Refer to Specification Section 01 77 00 for specific requirements on submittal of closeout information, materials, tools, and similar items.

(1) Record Documents: Section 01 77 00.

(2) Materials and Tools: Spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.

(3) Operating and maintenance data.

H. Operation and Maintenance Manuals:

1. Submit Operation and Maintenance Manuals in accordance with Section 01 78 23.

I. General Distribution:

PART 1 - DOWNHOLE CONSTRUCTION

1. Unless required elsewhere, provide distribution of submittals to subcontractors, suppliers, governing authorities, and others as necessary for proper performance of work.

1.5 ACTION ON SUBMITTALS

A. ENGINEER's Action:

1. General:

a. Except for submittals for record and similar purposes, where action and return on submittals are required or requested, ENGINEER will review each submittal, mark with appropriate action, and return. Where submittal must be held for coordination, ENGINEER will also advise CONTRACTOR without delay.

b. ENGINEER will stamp each submittal with uniform, self-explanatory action stamp, appropriately marked with submittal action.

B. Action Stamp:

1. Approved:

a. Final Unrestricted Release: Where submittals are marked "Approved", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH CONTRACT DOCUMENTS. Acceptance of Work will depend upon that compliance.

2. Approved As Noted:

a. When submittals are marked "Approved as Noted", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH BOTH ENGINEER'S NOTATIONS OR CORRECTIONS ON SUBMITTAL AND WITH Contract Documents. Acceptance of Work will depend on that compliance. Re-submittal is not required.

3. Comments Attached - Confirm or Resubmit:

a. When submittals are marked "Examined and Returned for Correction", do not proceed with Work covered by submittal. Do not permit Work covered by submittal to be used at Project site or elsewhere where Work is in progress.

b. Revise submittal or prepare new submittal in accordance with ENGINEER's notations in accordance with Paragraph 1.3D of this section. Resubmit submittal without delay. Repeat if necessary to obtain different action marking.

PART 1 - DOWNHOLE CONSTRUCTION

1.6 RE-SUBMITTAL REVIEW

A. Cost of Subsequent Reviews: Shop Drawings and Operation and Maintenance Manuals submitted for each item will be reviewed no more than twice at the OWNER's expense. All subsequent reviews will be performed at times convenient to the ENGINEER and at the CONTRACTOR's expense based on the ENGINEER's then prevailing rates including all direct and indirect costs and fees. Reimburse the OWNER for all such fees invoiced to the OWNER by the ENGINEER.

B. Time Extension: Any need for more than one resubmission, or any other delay in ENGINEER's review of submittals, will not entitle CONTRACTOR to extension of the Contract Time.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

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SECTION 01 38 00

CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section specifies the taking and submission of digital construction photographs.

1.02 QUALITY ASSURANCE

A. Digital photographs shall be clean, sharp and clearly show details. Out-of-focus photographs will not be acceptable. Digital photographs shall be submitted on USB 2.0 flash drive in JPEG format or Lee County Utilities (LCU) approved format.

1.03 SUBMITTALS

A. In accordance with **Section 01 33 00 - Submittals**, submit digital construction photos with each photo file name labeled clearly as follows:

1. Within 14 days of receiving Notice to Proceed and within the first 10 days of each month.
2. Filename shall be in sequence beginning with the numeral one.

PART 2 PRODUCTS

2.01 QUANTITY

A. A minimum of 12 photographs shall be taken prior to construction and each month until completion of the Work.

PART 3 EXECUTION

3.01 INITIAL AND CONSTRUCTION PHOTOGRAPHY

A. Take pre-construction photographs of the entire Site after receiving the Notice to Proceed and prior to disturbing the Site in any manner.

B. Photography during Construction: Coordinate with the LCU as to the actual number and location of views to be photographed and the day and time of photographing.

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

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SECTION 01 42 00

REFERENCE STANDARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Abbreviations and Symbols

B. Reference Standards

C. Definitions

1.2 RELATED SECTIONS

A. Information provided in this section is used where applicable in individual Specification Sections, Divisions 2 through 16.

1.3 REFERENCE ABBREVIATIONS

A. Reference to a technical society, trade association or standards setting organization, may be made in the Specifications by abbreviations in accordance with the following list:

AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
ADC	Air Diffusion Council
AFBMA	Anti-friction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHA	Association of Home Appliance Manufacturers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association, Inc.
ANSI	American National Standards Institute
APA	American Plywood Association
ARI	American Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers

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ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders' Hardware Manufacturers Association
BIA	Brick Institute of American
CABO	Council of American Building Officials
CAGI	Compressed Air and Gas Institute
CISPI	Cast Iron Soil Pipe Institute
CMAA	Crane Manufacturers Association of America
CRD	U.S. Corps of Engineers Specifications
CRSI	Concrete Reinforcing Steel Institute
CTI	Cooling Tower Institute
DHI	Door and Hardware Institute
DOH	Department of Health
DOT	Department of Transportation
Fed. Spec.	Federal Specifications
FGMA	Flat Glass Marketing Association
FM	Factory Mutual
HMI	Hoist Manufacturing Institute
HPMA	See HPVA
HPVA	Hardwood Plywood Veneer Association
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IFI	Industrial Fasteners Institute
MIL	Military Specifications
MSS	Manufacturer's Standardization Society
NAAMM	National Association of Architectural Metal Manufacturers
NACM	National Association of Chain Manufacturers
NBS	National Bureau of Standards, See NIST
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NETA	National Electrical Testing Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NFPA	National Fluid Power Association
NIST	National Institute of Standards and Technology
NLMA	National Lumber Manufacturers Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Act
PCI	Prestressed Concrete Institute
PDI	Plumbing and Drainage Institute
SAE	Society of Automotive Engineers
SCPRF	Structural Clay Products Research Foundation
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPI	Society of the Plastics Industry

PART 1 - DOWNHOLE CONSTRUCTION

SSPC	Steel Structures Painting Council
STI	Steel Tank Institute
TCA	Tile Council of American
TIMA	Thermal Insulation Manufacturers' Association
UL	Underwriters' Laboratories, Inc.
USBR	U. S. Bureau of Reclamation
USBS	U. S. Bureau of Standards, See NIST

1.4 REFERENCE STANDARDS

A. Latest Edition: Construe references to furnishing materials or testing, which conform to the standards of a particular technical society, organization, or body, to mean the latest standard, code, or specification of that body, adopted and published as of the date of bidding this Contract. Standards referred to herein are made a part of these Specifications to the extent which is indicated or intended.

B. Precedence: The duties and responsibilities of the OWNER, CONTRACTOR or ENGINEER, or any of their consultants, agents or employees are set forth in the Contract Documents and are not changed or altered by any provision of any referenced standard specifications, manuals or code, whether such standard manual or code is or is not specifically incorporated by reference in the Contract Documents. Any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority, to undertake responsibility contrary to the powers of the ENGINEER as set forth in the Contract Documents cannot be assigned to the ENGINEER or any of the ENGINEER's consultants, agents or employees.

1.5 DEFINITIONS

A. In these Contract Documents the words furnish, install and provide are defined as follows:

1. Furnish (Materials): to supply and deliver to the project ready for installation and in operable condition.

2. Install (services or labor): to place in final position, complete, anchored, connected in operable condition.

3. Provide: to furnish and install complete. Includes the supply of specified services. When neither furnish, install or provide is stated, provided is implied.

1.6 LCU APPROVED MATERIALS LIST

A. The CONTRACTOR shall refer to the most resent Approved Materials List, as of the date of the advertisement for these contract documents.

B. The Approved Materials List located on LCU website constitutes a part of these contract documents.

PART 1 - DOWNHOLE CONSTRUCTION

1.7 LCU STANDARD DETAILS

A. The CONSTRACTOR shall refer to the most resent LCU Standard Details, as of the date of the advertisement for these contract documents.

B. The Standard Details located on LCU website constitutes a part of these contract documents.

1.8 LCU DESIGN MANUAL

A. The CONSTRACTOR shall refer to the most resent LCU Design Manual, as of the date of the advertisement for these contract documents.

B. The Design Manual located on LCU website constitutes a part of these contract documents.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

SECTION 01 42 13

ABBREVIATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Abbreviations

B. Standards for Abbreviations

1.2 RELATED SECTIONS

A. Abbreviations provided in this section are used where applicable in individual Specification Sections, Divisions 2 through 16.

1.3 ABBREVIATIONS

A. Abbreviations which may be used in Divisions 1 through 16 for units of measure are as follows:

alternating current..... ac
American wire gauge .....AWG
ampere(s) .....amp
ampere-hour(s) ..... AH
annual..... ann
Ampere Interrupting Capacity.....AIC
atmosphere(s) .....atm
average ..... avg

biochemical oxygen demand .....BOD
Board Foot..... FBM
brake horsepower.....bhp
Brinell Hardness ..... BH
British thermal unit(s).....Btu

calorie (s).....cal
carbonaceous biochemical oxygen demand ..... CBOD
Celsius (centigrade)..... C
Center to Center ..... C to C
centimeter(s)..... cm
chemical oxygen demand ..... COD
coefficient, valve flow..... C_v

cubic ..... cu
cubic centimeter(s)..... cc
cubic feet per day..... cfd
cubic feet per hour .....cfh
cubic feet per minute..... cfm
cubic feet per minute, standard conditions ..... scfm
cubic feet per second .....cfs
cubic foot (feet) .....cu ft
cubic inch(es)..... cu in
cubic yard(s) ..... cu yd

decibels..... dB
decibels (A scale)..... dBa
degree(s).....deg
dewpoint temperature .....dpt
diameter.....dia
direct current .....dc
dissolved oxygen..... DO
dissolved solids .....DS
dry-bulb temperature.....dbt

efficiency .....eff
elevation..... el

PART 1 - DOWNHOLE CONSTRUCTION

entering water temperature.....ewt
entering air temperature .....eat
equivalent direct radiation.....edr

face area .....fa
face to face.....f to f
Fahrenheit ..... F
feet per day..... fpd
feet per hour .....fph
feet per minute..... fpm
feet per second..... fps
foot (feet) .....ft
foot-candle..... fc
foot-pound .....ft-lb
foot-pounds per minute..... ft-lb/min
foot-pounds per second .....ft-lb/sec
formazin turbidity unit(s) .....FTU
frequency..... freq

gallon(s)..... gal
gallons per day .....gpd
gallons per day per
cubic foot ..... gpd/cu ft
gallons per day per
square foot..... gpd/sq ft
gallons per hour ..... gph
gallons per minute .....gpm
gallons per second ..... gps
gas chromatography and
mass spectrometry .....GC-MS
gauge .....ga
grain(s) .....gr
gram(s) .....g
grams per cubic centimeter .....gm/cc

Heat Transfer Coefficient.....U
height..... hgt
Hertz..... Hz
horsepower..... hp
horsepower-hour .....hp-hr
hour(s) ..... hr
humidity, relative..... rh
hydrogen ion concentration .....pH

inch(es)..... in
inches per second .....ips
inside diameter .....ID

Jackson turbidity unit(s) .....JTU

kelvin..... K
kiloamperes..... kA
kilogram(s) .....kg
kilometer(s) .....km
kilovar (kilovolt-amperes
reactive) .....kvar
kilovolt(s)..... kV
kilovolt-ampere(s).....kVA
kilowatt(s).....kW
kilowatt-hour(s) .....kWh

linear foot (feet).....lin ft
liter(s) L

megavolt-ampere(s).....MVA
meter(s).....m
micrograms per liter ..... ug/L
miles per hour .....mph
milliampere(s) ..... mA
milligram(s) ..... mg
milligrams per liter ..... mg/L
milliliter(s)..... mL
millimeter(s) ..... mm
million gallons ..... MG
million gallons per day..... mgd
millisecond(s) ..... ms
millivolt(s) ..... mV
minute(s) ..... min

mixed liquor suspended
solids.....MLSS

nephelometric turbidity
unit .....NTU
net positive suction head.....NPSH
noise criteria.....nc
noise reduction coefficient.....NRC
number.....no

ounce(s).....oz
outside air .....oa
outside diameter ..... OD

parts per billion..... ppb
parts per million..... ppm
percent ..... pct

PART 1 - DOWNHOLE CONSTRUCTION

phase (electrical) .... ph
pound(s) ..... lb
pounds per cubic foot ..... pcf
pounds per cubic foot
per hour ..... pcf/hr
pounds per day..... lbs/day
pounds per day per
cubic foot .....lbs/day/cu ft
pounds per day per
square foot..... lbs/day/sq ft
pounds per square foot..... psf
pounds per square foot
per hour ..... psf/hr
pounds per square inch ..... psi
pounds per square inch
absolute .....psia
pounds per square inch
gauge .....psig
power factor.....PF
pressure drop or
difference..... dp
pressure, dynamic
(velocity) .....vp
pressure, vapor..... vap pr

quart(s) .....qt

Rankine ..... R
relative humidity.....rh
resistance ..... res
return air .....ra
revolution(s)..... rev
revolutions per minute .....rpm
revolutions per second..... rps
root mean squared..... rms

safety factor ..... sf
second(s)..... sec
shading coefficient ..... SC
sludge density index ..... SDI

Sound Transmission
Coefficient..... STC
specific gravity ..... sp gr
specific volume ..... Sp Vol
sp ht at constant pressure ..... Cp
square ..... sq
square centimeter(s).....sq cm
square foot (feet)..... sq ft
square inch (es) ..... sq in
square meter(s)..... sq m
square yard(s)..... sq yd
standard ..... std
static pressure.....st pr
supply air..... . . sa
suspended solids ..... SS

temperature..... temp
temperature difference ..... TD
temperature entering..... TE
temperature leaving ..... TL
thousand Btu per hour..... Mbh
thousand circular mils ..... kcmil
thousand cubic feet ..... Mcf
threshold limit value ..... TLV
tons of refrigeration .....tons
torque..... TRQ
total dissolved solids .....TDS
total dynamic head ..... TDH
total kjeldahl nitrogen .....TKN
total oxygen demand..... TOD
total pressure ..... TP
total solids ..... TS
total suspended solids..... TSS
total volatile solids .....TVS

vacuum ..... vac
viscosity .....visc
volatile organic chemical ..... VOC
volatile solids.....VS
volatile suspended solids ..... VSS
volt(s).....V
volts-ampere(s) ..... VA
volume ..... vol

watt(s) ..... W
watthour(s) ..... Wh
watt-hour demand .....WHD
watt-hour demand meter..... WHDM
week(s) ..... wk
weight ..... wt
wet-bulb ..... WB
wet bulb temperature ..... WBT

yard(s).....yd
year(s).....yr

PART 1 - DOWNHOLE CONSTRUCTION

1.4 STANDARD FOR ABBREVIATIONS

A. Use ASME Y1.1-1989, "Abbreviations for use on Drawings and in Text" for abbreviations for units of measure not included in Paragraph 1.3.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

SECTION 01 43 00

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittals

B. Inspection Services

C. Inspection of Materials

D. Quality Control

E. Costs of Inspection

F. Acceptance Tests

G. Failure to Comply with Contract

1.2 RELATED SECTIONS

A. Section 01 33 00 - Submittals: Specific Submittal Requirements

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Certificate Submittals: Furnish the ENGINEER authoritative evidence in the form of Certificates of Manufacture that the materials and equipment to be used in the Work have been manufactured and tested in conformity with the Contract Documents. Include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

1.4 INSPECTION SERVICES

A. OWNER's Access: At all times during the progress of the Work and until the date of final completion, afford the OWNER and ENGINEER every reasonable, safe, and proper facility for inspecting the Work at the site. The observation and inspection of any work will not relieve the CONTRACTOR of any obligations to perform proper and satisfactory work as specified. Replace work rejected due to faulty design, inferior, or defective materials, poor workmanship, improper installation, excessive wear, or nonconformity with the requirements of the Contract Documents, with satisfactory

PART 1 - DOWNHOLE CONSTRUCTION

work at no additional cost to the OWNER. Replace as directed, finished or unfinished work found not to be in strict accordance with the Contract, even though such work may have been previously approved and payment made therefor.

B. Rejection: The OWNER and the OWNER's Authorized Representatives have the right to reject materials and workmanship which are defective or require correction. Promptly remove rejected work and materials from the site.

C. Inferior Work Discoveries: Failure or neglect on the part of the OWNER or the OWNER's Authorized Representatives to condemn or reject bad or inferior work or materials does not imply an acceptance of such work or materials. Neither is it to be construed as barring the OWNER or the OWNER's Authorized Representatives at any subsequent time from recovering damages or a sum of money needed to build anew all portions of the Work in which inferior work or improper materials were used.

D. Removal for Examination: Should it be considered necessary or advisable by the OWNER or the OWNER's Authorized Representatives, at any time before final acceptance of the Work, to make examinations of portions of the Work already completed, by removing or tearing out such portions, promptly furnish all necessary facilities, labor, and material, to make such an examination. If such Work is found to be defective in any respect, defray all expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the cost of examination and restoration of the Work will be considered a change in the Work to be paid for in accordance with applicable provisions of the Contract.

E. Operation Responsibility: Assume full responsibility for the proper operation of equipment during tests and instruction periods. Make no claim for damage which may occur to equipment prior to the time when the OWNER accepts the Work.

F. Rejection Prior to Warranty Expiration: If at anytime prior to the expiration of any applicable warranties or guarantees, equipment is rejected by the OWNER, repay to the OWNER all sums of money received for the rejected equipment on progress certificates or otherwise on account of the Contract lump sum prices, and upon the receipt of the sum of money, OWNER will execute and deliver a bill of sale of all its rights, title, and interest in and to the rejected equipment. Do not remove the equipment from the premises of the OWNER until the OWNER obtains from other sources, equipment to take the place of that rejected. The OWNER hereby agrees to obtain other equipment within a reasonable time and the CONTRACTOR agrees that the OWNER may use the equipment furnished by the CONTRACTOR without rental or other charge until the other new equipment is obtained.

1.5 INSPECTION OF MATERIALS

A. Premanufacture Notification: Give notice in writing to the ENGINEER sufficiently in advance of the commencement of manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. When required, notice to include a request for inspection, the date of commencement, and

PART 1 - DOWNHOLE CONSTRUCTION

the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, ENGINEER will arrange to have a representative present at such times during the manufacture or testing as may be necessary to inspect the materials, or will notify CONTRACTOR that the inspection will be made at a point other than the point of manufacture or testing, or that the inspection will be waived. Comply with these provisions before shipping any materials. Such inspection will not constitute a release from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

B. Testing Standards: Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized, applicable test codes except as may otherwise be stated herein.

1.6 QUALITY CONTROL

A. Testing

1. Field and Laboratory

a. Provide personnel to assist the ENGINEER in performing the following periodic observation and associated services.

(1) Soils: Observe and test excavations, placement and compaction of soils. Determine suitability of excavated material. Observe subgrade soils and foundations.

(2) Concrete: Observe forms and reinforcement; observe concrete placement; witness air entrainment tests, facilitate concrete cylinder preparation and assist with other tests performed by ENGINEER.

(3) Masonry: Sample and test mortar, bricks, blocks and grout; inspect brick and block samples and sample panels; inspect placement of reinforcement and grouting.

b. When specified in Divisions 2 through 16 of the Contract Documents, provide an independent laboratory testing facility to perform required testing. Qualify the laboratory as having performed previous satisfactory work. Prior to use, submit to the ENGINEER for approval.

c. Cooperate with the ENGINEER and laboratory testing representatives. Provide at least 24 hours notice prior to when specified testing is required. Provide labor and materials, and necessary facilities at the site as required by the ENGINEER and the testing laboratory.

d. Provide an independent testing agency, a member of the National Electrical Testing Association, to perform inspections and tests specified in Division 16 of these Specifications.

PART 1 - DOWNHOLE CONSTRUCTION

2. Equipment: Coordinate and demonstrate test procedures as specified in the Contract Documents or as otherwise required during the formal tests.

3. Pipeline and Other Testing: Conform to test procedures and requirements specified in the appropriate Specification Section.

B. Reports

1. Certified Test Reports: Where transcripts or certified test reports are required by the Contract Documents, meet the following requirements:

a. Before delivery of materials or equipment submit and obtain approval of the ENGINEER for all required transcripts, certified test reports, certified copies of the reports of all tests required in referenced specifications or specified in the Contract Documents. Perform all testing in an approved independent laboratory or the manufacturer's laboratory. Submit for approval reports of shop equipment tests within thirty days of testing. Transcripts or test reports are to be accompanied by a notarized certificate in the form of a letter from the manufacturer or supplier certifying that tested material or equipment meets the specified requirements and the same type, quality, manufacture and make as specified. The certificate shall be signed by an officer of the manufacturer or the manufacturer's plant manager.

2. Certificate of Compliance: At the option of the ENGINEER, or where not otherwise specified, submit for approval a notarized Certificate of Compliance. The Certificates may be in the form of a letter stating the following:

a. Manufacturer has performed all required tests

b. Materials to be supplied meet all test requirements

c. Tests were performed not more than one year prior to submittal of the certificate

d. Materials and equipment subjected to the tests are of the same quality, manufacture and make as those specified

e. Identification of the materials

1.7 COSTS OF INSPECTION

A. OWNER's Obligation: Initial inspection and testing of materials furnished under this Contract will be performed by the OWNER or his authorized Representatives or inspection bureaus without cost to the CONTRACTOR, unless otherwise expressly specified. If subsequent testing is necessary due to failure of the initial tests or

PART 1 - DOWNHOLE CONSTRUCTION

because of rejection for noncompliance, reimburse the OWNER for expenditures incurred in making such tests.

B. CONTRACTOR's Obligation: Include in the Contract Price, the cost of all shop and field tests of equipment and other tests specifically called for in the Contract Documents.

C. Reimbursements to OWNER:

1. Materials and equipment submitted by the CONTRACTOR as the equivalent to those specifically named in the Contract may be tested by the OWNER for compliance. Reimburse the OWNER for expenditures incurred in making such tests on materials and equipment which are rejected for noncompliance.

2. Reimburse OWNER for the costs of any jobsite inspection between the hours of 7:00 p.m. and 6:00 a.m.

3. Reimburse OWNER for all costs associated with Witness Tests which exceed 5 Calendar Days per kind of equipment.

1.8 ACCEPTANCE TESTS

A. Preliminary Field Tests: As soon as conditions permit, furnish all labor and materials and services to perform preliminary field tests of all equipment provided under this Contract. If the preliminary field tests disclose that any equipment furnished and installed under this Contract does not meet the requirements of the Contract Documents, make all changes, adjustments and replacements required prior to the acceptance tests.

B. Final Field Tests: Upon completion of the Work and prior to final payment, subject all equipment, piping and appliances installed under this Contract to specified acceptance tests to demonstrate compliance with the Contract Documents.

1. Furnish all labor, fuel, energy, water and other materials, equipment, instruments and services necessary for all acceptance tests.

2. Conduct field tests in the presence of the ENGINEER. Perform the field tests to demonstrate that under all conditions of operation each equipment item:

a. Has not been damaged by transportation or installation
b. Has been properly installed
c. Has been properly lubricated
d. Has no electrical or mechanical defects
e. Is in proper alignment
f. Has been properly connected
g. Is free of overheating of any parts
h. Is free of all objectionable vibration

PART 1 - DOWNHOLE CONSTRUCTION

i. Is free of overloading of any parts
j. Operates as intended

3. Operate work or portions of work for a minimum of 100 hours or 14 days continuous service, whichever comes first. For those items of equipment which would normally operate on wastewater or sludge, plant effluent may be used if available when authorized by ENGINEER. If water can not properly exercise equipment, conduct 100-hour test after plant startup. Conduct test on those systems which require load produced by weather (heating or cooling) exercise only when weather will produce proper load.

C. Failure of Tests: If the acceptance tests reveal defects in material or equipment, or if the material or equipment in any way fails to comply with the requirements of the Contract Documents, then promptly correct such deficiencies. Failure or refusal to correct the deficiencies, or if the improved materials or equipment, when tested again, fail to meet the guarantees or specified requirements, the OWNER, notwithstanding its partial payment for work and materials or equipment, may reject said materials or equipment and may order the CONTRACTOR to remove the defective work from the site at no addition to the Contract Price, and replace it with material or equipment which meets the Contract Documents.

1.9 FAILURE TO COMPLY WITH CONTRACT

A. Unacceptable Materials: If it is ascertained by testing or inspection that the material or equipment does not comply with the Contract, do not deliver said material or equipment, or if delivered remove it promptly from the site or from the Work and replace it with acceptable material without additional cost to the OWNER. Fulfill all obligations under the terms and conditions of the Contract even though the OWNER or the OWNER's Authorized Representatives fail to ascertain noncompliance or notify the CONTRACTOR of noncompliance.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

SECTION 01 57 00

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General Requirements

B. Temporary Utilities

C. Temporary Construction

D. Barricades and Enclosures

E. Fences

F. Security

G. Temporary Controls

H. Traffic Regulation

I. Contractor Field Offices and Sheds

J. Engineer’s Field Office

1.2 GENERAL REQUIREMENTS

A. Plant and Facilities: Furnish, install, maintain and remove all false work, scaffolding, ladders, hoistways, braces, pumping plants, shields, trestles, roadways, sheeting, centering forms, barricades, drains, flumes, and the like, any of which may be needed in the construction of any part of the Work and which are not herein described or specified in detail. The CONTRACTOR shall accept responsibility for the safety and efficiency of such works and for any damage that may result from their failure or from their improper construction, maintenance or operation.

B. First Aid: Maintain a readily accessible, completely equipped first aid kit at each location where work is in progress.

C. Safety Responsibility: Accept sole responsibility for safety and security at the site. Indemnify and hold harmless the OWNER and the OWNER's Authorized Representatives, including the ENGINEER, for any safety violation, or noncompliance with governing bodies and their regulations, and for accidents, deaths, injuries, or damage at the site during occupancy or partial occupancy of the site by

PART 1 - DOWNHOLE CONSTRUCTION

CONTRACTOR's forces while performing any part of the Work.

D. Hazard Communication: Furnish two copies of the CONTRACTOR's Hazard Communication Program required under OSHA regulations before beginning on site activities. Furnish two copies of amendments to Hazard Communications Program as they are prepared.

1.3 TEMPORARY UTILITIES - WATER

A. Provide all necessary and required water without additional cost, unless otherwise specified. If necessary, provide and lay water lines to the place of use; secure all necessary permits; pay for all taps to water mains and hydrants and for all water used at the established rates.

1.4 TEMPORARY UTILITIES – SANITARY FACILITIES

A. Provide sufficient sanitary facilities for construction personnel. Prohibit and prevent nuisances on the site of the Work or on adjoining property. Discharge any employee who violates this rule. Abide by all environmental regulations or laws applicable to the Work.

1.5 TEMPORARY UTILITIES – ELECTRICITY

A. Provide an engine generator, muffled to the satisfaction of the ENGINEER, or obtain a power source for temporary electricity (from Florida Power and Light Company [FPL]). Furnish, install and maintain temporary electric power service for construction needs throughout construction site as necessary.

1. Power centers for miscellaneous tools and equipment used in construction work are to be supplied as appropriate.
   a. Locate so that power is available at any desired point with no more than 100 feet extension.
   b. Provide weatherproof distribution box with minimum of four 20 amp 120-volt ground outlets.
   c. Provide circuit breaker protection for each outlet.
   d. Provide equipment grounding continuity for entire system.
   e. Users shall provide grounded, Underwriters' Laboratories (UL) approved extension cords from power center to point of operations.
2. Power for construction equipment.
3. Power for testing and checking equipment.
4. Power for welding units and for other equipment having special power requirements.

B. Capacity:

1. Adequate electrical service distribution for construction use by all trades during construction period.
2. If using a temporary FPL service, notify FPL if unusually heavy loads, such as

PART 1 - DOWNHOLE CONSTRUCTION

welding, pumps, and other special power requirements, will be connected.
a. Provide special circuits for heavy load requirements.
b. Do not overload any circuit.

C. Maintain strict supervision of use of temporary services.

1. Enforce conformance with applicable standards.
2. Enforce safe practices.
3. Prevent abuse of services.

D. Costs of Installation and Operation: The CONTRACTOR shall pay costs of temporary electrical power used, including costs of installation, meter, maintenance and removal of temporary services upon completion of construction.

E. Code Compliance: Comply with the following applicable codes:

1. National Electrical Code.
2. National Electrical Safety Code.
3. National Fire Protection Association.
4. Federal, State and local codes and utility company regulations.

1.6 CONNECTIONS TO EXISTING UTILITIES:

1. Unless otherwise specified or indicated, make all necessary connections to existing facilities including structures, drain lines, and utilities such as water, sewer, gas, telephone, and electricity. In each case, obtain permission from the OWNER or the owning utility prior to undertaking connections. Protect facilities against deleterious substances and damage.

2. Thoroughly plan in advance all connections to existing facilities. Have on hand at the time of undertaking the connections, all material, labor and required equipment. Proceed continuously to complete connections in minimum time. Arrange for the operation of valves or other appurtenances on existing utilities, under the direct supervision of the owning utility.

1.7 TEMPORARY CONSTRUCTION

A. Bridges: Design and place suitable temporary bridges where necessary for the maintenance of vehicular and pedestrian traffic. Assume responsibility for the sufficiency and safety of all such temporary work or bridges and for any damage which may result from their failure or their improper construction, maintenance, or

PART 1 - DOWNHOLE CONSTRUCTION

operation. Indemnify and save harmless the OWNER and the OWNER's representatives from all claims, suits or actions, and damages or costs of every description arising by reason of failure to comply with the above provisions.

1.8 BARRICADES AND ENCLOSURES

A. Protection of Workmen and Public: Effect and maintain at all times during the prosecution of the Work, barriers and lights necessary for the protection of Workmen and the Public. Provide suitable barricades, lights, "danger" or "caution" or "street closed" signs and watchmen at all places where the Work causes obstructions to normal traffic, excavation sites, or constitutes in any way a hazard to the public.

B. Barricades and Lights:

1. Protect all streets, roads, highways, excavations and other public thoroughfares which are closed to traffic; use effective barricades which display acceptable warning signs. Locate barricades at the nearest public highway or street on each side of the blocked section.

2. Statutory Requirements: Install and maintain all barricades, signs, lights, and other protective devices within highway rights-of-way in strict conformity with applicable statutory requirements by the authority having jurisdiction.

1.9 FENCES

A. Existing Fences: Obtain written permission from the OWNER prior to relocating or dismantling fences which interfere with construction operations. Reach agreements with the fence owner as to the period the fence may be left relocated or dismantled. Install adequate gates where fencing must be maintained. Keep gates closed and locked at all times when not in use.

B. Restoration: Restore all fences to their original or better condition and to their original location on completion of the Work.

1.10 SECURITY

A. Preservation of Property:

1. Preserve from damage, all property along the line of the Work, in the vicinity of or in any way affected by the Work, the removal or destruction of which is not called for by the Drawings. Preserve from damage, public utilities, trees, lawn areas, building monuments, fences, pipe and underground structures, and public streets. Note: Normal wear and tear of streets resulting from legitimate use by the CONTRACTOR are not considered as damage. Whenever damages occur to such property, immediately restore to its original condition. Costs for such repairs are incidental to the Contract.

PART 1 - DOWNHOLE CONSTRUCTION

2. In case of failure on the part of the CONTRACTOR to restore property or make good on damage or injury, the OWNER may, upon 24 hours written notice, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary, and the cost thereof will be deducted from any moneys due or which may become due the CONTRACTOR under this Contract. If removal, repair or replacement of public or private property is made necessary by alteration of grade or alignment authorized by the OWNER and not contemplated by the Contract Documents, the CONTRACTOR will be compensated, in accordance with the General Conditions, provided that such property has not been damaged through fault of the CONTRACTOR or the CONTRACTOR's employees.

B. Public Utility Installations and Structures:

1. Public utility installations and structures include all poles, tracks, pipes, wires, conduits, vaults, manholes, and other appurtenances and facilities, whether owned or controlled by public bodies or privately-owned individuals, firms or corporations, used to serve the public with transportation, gas, electricity, telephone, storm and sanitary sewers, water, or other public or private utility services. Facilities appurtenant to public or private property which may be affected by the Work are deemed included hereunder.

2. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. Existing public utility installations and structures are indicated on the Drawings only to the extent such information was made available to, or found by, the ENGINEER in preparing the Drawings. These data are not guaranteed for completeness or accuracy, and the CONTRACTOR is responsible for making necessary investigations to become fully informed as to the character, condition, and extent of all public utility installations and structures that may be encountered and that may affect the construction operations.

3. Contact utility locating service sufficiently in advance of the start of construction to avoid damage to the utilities and delays to the completion date.

4. Remove, replace, relocate, repair, rebuild, and secure any public utility installations and structures damaged as a direct or indirect result of the Work under this Contract. Costs for such work are incidental to the Contract. Be responsible and liable for any consequential damages done to or suffered by any public utility installations or structures. Assume and accept responsibility for any injury, damage, or loss which may result from or be consequent to interference with, or interruption or discontinuance of, any public utility service.

5. Repair or replace any water, electric, sewer, gas, irrigation, or other service connection damaged during the Work with no addition to the Contract price.

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6. At all times in performance of the Work, employ proven methods and exercise reasonable care and skill to avoid unnecessary delay, injury, damage, or destruction to public utility installations and structures. Avoid unnecessary interference with, or interruption of, public utility services. Cooperate fully with the owners thereof to that end.

7. Give written notice to the owners of all public utility installations and structures affected by proposed construction operations, sufficiently in advance of breaking ground in any area or on any unit of the Work, to obtain their permission before disrupting the lines and to allow them to take measures necessary to protect their interests. Advise the Chiefs of Police, Fire and Rescue Services of any excavation in public streets or the temporary shut-off of any water main. Provide at least 24 hours notice to all affected property owners whenever service connections are taken out of service.

C. Miscellaneous Structures: Assume and accept responsibility for all injuries or damage to culverts, building foundations and walls, retaining walls, or other structures of any kind met with during the prosecution of the Work. Assume and accept liability for damages to public or private property resulting therefrom. Adequately protect against freezing all pipes carrying liquid.

D. Protection of Trees and Lawn Areas:

1. Protect with boxes, trees and shrubs, except those ordered to be removed. Do not place excavated material so as to cause injury to such trees or shrubs. Replace trees or shrubs destroyed by accident or negligence of the CONTRACTOR or CONTRACTOR's employees with new stock of similar size and age, at the proper season, at no additional cost to the OWNER.

2. Leave lawn areas in as good condition as before the start of the Work. Restore areas where sod has been removed by seeding or sodding.

1.11 TEMPORARY CONTROLS

A. During Construction:

1. Keep the site of the Work and adjacent premises free from construction materials, debris, and rubbish. Remove this material from any portion of the site if such material, debris, or rubbish constitutes a nuisance or is objectionable.

2. Remove from the site all surplus materials and temporary structures when they are no longer needed.

3. Neatly stack construction materials such as concrete forms and scaffolding when not in use. Promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or

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other damage.

4. Properly store volatile wastes in covered metal containers and remove from the site daily.

5. Do not bury or burn on the site or dispose of into storm drains, sanitary sewers, streams, or waterways, any waste material. Remove all wastes from the site and dispose of in a manner complying with applicable ordinances and laws.

B. Smoke Prevention:

1. Strictly observe all air pollution control regulations.
2. Open fires will be allowed only if permitted under current ordinances.

C. Noises:

1. Maintain acceptable noise levels in the vicinity of the Work. Limit noise production to acceptable levels by using special mufflers, barriers, enclosures, equipment positioning, and other approved methods.

2. Supply written notification to the OWNER sufficiently in advance of the start of any work which violates this provision. Proceed only when all applicable authorizations and variances have been obtained in writing.

D. Hours of Operation:

1. Once well drilling efforts begin, the work may proceed continuously, (24 hours/day, 7 days/week) start to finish at the discretion of the Contractor staying within the limits of any applicable local ordinances (noise, dust, traffic, etc), until the Work is completed within the approved construction schedule in compliance with the contract duration requirements of the Contract.

E. Dust Control:

1. Take measures to prevent unnecessary dust. Keep earth surfaces exposed to dusting moist with water or a chemical dust suppressant. Cover materials in piles or while in transit to prevent blowing or spreading dust.

2. Adequately protect buildings or operating facilities which may be affected adversely by dust. Protect machinery, motors, instrument panels, or similar equipment by suitable dust screens. Include proper ventilation with dust screens.

F. Temporary Drainage Provisions:

1. Provide for the drainage of stormwater and any water applied or discharged on the site in performance of the Work. Provide adequate drainage facilities to

PART 1 - DOWNHOLE CONSTRUCTION

prevent damage to the Work, the site, and adjacent property.

2. Supplement existing drainage channels and conduits as necessary to carry all increased runoff from construction operations. Construct dikes as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect the OWNER's facilities and the Work, and to direct water to drainage channels or conduits. Provide ponding as necessary to prevent downstream flooding.

3. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

G. Pollution: Prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities. Do not permit sanitary wastes to enter any drain or watercourse other than sanitary sewers. Do not permit sediment, debris, or other substances to enter sanitary sewers. Take reasonable measures to prevent such materials from entering any drain or watercourse.

1.12 TRAFFIC REGULATION

A. Parking: Provide and maintain suitable parking areas for the use of all construction workers and others performing work or furnishing services in connection with the Contract, to avoid any need for parking personal vehicles where they may interfere with public traffic, construction activities, or plant personnel/operations.

B. Access: Conduct Work to interfere as little as possible with public travel, whether vehicular or pedestrian. Provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when the CONTRACTOR has obtained permission from the owner or tenant of private property, or from the authority having jurisdiction over the public property involved, to obstruct traffic at the designated point.

1.13 CONTRACTOR FIELD OFFICES AND SHEDS

A. CONTRACTOR's Office: Erect, furnish, and maintain a field office. Have an authorized agent present at this office at all times while the Work is in progress. Keep readily accessible copies of the Contract Documents, required record documents, and the latest approved shop drawings at this field office.

B. Material Sheds and Temporary Structures: Provide material sheds and other temporary structures of sturdy construction and neat appearance.

C. Location: Coordinate location of field offices, material sheds and temporary structures with ENGINEER and OWNER.

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1.14 ENGINEER'S FIELD OFFICE

A. The Contractor shall provide and maintain a field office for the exclusive use of the Engineer. The facilities shall be available for his use during the entire life of the Project, and shall not be disturbed, moved, or interrupted without the Engineer's approval. The office shall be a separate structure containing at least 360 square feet of floor area, sealed from the weather, completed and ready for occupancy within thirty (30) days following the Notice to Proceed with the Project. The office shall be erected at a location approved by the Engineer. The Contractor shall arrange for the office to be cleaned at least once a week in a manner satisfactory to the Engineer. A mobile field office trailer a minimum of 12 feet wide and approximately 30 feet long is acceptable if it contains the required facilities.

B. All doors and windows shall be equipped with locking devices to prevent unauthorized entry, and all keys to the door locks shall be provided to the Engineer. The office shall contain adequate heating, air conditioning, and ventilating facilities. Adequate electric lights shall be provided with a wall receptacle on each of the four walls. Field Office layout shall include:

1. Two private offices with doors and locks
2. Conference area for 12
3. Separate lab room with hot/cold water janitor type sink and 6 feet of cabinet/counter space (below counter and above)
4. Kitchen area with hot/cold water wash sink, 4 feet of counter/cabinet space (below counter and above)
5. Functional, totally enclosed water closet and lavatory

C. Twenty-four-inch by thirty-six-inch plywood signs shall be erected on the outside wall of the field office in a location determined by the Engineer. The sign shall be painted blue with white, 3-inch high lettering, neatly arranged as follows:

Field Office
BLACK & VEATCH
ENGINEERS AND HYDROGEOLOGIST
Fort Myers, Florida

D. The following office furniture and new equipment shall be furnished in the office:

2	Flat top desk, 2-1/2 x 5 feet, with drawers at each end
1	Drawing table, 3 feet x 6 feet tilt top with drafting stool
10	Straight chairs
1	Toaster Oven
1	Microwave Oven
2	Four-drawer, legal size steel filing cabinet with lock and key
2	Large metal waste baskets
1	Rack from which to hang drawings, including related appurtenances
2	Wall-mounted fire extinguishers

PART 1 - DOWNHOLE CONSTRUCTION

1 Electric water cooler with bottle water supply and disposable drink cups

5 Metal office folding tables 30 inches x 60 inches (minimum)

1 Conference room with table and chairs for 12 people

2 Bookcase with 3 shelves, 3 feet long

2 18-inch square locker by 6 feet high

1 First Aid Cabinet

3 Tilt / swivel type desk chair

1 4 cu. ft. capacity refrigerator

1 Color laser copier, scanner, printing machine, with local service contract, suitable for letter and tabloid size for all functions

1 Internet Service for WIFI connectivity (i.e. hotspots), minimum 100Mbps download, 20 Mbps upload

1 24"x36" dry erase board

F. First Aid Cabinet shall conform to the OSHA requirements for an office of up to 15 persons or a construction site of up to 5 persons.

G. Location: Coordinate location of engineer's field office with ENGINEER and OWNER.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

SECTION 01 61 00

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description

B. Substitutions

C. Manufacturer's Written Instructions

D. Transportation and Handling

E. Storage, Protection and Maintenance

F. Manufacturer's Field Quality Control Services

G. Post Startup Services

H. Special Tools and Lubricating Equipment

I. Lubrication

1.2 DESCRIPTION

A. Proposed Manufacturers List: Within 15 calendar days of the date of the Notice to Proceed, submit to the ENGINEER a list of the names of proposed manufacturers, materialmen, suppliers and subcontractors, obtain approval of this list by OWNER prior to submission of any working drawings. Upon request submit evidence to ENGINEER that each proposed manufacturer has manufactured a similar product to the one specified and that it has previously been used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.

B. Furnish and install Material and Equipment which meets the following:

1. Conforms to applicable specifications and standards.

2. Complies with size, make, type, and quality specified or as specifically approved, in writing, by ENGINEER.

3. Will fit into the space provided with sufficient room for operation and maintenance access and for properly connecting piping, ducts and services, as applicable. Make the clear spaces that will be available for operation and maintenance access and connections equal to or greater than those shown and meeting all the manufacturers' requirements. Make all provisions for installing equipment furnished at no increase in Contract Price.

4. Manufactured and fabricated in accordance with the following:

   a. Design, fabricate, and assemble in accordance with best engineering and shop practices.

   b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.

   c. Provide two or more items of same kind identical, by same manufacturer.

   d. Provide materials and equipment suitable for service conditions.

   e. Adhere to equipment capabilities, sizes, and dimensions shown or specified unless variations are specifically approved, in writing, in accordance with the Contract Documents.

   f. Adapt equipment to best economy in power consumption and maintenance. Proportion parts and components for stresses that may occur during continuous or intermittent operation, and for any additional stresses that may occur during fabrication or installation.

   g. Working parts are readily accessible for inspection and repair, easily duplicated and replaced.

5. Use material or equipment only for the purpose for which it is designed or specified.

1.3 SUBSTITUTIONS

A. Substitutions:

1. CONTRACTOR's requests for changes in equipment and materials from those required by the Contract Documents are considered requests for substitutions and are subject to CONTRACTOR's representations and review provisions of the Contract Documents when one of following conditions are satisfied:

   a. Where request is directly related to an "or equal" clause or other language of same effect in Specifications.

PART 1 - DOWNHOLE CONSTRUCTION

b. Where required equipment or material cannot be provided within Contract Time, but not as result of CONTRACTOR's failure to pursue Work promptly or to coordinate various activities properly.

c. Where required equipment or material cannot be provided in manner compatible with other materials of Work, or cannot be properly coordinated therewith.

2. CONTRACTOR'S Options:

a. Where more than one choice is available as options for CONTRACTOR's selection of equipment or material, select option compatible with other equipment and materials already selected (which may have been from among options for other equipment and materials).

b. Where compliance with specified standard, code or regulation is required, select from among products which comply with requirements of those standards, codes, and regulations.

c. "Or Equal": For equipment or materials specified by naming one or more equipment manufacturer and "or equal", submit request for substitution for any equipment or manufacturer not specifically named.

B. Conditions Which are Not Substitution:

1. Requirements for substitutions do not apply to CONTRACTOR options on materials and equipment provided for in the Specifications.

2. Revisions to Contract Documents, where requested by OWNER or ENGINEER, are "changes" not "substitutions".

3. CONTRACTOR's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute substitutions and do not constitute basis for a Change Order, except as provided for in Contract Documents.

1.4 MANUFACTURER'S WRITTEN INSTRUCTIONS

A. Instruction Distribution: When the Contract Documents require that installation, storage, maintenance and handling of equipment and materials comply with manufacturer's written instruction's, obtain and distribute printed copies of such instructions to parties involved in installation, including six copies to ENGINEER.

1. Maintain one set of complete instructions at jobsite during storage and installation, and until completion of work.

PART 1 - DOWNHOLE CONSTRUCTION

B. Manufacturer's Requirements: Store, maintain, handle, install, connect, clean, condition, and adjust products in accordance with manufacturer's written instructions and in conformity with Specifications.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult ENGINEER for further instructions.

2. Do not proceed with work without written instructions.

C. Performance Procedures: Perform work in accordance with manufacturer's written instructions. Do not omit preparatory steps or installation procedures, unless specifically modified or exempted by Contract Documents.

1.5 TRANSPORTATION AND HANDLING

A. Coordination with Schedule: Arrange deliveries of materials and equipment in accordance with Construction Progress Schedules. Coordinate to avoid conflict with work and conditions at site.

1. Deliver materials and equipment in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

2. Protect bright machined surfaces, such as shafts and valve faces, with a heavy coat of grease prior to shipment.

3. Immediately upon delivery, inspect shipments to determine compliance with requirements of Contract Documents and approved submittals and that material and equipment are protected and undamaged.

B. Handling: Provide equipment and personnel to handle material and equipment by methods recommended by manufacturer to prevent soiling or damage to materials and equipment or packaging.

1.6 STORAGE, PROTECTION, AND MAINTENANCE

A. On-site storage areas and buildings:

1. Conform storage buildings to requirements of Section 01 57 00.

2. Coordinate location of storage areas with ENGINEER and OWNER.

3. Arrange on site storage areas for proper protection and segregation of stored materials and equipment with proper drainage. Provide for safe travel around storage areas and safe access to stored materials and equipment.

4. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.

5. Store materials such as pipe, reinforcing and structural steel, and equipment on

PART 1 - DOWNHOLE CONSTRUCTION

pallets, blocks or racks, off ground.

6. PVC Pipe may be damaged by prolonged exposure to direct sunlight and the CONTRACTOR shall take necessary precautions during storage and installation to avoid this damage. Pipe shall be stored under cover and installed with sufficient backfill to shield it from the sun.

7. Store fabricated materials and equipment above ground, on blocking or skids, to prevent soiling or staining. Cover materials and equipment which are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.

B. Interior Storage:

1. Store materials and equipment in accordance with manufacturer's instructions, with seals and labels intact and legible.

2. Store materials and equipment, subject to damage by elements, in weathertight enclosures.

3. Maintain temperature and humidity within ranges required by manufacturer's instructions.

C. Accessible Storage: Arrange storage in a manner to provide easy access for inspection and inventory. Make periodic inspections of stored materials or equipment to assure that materials or equipment are maintained under specified conditions and free from damage or deterioration.

1. Perform maintenance on stored materials of equipment in accordance with manufacturer's instructions, in presence of OWNER or ENGINEER.

2. Submit a report of completed maintenance to ENGINEER with each Application for Payment.

3. Failure to perform maintenance, to notify ENGINEER of intent to perform maintenance or to submit maintenance report may result in rejection of material or equipment.

D. OWNER's Responsibility: OWNER assumes no responsibility for materials or equipment stored in buildings or on-site. CONTRACTOR assumes full responsibility for damage due to storage of materials or equipment.

E. CONTRACTOR's Responsibility: CONTRACTOR assumes full responsibility for protection of completed construction. Repair and restore damage to completed Work equal to its original condition.

F. Special Equipment: Use only rubber-tired wheelbarrows, buggies, trucks, or dollies to wheel loads over finished floors, regardless if the floor has been protected or not.

PART 1 - DOWNHOLE CONSTRUCTION

This applies to finished floors and to exposed concrete floors as well as those covered with composition tile or other applied surfacing.

G. Surface Damage: Where structural concrete is also the finished surface, take care to avoid marking or damaging surface.

1.7 MANUFACTURER'S FIELD QUALITY CONTROL SERVICES

A. General:

1. Provide manufacturer's field services in accordance with this subsection for those tasks specified in other sections.

2. Provide training as specified in Section 01 79 00.

3. Include and pay all costs for suppliers' and manufacturers' services, including, but not limited to, those specified.

B. Installation Instruction: Provide instruction by competent and experienced technical representatives of equipment manufacturers or system suppliers as necessary to resolve assembly or installation procedures which are attributable to, or associated with, the equipment furnished.

C. Installation Inspection, Adjustments and Startup Participation:

1. Provide competent and experienced technical representatives of equipment manufacturers or system suppliers to inspect the completed installation as follows.

a. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or for other conditions which may cause damage.

b. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

c. Verify that wiring and support components for equipment are complete.

d. Verify that equipment or system is installed in accordance with the manufacturer's recommendations, approved shop drawings and the Contract Documents.

e. Verify that nothing in the installation voids any warranty.

2. Provide manufacturer's representatives to perform initial equipment and system adjustment and calibration conforming to the manufacturer's recommendations and instructions, approved shop drawings and the Contract Documents.

3. Obtain ENGINEER's approval before start-up of equipment. Execute start-up

under supervision of applicable manufacturer's representative in accordance with manufacturers' instructions.

4. Furnish ENGINEER with three copies of the following. When training is specified, furnish the copies at least 24 hours prior to training.

   a. "Certificate of Installation, Inspection and Start-up Services" by manufacturers' representatives for each piece of equipment and each system specified, certifying:

      (1) That equipment is installed in accordance with the manufacturers' recommendations, approved shop drawings and the Contract Documents.

      (2) That nothing in the installation voids any warranty.

      (3) That equipment has been operated in the presence of the manufacturer's representative.

      (4) That equipment, as installed, is ready to be operated by others.

   b. Detailed report by manufacturers' representatives, for review by ENGINEER of the installation, inspection and start-up services performed, including:

      (1) Description of calibration and adjustments if made; if not in Operation and Maintenance Manuals, attach copy.

      (2) Description of any parts replaced and why replaced.

      (3) Type, brand name, and quantity of lubrication used, if any.

      (4) General condition of equipment.

      (5) Description of problems encountered, and corrective action taken.

      (6) Any special instructions left with CONTRACTOR or ENGINEER.

D. Field Test Participation: Provide competent and experienced technical representatives of all equipment manufacturers and system suppliers as necessary to participate in field testing of the equipment specified in Section 01 43 00.

E. Trouble-Free Operation: Provide competent and experienced technical representatives of all equipment manufacturers and system suppliers as necessary to place the equipment in trouble-free operation after completion of start-up and field tests.

1.8 POST START-UP SERVICES

PART 1 - DOWNHOLE CONSTRUCTION

A. General: Provide Post Start-up Services in accordance with this subsection for equipment specified in other sections.

B. Site Visit: Provide the services of an authorized service representative for each equipment manufacturer or system supplier to make a final site visit after the equipment or system has been in operation for at least 6 months, but no longer than 11 months. Furnish assistance to OWNER's operating personnel in making adjustments and calibrations required to determine that the equipment and system is operating in conformance with design, manufacturer's, and specification requirements. Instruct the personnel in a review of proper operation and maintenance procedures.

C. Certificate: Furnish "Certificate of Post Start-up Services" cosigned by ENGINEER and the manufacturer's representative, certifying that this service has been performed. Use form provided in this section, and furnish OWNER with three copies.

1.9 SPECIAL TOOLS AND LUBRICATING EQUIPMENT

A. General: Furnish, per manufacturer's recommendations, special tools required for checking, testing, parts replacement, and maintenance. (Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics.)

B. Time of Delivery: Deliver special tools and lubricating equipment to OWNER when unit is placed into operation and after operating personnel have been properly instructed in operation, repair, and maintenance of equipment.

C. Quality: Provide tools and lubricating equipment of a quality meeting equipment manufacturer's requirements.

1.10 LUBRICATION

A. General: Where lubrication is required for proper operation of equipment, incorporate in the equipment the necessary and proper provisions in accordance with manufacturer's requirements. Where possible, make lubrication automated and positive.

B. Oil Reservoirs: Where oil is used, supply reservoir of sufficient capacity to lubricate unit for a 24-hour period.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

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SECTION 01 73 29

CUTTING AND PATCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General Requirements

B. Scheduling of Shutdown

1.2 RELATED SECTIONS

A. Section 32 10 01 – Pavement Repair and Restoration

1.3 GENERAL REQUIREMENTS

A. CONTRACTOR shall be responsible for all cutting, fitting and patching, including attendant excavation and backfill, required to complete the work or to:

1. Make its several parts fit together properly.
2. Uncover portions of the work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace work not conforming to requirements of Contract Documents.
5. Remove samples of installed work as specified for testing.
6. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.

B. Coordination: Perform all cutting, fitting or patching of the Work that may be required to make the several parts thereof join in accordance with the Contract Documents. Perform restoration with competent workmen skilled in the trade.

C. Improperly Timed Work: Perform all cutting and patching required to install improperly timed work, to remove samples of installed materials for testing, and to provide for alteration of existing facilities or for the installation of new Work in the existing construction.

D. Limitations: Except when the cutting or removal of existing construction is specified or indicated, do not undertake any cutting or demolition which may affect the structural stability of the Work or existing facilities without the ENGINEER's concurrence.

PART 1 - DOWNHOLE CONSTRUCTION

1.4 SUBMITTALS

A. Submit a written request to the ENGINEER well in advance of executing any cutting or alteration which affects:
   1. Work of the OWNER or any separate contractor.
   2. Structural value or integrity of any element of the project or work.
   3. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
   4. Efficiency, operational life, maintenance or safety of operational elements.
   5. Visual qualities of sight-exposed elements.

B. Request shall include:
   1. Identification of the work.
   2. Description of affected work.
   3. The necessity for cutting, alteration or excavation.
   4. Effect on work of OWNER or any separate contract, or on structural or weatherproof integrity of work.
   5. Description of proposed work:
      a. Scope of cutting, patching, alteration, or excavation.
      b. Trades who will execute the work.
      c. Products proposed to be used.
      d. Extent of refinishing to be done.
   6. Alternatives to cutting and patching.
   7. Cost proposal, when applicable.
   8. Written permission of any separate contractor whose work will be affected.

C. SUBMIT WRITTEN NOTICE TO THE ENGINEER DESIGNATING THE DATE AND THE TIME THE WORK WILL BE UNCOVERED.

1.5 SCHEDULING OF SHUTDOWN

A. Connections to Existing Facilities: If any connections, replacement, or other work requiring the shutdown of an existing facility is necessary, schedule such work at times when the impact on the OWNER's normal operation is minimal. Overtime, night and weekend work without additional compensation from the OWNER, may be required to make these connections, especially if the connections are made at times other than those specified.

B. Request for Shutdowns: Submit a written request for each shutdown to the OWNER and the ENGINEER sufficiently in advance of any required shutdown.

PART 2 PRODUCTS

2.1 MATERIALS

A. Comply with specifications and standards for each specific product involved.

PART 1 - DOWNHOLE CONSTRUCTION

PART 3 EXECUTION

3.1 INSPECTION

A. Inspect existing conditions of projects, including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, inspect conditions affecting installation of products, or performance of the work.

C. Report unsatisfactory or questionable conditions to the ENGINEER in writing; do not proceed with work until the ENGINEER has provided further instructions.

3.2 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value or integrity or affected portion of work.

B. Provide devices and methods to protect other portions of project from damage.

C. Provide protection from elements for that portion of the project which may be exposed by cutting and patching work, and maintain excavations free from water.

D. Material Removal: Cut and remove all materials to the extent shown or as required to complete the Work. Remove materials in a careful manner with no damage to adjacent facilities. Remove materials which are not salvageable from the site.

3.3 PERFORMANCE

A. Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs.

B. Execute excavating and backfilling by methods which will prevent settlement or damage to other work.

C. Employ original installer or fabricator to perform cutting and patching for:
   1. Weather-exposed or moisture-resistant elements.
   2. Sight-exposed finished surfaces.

D. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.

E. Restore work which has been cut or removed; install new products to provide completed work in accord with requirements of contract documents.

F. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

PART 1 - DOWNHOLE CONSTRUCTION

G. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:
   1. For continuous surfaces, refinish to nearest intersection.
   2. For an assembly, refinish entire unit.

3.4 PAVEMENT RESTORATION

A. Restore all pavement or roadway surfaces in accordance with Section 32 10 01 – Pavement Repair and Restoration.

B. The restoration of existing street paving, including underdrains, if any are encountered, where damaged, shall be restored by the CONTRACTOR and shall be replaced or rebuilt using the same type of construction as was in the original. The CONTRACTOR shall be responsible for restoring all such work, including subgrade, base courses, curb and gutter or other appurtenances where present. The CONTRACTOR shall obtain and pay for at his own expense such local or other governmental permits as may be necessary for the opening of streets and shall satisfy himself as to any requirements other than those herein set forth which may affect the type, quality and manner of carrying on the restoration of surfaces by reason of jurisdiction of such governmental bodies.

C. This section does not describe the construction of new road surfaces or the complete resurfacing of existing pavements.

D. In all cases, the CONTRACTOR will be required to maintain, without additional compensation, all permanent replacement of street paving, done by him under this Contract for a period of 12 months after the acceptance of the Contract, including the removal and replacement of such work wherever surface depressions or underlying cavities result from settlement of trench backfill.

E. The CONTRACTOR shall do all the final resurfacing or repaving of streets or roads, over the excavations that he has made and he shall be responsible for relaying paving surfaces of roads that have failed or been damaged, at any time before the termination of the maintenance period on account of work done by him and he shall resurface or repave over any tunnel jacking, or boring excavation that shall settle or break the surface, shall be repaved to the satisfaction of the OWNER and at the CONTRACTOR's sole expense. Backfilling of trenches and the preparation of subgrades shall conform to the requirements of excavation and backfilling of pipeline trenches.

F. Where pipeline construction crosses paved streets, the CONTRACTOR may elect, at no additional cost to the OWNER, to place the pipe by the jacking or boring or tunneling method in lieu of cutting and patching of the paved surfaces.

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

SECTION 01 74 00

CLEANING

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. General Requirements

B. Disposal Requirements

1.2 GENERAL REQUIREMENTS

A. Execute cleaning during progress of the work and at completion of the work.

1.3 DISPOSAL REQUIREMENTS

A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 DURING CONSTRUCTION

A. Execute daily cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris, resulting from construction operations.

B. Provide onsite containers for the collection of waste materials, debris and rubbish. All waste materials including containers, food debris and other miscellaneous materials must be disposed of daily in onsite containers.

C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

PART 1 - DOWNHOLE CONSTRUCTION

3.2 FINAL CLEANING

A. Requirements: At the completion of work and immediately prior to final inspection, clean the entire project as follows:

1. Thoroughly clean, sweep, wash, and polish all work and equipment provided under the Contract, including finishes. Leave the structures and site in a complete and finished condition to the satisfaction of the ENGINEER.

2. Direct all subcontractors to similarly perform, at the same time, an equivalent thorough cleaning of all work and equipment provided under their contracts.

3. Remove all temporary structures and all debris, including dirt, sand, gravel, rubbish and waste material.

4. Should the CONTRACTOR not remove rubbish or debris or not clean the buildings and site as specified above, the OWNER reserves the right to have the cleaning done at the expense of the CONTRACTOR.

B. Employ experienced workers, or professional cleaners, for final cleaning.

C. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

D. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.

E. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces. Polish surfaces so designated to shine finish.

F. Repair, patch, and touch up marred surfaces to specified finish, to match adjacent surfaces.

G. Replace air-handling filters if units were operated during construction.

H. Clean ducts, blowers, and coils, if air-handling units were operated without filters during construction.

I. Vacuum clean all interior spaces, including inside cabinets.

J. Handle materials in a controlled manner with as few handlings as possible. Do not drop or throw materials from heights.

PART 1 - DOWNHOLE CONSTRUCTION

K. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly-painted surfaces.

L. Clean interior of all panel cabinets, pull boxes, and other equipment enclosures.

M. Wash and wipe clean all lighting fixtures, lamps, and other electrical equipment which may have become soiled during installation.

N. Perform touch-up painting.

O. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

P. Remove erection plant, tools, temporary structures and other materials.

Q. Remove and dispose of all water, dirt, rubbish or any other foreign substances.

3.3 FINAL INSPECTION

A. After cleaning is complete the final inspection may be scheduled. The inspection will be done with the OWNER and ENGINEER.

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

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SECTION 01 77 00

CONTRACT CLOSE OUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Warranties and Bonds

B. Record Drawings

C. Special Tools

1.2 WARRANTIES AND BONDS

Prior to final payment deliver to the OWNER the original and one copy of all bonds, warranties, guarantees and similar documents, including those customarily provided by manufacturers and suppliers which cover a period greater than the one year correction period. Show OWNER as beneficiary of these documents.

1.3 RECORD DRAWINGS

At the site keep and maintain one record copy of all Contract Documents, reference documents and all technical documents submitted in good order. As the work progresses the Engineer or his designated representative shall record on one set of reproducible drawings all changes and deviations from the original Plans. He shall record the exact location of all changes in vertical and horizontal alignment by offsets and ties at each; sewer, water, electric, gas, communication and other services by off-set distance to permanent improvements such as building and curbs.

Prior to acceptance of the project and before final payment is made, the Engineer shall submit one (1) set of reproducible drawings, two (2) sets of blueline or blackline prints, all marked "Drawings of Record". These Record Drawings must be certified by the Florida Registered Professional Engineer, who prepared the plans and signs and seals these plans, and submits AutoCAD compatible diskette copy of the drawings, and other applicable related records to the Department of Lee County Utilities.

The CONTRACTOR shall retain the services of a Florida Registered Land Surveyor to provide the OWNER with the As-Built Record Drawings necessary to record the existence of the injection well and temporary pad with the permanent warranty deed or other instrument of conveyance as a two page provision or addendum that contains certification of the location of the injection well (by meters and bounds) and a detailed sketch of the parcel that shows the location of the injection well. The location shall be measured by a Florida Registered Land Surveyor, and shall contain the surveyor’s signature, registration number, official seal, and the following statement: “I hereby certify that this survey was made under my responsible direction and supervision, and

PART 1 - DOWNHOLE CONSTRUCTION

is a correct representation of the land surveted.

On a case by case basis, Lee County Utilities may waive the requirement for certification by a Professional Land Surveyor, licensed in the State of Florida. However, prior consent must first be obtained from Lee County Utilities. The County shall withhold final acceptance of the project until the requirement for record drawings and related records has been met. Record Drawings without detailed field verified horizontal and vertical locations of all facilities shown will be rejected.

1.4 SPECIAL TOOLS

Special tools are considered to be those tools which, because of their limited use, are not normally available but which are necessary for maintenance of particular equipment.

For each type of equipment provided under this CONTRACT, furnish a complete set of all special tools including grease guns and other lubricating devices, which may be needed for the adjustment, operation, maintenance, and disassembly of such equipment. Furnish only tools of high grade, smooth forged alloy tool steel. Manufacture grease guns of the lever type.

Furnish and erect one or more neat and substantial steel wall cases or cabinets with flat key locks and clips or hooks to hold each special tool in a convenient arrangement.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

SECTION 01 78 23

OPERATION AND MAINTENANCE MANUALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description

B. Quality Assurance

C. Submittals

D. Format and Contents

1.2 DESCRIPTION

A. Scope: Furnish to the ENGINEER 10 copies and a PDF of an Operation and Maintenance Manual for all equipment and associated control systems furnished and installed.

1.3 QUALITY ASSURANCE

A. Reference Codes and Specifications: No current government or commercial specifications or documents apply.

1.4 SUBMITTALS

A. Prior to the Work Reaching 50 Percent Completion, submit to the ENGINEER for approval two copies of the manual with all specified material. Submit the approval copies with the partial payment request for the specified completion. Within 30 days after the ENGINEER's approval of the two-copy submittal, furnish to the ENGINEER the remaining 8 copies of the manual. Provide space in the manual for additional material. Submit any missing material for the manual prior to requesting certification of substantial completion.

1.5 FORMAT AND CONTENTS

A. Prepare and arrange each copy of the manual as follows:

1. One copy of an equipment data summary (see sample form) for each item of equipment.

2. One copy of an equipment preventive maintenance data summary (see sample form) for each item of equipment.

PART 1 - DOWNHOLE CONSTRUCTION

3. One copy of the manufacturer's operating and maintenance instructions. Operating instructions include equipment start-up, normal operation, shutdown, emergency operation and troubleshooting. Maintenance instructions include equipment installation, calibration and adjustment, preventive and repair maintenance, lubrication, troubleshooting, parts list and recommended spare parts.

4. List of electrical relay settings and control and alarm contact settings.

5. Electrical interconnection wiring diagram for equipment furnished including all control and lighting systems.

6. One valve schedule giving valve number, location, fluid, and fluid destination for each valve installed. Group all valves in same piping systems together in the schedule. Obtain a sample of the valve numbering system from the ENGINEER.

7. Furnish all O&M Manual material on 8-1/2 by 11 commercially printed or typed forms or an acceptable alternative format.

8. Provide a digital copy al all O&M Manual material.

B. Organize each manual into sections paralleling the equipment specifications. Identify each section using heavy section dividers with reinforced holes and numbered plastic index tabs. Use 3-ring, hard-back binders Type No. VS11 as manufactured by K&M Company, Torrence, CA, or equal. Punch all loose data for binding. Arrange composition and printing so that punching does not obliterate any data. Print on the cover and binding edge of each manual the project title, and manual title, as furnished and approved by the ENGINEER.

C. Leave all operating and maintenance material that comes bound by the equipment manufacturer in its original bound state. Cross-reference the appropriate sections of the CONTRACTOR's O&M manual to the manufacturers' bound manuals.

D. Label binders Volume 1, 2, and so on, where more than one binder is required. Include the table of contents for the entire set, identified by volume number, in each binder.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

PART 1 - DOWNHOLE CONSTRUCTION

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

Lee County Utilities
Three Oaks Water Reclamation Facility
Deep Injection Well IW-2

Equipment Data Summary

Equipment Name: Specification Reference:

Manufacturer:

Name:

Address:

Telephone:

Number Supplied: Location/Service:

Model No: Serial No:

Type:

Size/Speed/Capacity/Range (as applicable):

Power Requirement (Phase/Volts/Hertz):

Local Representative:

Name:

Address:

Telephone:

NOTES:

PART 1 - DOWNHOLE CONSTRUCTION

Lee County Utilities
Three Oaks Water Reclamation Facility
Deep Injection Well IW-2

Preventive Maintenance Summary

Equipment Name: Location:

Manufacturer:

Name:

Address:

Telephone:

Model No: Serial No:

Maintenance Task	Lubricant/Part	D W M Q SA A	O&M Manual Reference

NOTES:

*D-Daily W-Weekly M-Monthly Q-Quarterly SA-Semi-Annual A-Annual

PART 1 - DOWNHOLE CONSTRUCTION

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SECTION 01 78 36

WARRANTIES AND BONDS

PART 1 GENERAL

1.1 REQUIREMENTS INCLUDED

A. Compile specified warranties and bonds, as in Articles 6 and 13 of the General Conditions.

B. Co-execute submittals when so specified.

C. Review submittals to verify compliance with Contract Documents.

D. Submit to the ENGINEER for review and transmittal to OWNER.

1.2 SUBMITTAL REQUIREMENTS

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.

B. Two original signed copies are required.

C. Table of Contents. Neatly typed in orderly sequence. Provide complete information for each items.

1. Product or work item.
2. Firm, with name of principal, address and telephone number.
3. Scope.
4. Date of beginning warranty, bond or service and maintenance contract.
5. Duration of warranty, bond or service maintenance contract.
6. Provide information for OWNER's personnel:
    a. Proper procedure in case of failure.
    b. Instances which might affect the validity of warranty or bond.
7. CONTRACTOR, name of responsible principal, address and telephone number.

1.3 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2" x 11", punch sheets for standard 3-post binder.
    a. Fold larger sheets to fit into binders.

PART 1 - DOWNHOLE CONSTRUCTION

2. Cover: Identify each packet with typed or printed title “WARRANTIES AND BONDS” list:
   a. Title of Project
   b. Name of CONTRACTOR

C. Binders: Commercial quality, three-post binder, with durable and cleanable plastic covers and maximum post width of 2 inches.

1.4 WARRANTY SUBMITTAL REQUIREMENTS

A. For all major pieces of equipment, submit a warranty from the equipment manufacturer. The manufacturer’s warranty period shall be concurrent with the CONTRACTOR’s for one (1) year, unless otherwise specified, commencing at the time of substantial completion.

B. The CONTRACTOR shall be responsible for obtaining certificates for equipment warranty for all major equipment specified under Division 11, 13, 14, 15, and 16 and which has a 1 HP motor or which lists for more than $1,000. The ENGINEER reserves the right to request warranties for equipment not classified as major. The CONTRACTOR shall still warrant equipment not considered to be “major” in the CONTRACTOR’s one-year warranty period even though certificates of warranty may not be required.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

SECTION 02 21 13

LINES AND GRADES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General

B. Surveys

C. Datum Plane

D. Protection of Survey Data

1.2 GENERAL

A. Construct all work in accordance with the lines and grades shown on the Drawings. Assume full responsibility for keeping all alignment and grade.

1.3 SURVEYS

A. Reference Points: The OWNER will provide reference points for the work as described in the General Conditions. Base horizontal and vertical control points will be designated by the ENGINEER and used as datum for the Work. Perform all additional survey, layout, and measurement work.

1. Keep ENGINEER informed, sufficiently in advance, of the times and places at which work is to be performed so that base horizontal and vertical control points may be established, and any checking deemed necessary by ENGINEER may be done, with minimum inconvenience to the ENGINEER and at no delay to CONTRACTOR. It is the intention not to impede the Work for the establishment of control points and the checking of lines and grades set by the CONTRACTOR. However, when necessary, suspend working operations for such reasonable time as the ENGINEER may require for this purpose. Costs associated with such suspension are deemed to be included in the Contract Price, and no time extension or additional costs will be allowed.

2. Provide an experienced survey crew including an instrument operator, competent assistants, and any instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement of work performed by the CONTRACTOR.

PART 1 - DOWNHOLE CONSTRUCTION

1.4 DATUM PLANE

A. All elevations indicated or specified refer to the Mean Sea Level Datum Plane, 1988 General Adjustment, of the United States Coast and Geodetic Survey and are expressed in feet and decimal parts thereof, or in feet and inches.

1.5 PROTECTION OF SURVEY DATA

A. General: Safeguard all points, stakes, grade marks, known property corners, monuments, and bench marks made or established for the Work. Reestablish them if disturbed and bear the entire expense of checking reestablished marks and rectifying work improperly installed.

B. Records: Keep neat and legible notes of measurements and calculations made in connection with the layout of the Work. Furnish copies of such data to the ENGINEER for use in checking the CONTRACTOR's layout. Data considered of value to the OWNER will be transmitted to the OWNER by the ENGINEER with other records on completion of the Work.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

SECTION 02 40 00

DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: All work necessary for the removal and disposal of buildings, structures, foundations, piping, equipment and roadways, or any part thereof including masonry, steel, reinforced concrete, plain concrete, electrical facilities, and any other material or equipment shown or specified to be removed.

B. Basic Procedures and Schedule: Carry out demolition so that adjacent structures, which are to remain, are not endangered. Schedule the work so as not to interfere with the day to day operation of the existing facilities. Do not block doorways or passageways in existing facilities.

C. Additional Requirements: Provide dust control and make provisions for safety.

1.2 SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 1.

B. Site Inspection: Visit the site and inspect all existing structures. Observe and record any defects which may exist in buildings or structures adjacent to but not directly affected by the demolition work. Provide the OWNER with a copy of this inspection record and obtain the OWNER's approval prior to commencing the demolition.

1.3 QUALITY ASSURANCE

A. Limits: Exercise care to break concrete sufficiently for removal in reasonably small masses. Where only parts of a structure are to be removed, cut the concrete along limiting lines with a suitable saw so that damage to the remaining structure is held to a minimum.

PART 2 PRODUCTS

Not Used

PART 1 - DOWNHOLE CONSTRUCTION

PART 3 EXECUTION

3.1 EXAMINATION OF EXISTING DRAWINGS

A. Drawings of existing structures and equipment will be available for inspection at the office of the OWNER.

3.2 PROTECTION

A. General Safety: Provide warning signs, protective barriers, and warning lights as necessary adjacent to the work as approved or required. Maintain these items during the demolition period.

B. Existing Services: Undertake no demolition work until all mechanical and electrical services affected by the work have been properly disconnected. Cap, reroute or reconnect interconnecting piping or electrical services that are to remain in service either permanently or temporarily in a manner that will not interfere with the operation of the remaining facilities.

C. Hazards: Perform testing and air purging where the presence of hazardous chemicals, gases, flammable materials or other dangerous substances is apparent or suspected, and eliminate the hazard before demolition is started.

3.3 DEMOLITION REQUIREMENTS

A. Explosives: The use of explosives will not be permitted.

B. Protection: Carefully protect all mechanical and electrical equipment against dust and debris.

C. Removal: Remove all debris from the structures during demolition and do not allow debris to accumulate in piles.

D. Access: Provide safe access to and egress from all working areas at all times with adequate protection from falling material.

E. Protection: Provide adequate scaffolding, shoring, bracing railings, toe boards and protective covering during demolition to protect personnel and equipment against injury or damage. Cover floor openings not used for material drops with material substantial enough to support any loads placed on it. Properly secure the covers to prevent accidental movement.

F. Lighting: Provide adequate lighting at all times during demolition.

G. Closed Areas: Close areas below demolition work to anyone while removal is in progress.

PART 1 - DOWNHOLE CONSTRUCTION

H. Material Drops: Do not drop any material to any point lying outside the exterior walls of the structure unless the area is effectively protected.

3.4 DISPOSAL OF MATERIALS

A. Final Removal: Remove all debris, rubbish, scrap pieces, equipment, and materials resulting from the demolition unless otherwise indicated. Take title to all demolished materials and remove such items from the site.

B. OWNER's Property: In addition to any items which may be shown, the following items remain the property of the OWNER. Remove carefully, without damage, all items listed or shown, and stockpile as directed.

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

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Section 03 30 53

MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1-1. SCOPE. This section covers all cast-in-place concrete, including reinforcing steel, forms, finishing, curing, and appurtenant work.

1-2. GENERAL. All cast-in-place concrete shall be accurately formed and properly placed and finished as indicated on the drawings and as specified herein.

1-3. SUBMITTALS. All submittals shall be made in accordance with the Submittal Procedures section.

The following items shall be submitted, as a minimum.

Manufacturer's information for all products and concrete ingredients supplied under this section, in the form of technical data sheets, certificates of compliance, test data, or reports.

Items required to verify the concrete mixture:

Aggregate reports (ASTM C33 and ASTM C1778)

Source and type

Gradation

Deleterious materials

Alkali-aggregate reactivity

Cement mill report

Fly ash or slag cement test report

Admixture data sheets

Proposed mixture proportions

Concrete compressive strength at 28 days

PART 1 - DOWNHOLE CONSTRUCTION

NSF/ANSI 61 and NSF/ANSI 600 compliance evaluations

Drawings or figures indicating the location of all construction joints, expansion joints, and contraction joints.

Drawings or figures indicating the location of all waterstops including prefabricated or specialty pieces at turns, intersections, and changes of waterstop types.

Bar lists and drawings for the fabrication and placing of reinforcement, with sufficient plans, elevations, and sections to adequately detail and label all reinforcement. Bar drawings shall also include a reference to the structure where the reinforcement is to be installed and the relevant contract drawings showing the reinforcement.

Proposed repair materials and procedures for defects in concrete that are more than 3 inches deep, submitted only after such repairs are found to be necessary.

A curing plan, indicating the planned method and duration of curing for each individual structure on the project.

1-4. STORAGE AND HANDLING. Cement shall be stored in suitable moistureproof enclosures. Cement which has become caked or lumpy shall not be used.

Aggregates shall be stored so that segregation and the inclusion of foreign materials are prevented. The bottom 6 inches of aggregate piles in contact with the ground shall not be used.

Reinforcing steel shall be carefully handled and shall be stored on supports that will prevent the steel from touching the ground.

PART 2 - PRODUCTS

2-1. LIMITING REQUIREMENTS. Unless otherwise specified, concrete shall be controlled within the following limiting requirements.

2-1.01. Cement Content. The cementitious material content shall be suitable for meeting the performance requirements of this specification.

2-1.02. Maximum Water-Cementitious Ratio. The maximum water-cementitious ratio shall be 0.42 on a weight basis. If fly ash or slag cement are used, the combined mass of cement plus fly ash or slag cement shall be used to determine the water-cementitious materials ratio.

PART 1 - DOWNHOLE CONSTRUCTION

2-1.03. Fly Ash and Slag Cement Content. At the option of Contractor, fly ash or slag cement may be substituted for cement, on the basis of 1.0 lb added for each 1.0 lb of cement reduction. Fly ash replacement shall be within a range of 15 to 25 percent. Slag cement replacement shall be within a range of 25 to 50 percent.

2-1.04. Coarse Aggregate. The maximum nominal coarse aggregate size shall be 1 inch. Recycled aggregates, or aggregates created from crushed concrete, will not be acceptable.

2-1.05. Slump. Concrete slump shall be kept as low as possible consistent with proper handling and thorough compaction. Unless otherwise authorized by Engineer, slump of concrete without a superplasticizer shall not exceed 4 inches. Slump of concrete with a high-range water reducer (superplasticizer), or a midrange water reducer, shall not exceed 8 inches.

2-1.06. Total Air Content. The total volumetric air content of concrete after placement shall be 6 percent ±1.5 percent. Air-entraining admixture shall be omitted from concrete for interior slabs which are to be trowel finished.

2-1.07. Admixtures. The admixture content, batching method, and time of introduction to the mix shall be in accordance with the manufacturer's recommendations and acceptable to Engineer. A water-reducing admixture and an air-entraining admixture shall be included in all concrete. A midrange water reducer or a high-range water reducer (superplasticizer) may be used at Contractor’s option. No calcium chloride or admixture containing chloride from sources other than impurities in admixture ingredients will be acceptable.

2-1.08. Strength. The minimum acceptable compressive strengths, as determined by ASTM C39, shall be:

Age	Minimum Compressive Strength
7 days	3,375 psi
28 days	4,500 psi

Cylinders shall be 6 inches diameter by 12 inches high for concrete mixes using a maximum nominal aggregate size of 1 inch or larger. Cylinders may be either 6 inches diameter by 12 inches high, or 4 inches diameter by 8 inches high for concrete mixes using a maximum nominal aggregate size of less than 1 inch. The average compressive strength shall be determined from the results of at least three cylinders when using 4 inch diameter cylinders, and at least two

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cylinders when using 6 inch diameter cylinders. All tests shall be performed using the same sized cylinders for the duration of the work.

2-1.09. Concrete for Ductbank, Pipe Blocking, and Pipe Encasement. Concrete for ductbank, buried blocking, and encasement of pipe shall conform to the limiting requirements specified herein, except that the cement factor and total water content may be adjusted to provide a minimum compressive strength of 3,000 psi at 28 days. Concrete shall have a slump of not less than 2 inches nor more than 5 inches when placed.

2-2. MATERIALS.

Cement	ASTM C150 Type I, II, or I/II, or ASTM C595 Type IL. ASTM C595 cements that incorporate ASTM C1157 cements will not be acceptable.
Fly Ash	ASTM C618, Class F, except loss on ignition shall not exceed 4 percent.
Slag Cement	ASTM C989, Grade 100 or Grade 120.
Fine Aggregate	Non-reactive, clean natural sand, ASTM C33. Artificial or manufactured sand will not be acceptable.
Coarse Aggregate	Non-reactive crushed rock, washed gravel, or other inert granular material conforming to ASTM C33, class 4S, except that clay and shale particles shall not exceed 1 percent.
Water	Potable. Water from concrete production operations shall not be used.
Admixtures	
Water-Reducing	ASTM C494, Type A or D.
Air-Entraining	ASTM C260.
Superplasticizing	ASTM C494, Type F or G.
Reinforcing Steel	

Bars	ASTM A615, Grade 60, deformed.
Welded Wire Fabric	ASTM A185 or A497.
Bar Supports	CRSI Class 1, plastic protected; or Class 2, stainless steel protected.
Mechanical Connectors	Splicing system meeting Type 2 tensile requirements of ACI 318. Products shall have a current evaluation report verifying testing per ICC-ES AC 133. Use only where indicated on the drawings.
Stainless Steel Waterstops	ASTM A240, low carbon stainless steel, 14 gage minimum thickness, size as indicated on the Drawings.
PVC Waterstops	Material shall meet the requirements of CRD-C-572, shall be white (no pigment), ribbed, 3/8 inch thick, size as indicated on the drawings. Reclaimed material will not be acceptable. Provide hog rings or grommets spaced at 12 inches on center entire length.
6 inches wide, at construction joints	Sika Greenstreak “679”, JP Specialties “PVC637”, or Vinylex “R638”.
9 inches wide, at construction joints	Sika Greenstreak “646”, JP Specialties “PVC937”, or Vinylex “R938”.
Expandable Waterstops, permitted only at locations indicated on Drawings	
For concrete sections that are at least 10 inches thick and 6 feet high, and with at least two layers of reinforcement	Hydrophilic; bentonite free, chemically modified rubber. Adeka "Ultra Seal MC-2010MN" or Sika "Hydrotite CJ-1020-2K". Adhesive and sealant as recommended by the manufacturer.
For other concrete sections	Hydrophilic; chemically modified rubber. Adeka "KBA-1510FP" or Sika "Swellstop". Adhesive and sealant as recommended by the manufacturer.

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Expansion joint materials	
Filler	Preformed sponge rubber. ASTM D1752, Type I.
Filler Adhesive	As recommended by manufacturer.
Sealant	As specified in the Joint Sealants section.
Forms	
Plywood Product	Standard PS1, waterproof, resin-bonded, exterior type, Douglas fir.
Lumber	Straight, uniform width and thickness, and free from knots, offsets, holes, dents, and other surface defects.
Form Coating	Nonstaining and nontoxic after 30 days. Product shall not exceed VOC limits established by the federal, state, or local regulatory agency having jurisdiction over the project site.
Evaporation Reducer	Dayton Superior "AquaFilm Concentrate J74", Euclid "Eucbar", L&M Chemical "E-Con", Master Builders Solutions "MasterKure ER50", or Sika "SikaFilm".
Polyethylene Film	Product Standard PS17 or ASTM D4397, 6 mils or thicker.
Vapor retarder and seam tape	Polyolefin membrane, 15 mil min, ASTM E1745, Class A, with maximum water vapor permeance of 0.02 perms. Stego Industries “Stego Wrap 15 Mil”, Raven Industries “Vaporblock 15”, Reef Industries “Griffolyn 15 Mil Green”, W.R. Meadows “Perminator 15”, Insulation Solutions “Viper VaporCheck II”. Manufacturer recommended seam tape and pipe boots.
Membrane Curing Compound and Floor Sealer	ASTM C1315, Type I, Class A, minimum 25 percent solids, acrylic, non-yellowing, unit moisture loss 0.40 kg/m^2 maximum in

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	72 hours. Product shall not exceed VOC limits established by the federal, state, or local regulatory agency having jurisdiction over the project site.
Concrete Surface Coloring/Hardener	Mineral aggregate dry-shake colored hardener for concrete flatwork. ChemSystems, Inc. “CSI Color Hardener”, Euclid “Surflex”, or Dayton Superior “Quartz Tuff”.
Epoxy Bonding Agent	ASTM C881, Type V, moisture insensitive, 100 percent solids; Dayton Superior “Sure Bond J58”, Euclid "Dural 452 MV", Prime Resins “Prime Bond 3900 High Mod LPL”, or SpecChem “SpecPoxy 2000”.

2-3. MIXTURE DESIGN AND TESTING. All reports and tests required for Engineer acceptance of materials and concrete mixtures shall be made at the expense of Contractor. Mixtures shall be adjusted in the field as necessary, within the limits specified, to meet the requirements of these specifications. If the source of any concrete materials is changed during the contract, concrete work shall pause until the new materials and the new mixture design are acceptable to Engineer.

2-3.01. Review of Materials. The source and quality of concrete materials shall be submitted to Engineer for review before concrete is placed.

2-3.02. Proposed Mixture Proportions. Proposed proportions of concrete shall meet the limiting requirements indicated herein.

2-3.03. Mixture Testing. Test results shall be submitted for review and shall be acceptable to Engineer before concrete work is started.

2-3.03.01. Field Test Record Data. Concrete mixtures may be qualified based on field test record performance data. Field test data records shall be from the production facility being used on the current Project and shall have been performed in the past 24 months. Field test records shall represent a single group of at least 10 consecutive strength tests for one mixture, using the same materials, under the same conditions, and encompassing a period of not less than 45 days.

2-3.03.02. Laboratory Trial Mixture Testing. If field test record data is not available, or does not meet the specified criteria, laboratory trial mixtures shall be

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performed to confirm concrete strength requirements. Laboratory trial mixtures shall meet a minimum compressive strength of f'_c + 1200 psi.

2-4. FORMS. Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings. Forms shall be substantial and sufficiently tight to prevent leakage of mortar and shall be maintained in proper position and accurate alignment.

Forms for pavement, curbs, or gutters shall be made of steel and shall be supported on thoroughly compacted earth. The top face of pavement forms shall not vary from a true plane more than 1/4 inch in 10 feet.

Forms shall be thoroughly cleaned and coated before concrete is placed.

Form-facing materials shall be selected in accordance with ACI 347.3R, based upon the applicable formed concrete surface category. Formed concrete surface categories vary by structure and application, and shall be as indicated in the Finishing Formed Surfaces paragraph.

2-4.01. Form Ties. Form ties shall be of the removable end, permanently embedded body type, and shall have sufficient strength and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders. Form ties for walls with waterstops at joints shall be provided with waterstop washers located on the permanently embedded portions of the ties at the approximate center of the wall. Through-wall tapered removable ties will not be acceptable for liquid-containing walls.

2-4.02. Edges and Corners. Chamfer strips shall be placed in forms to bevel all salient edges and corners, except the top edges of walls and slabs which are to be tooled and edges which are to be buried. Unless otherwise noted, bevels shall be 3/4 inch wide.

2-4.03. Form Removal. Forms shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all dead, live, and construction loads. Care shall be taken in form removal to avoid surface gouging, corner or edge breakage, and other damage to the concrete.

2-5. REINFORCEMENT. Reinforcement shall be accurately formed and positioned and shall be maintained in proper position while the concrete is being placed and compacted. Unless otherwise indicated on the drawings, the details of fabrication shall conform to ACI 315 and 318. In case of conflict, ACI 318 shall govern. Reinforcement shall be free from dirt, loose rust, scale, and contaminants. Mechanical connections shall be used only as indicated on the drawings.

PART 3 - EXECUTION

3-1. BATCHING, MIXING, AND DELIVERY. Concrete shall be furnished by an acceptable ready-mixed concrete supplier, and shall conform to ASTM C94 except as indicated otherwise in this specification. The time from start of concrete mixing to completion of discharge from the truck shall not exceed 1-1/2 hours.

3-1.01. Delivery Tickets. A delivery ticket shall be prepared for each load of ready-mixed concrete and a copy of the ticket shall be handed to Engineer by the truck operator at the time of delivery. Tickets shall indicate the name and location of Contractor, the project name, the mixture identification, the quantity of concrete delivered, the quantity of each material in the batch, the outdoor temperature in the shade, the time at which the cementitious materials were added, and the numerical sequence of the delivery.

3-1.02. Mixing Water. Mixing water shall not be added in transit. Any amount of water withheld from the truck mixer shall be clearly indicated on the delivery ticket. Water added at the site shall not exceed the amount withheld, and shall not be added without oversight by Owner’s on site inspector.

3-1.03. Consistency. The consistency of concrete shall be suitable for the placement conditions. Aggregates shall flow uniformly throughout the mass, and the concrete shall flow sluggishly when vibrated or spaded. The slump shall be kept uniform.

3-2. PLACEMENT. Contractor shall inform Engineer at least 24 hours in advance of the times and places at which he intends to place concrete.

Methods of conveying concrete to the point of final deposit and of placing shall prevent segregation or loss of ingredients. During and immediately after placement, concrete shall be thoroughly compacted and worked around all reinforcement and embedments and into the corners of the forms. Concrete shall be compacted by immersion-type vibrators, vibrating screeds, or other suitable mechanical compaction equipment. The use of "jitterbug" tampers to compact concrete flatwork will not be permitted.

3-2.01. Polyethylene Film. Where concrete is placed against gravel or crushed rock which does not contain at least 25 percent material passing a No. 4 sieve, such surfaces shall be covered with polyethylene film. Joints in the film shall be lapped at least 6 inches and taped.

3-2.02. Vapor Retarder. Not used.

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3-2.03. Cold Weather Concreting. Except as modified herein, cold weather concreting shall comply with ACI 306.1.

When placed, heated concrete shall not be warmer than 80°F.

3-2.04. Hot Weather Concreting. Except as modified herein, hot weather concreting shall comply with ACI 305.1.

At air temperatures of 90°F or above, concrete shall be kept as cool as practicable during placement. The temperature of the concrete when placed in the work shall not exceed 90°F.

Plastic shrinkage cracking due to rapid evaporation of moisture shall be prevented. Concrete shall not be placed when the evaporation rate (actual or anticipated) equals or exceeds 0.2 lb per square foot per hour, as determined using the nomograph in Appendix A of ACI 305.1.

3-2.05. Bonding to Hardened Concrete. The surface of hardened concrete upon which fresh concrete is to be placed shall be rough, clean, sound, and damp. Before placement of plastic concrete, the hardened surface shall be cleaned of all laitance and foreign substances (including curing compound), washed with clean water, wetted thoroughly, and the surface made free of standing water. Surface profile of the hardened concrete after surface preparation shall be as required for good bond.

Epoxy bonding agent shall only be required where specifically indicated on the project drawings or specifications. Fresh concrete shall be applied when bonding agent is still tacky. Bonding agent material that has exceeded the manufacturer's recommended pot life shall be removed.

3-3. WATERSTOPS. Each waterstop shall be continuous throughout the length of the joint in which it is installed. Waterstops shall be clean, free from coatings, and shall be maintained in proper position until surrounding concrete has been deposited and compacted.

Junctions between adjacent sections of metal waterstops shall be lapped 5 inches and securely bolted, screwed, or spot welded together.

Junctions between adjacent sections of elastomeric (PVC) waterstops shall be spliced in strict conformity with the recommendations of the manufacturer. Directional changes and intersections shall be factory fabricated by the waterstop manufacturer prior to delivery to the site of the work. Field splices will be acceptable only in straight sections.

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3-4. TOLERANCES. Tolerances for cast-in-place concrete work shall be as indicated in ACI 117, and ACI 347.3R based upon the relevant formed concrete surface category.

Formed concrete surfaces that are to have a face-mounted flat steel or FRP member attached, including but not limited to items such as weir plates or shelf angles, shall have more stringent flatness requirements. The surface profile shall permit the installation of the flat member without grinding the concrete surface (except for removal of fins), deforming the flat member, or requiring usage of backer rods or shims.

3-5. FINISHING.

3-5.01. Finishing Formed Surfaces. Formed concrete surfaces shall meet all criteria of the relevant formed concrete surface category (CSC), as defined in ACI 347.3R, except as indicated otherwise herein. Surfaces shall be assigned to CSC's as indicated.

Formed Concrete Surface Category	Applicable Surfaces	Mockup Required
CSC1	Formed concrete surfaces that will be in permanent contact with earth backfill.	No
CSC2	All other formed concrete surfaces not designated otherwise.	No
CSC3	None.	Yes
CSC4	None.	Yes

3-5.01.01. Fins. Fins, form seams, and construction joints shall be ground flush on all surfaces in formed concrete surface categories CSC2, CSC3, and CSC4, and in CSC1 surfaces that are required to be dampproofed.

3-5.01.02. Tie Holes. All tie holes in formed surfaces, regardless of the relevant CSC, shall be cleaned, wetted, and filled with patching mortar. The patches shall be finished flush and cured and shall match the texture and color of the adjacent concrete.

3-5.01.03. Dampproofed Surfaces. Concrete surfaces to be dampproofed shall have fins removed and tie holes filled, but no additional finishing will be required.

3-5.01.04. Painted Surfaces. Concrete surfaces to be painted shall have sharp edges and projections removed to provide an acceptable condition for painting. The concrete surfaces shall have bug holes filled per the Protective Coatings section.

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3-5.01.05. Mockups. Mockups shall be used to validate the means and methods to be used by Contractor, and to provide Owner a sample of the specified concrete surface. The use of a reference area within an existing structure shall not be acceptable as a mockup.

Mockups shall incorporate the structure geometries; reinforcing bar size, spacing, arrangement, and cover; inserts; the approved concrete mixture; sample tie hole patching, and other likely required repair procedures. Contractor shall confirm in writing that the mockup quality represents work than can be accomplished in the actual structure.

3-5.02. Finishing Unformed Surfaces. Unless otherwise specified, unformed surfaces shall be screeded and given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance, with no unnecessary working of the surface.

Initial floating shall be followed by a second floating at the time of initial set. The second floating shall produce a finish of uniform texture and color and the completed finish for unformed surfaces unless indicated otherwise.

3-5.03. Troweling. Interior floor surfaces which will be exposed after construction is completed; exposed top surfaces of equipment bases and interior curbs; and other surfaces designated on the drawings shall be steel trowel finished. Troweling shall be performed after the second floating when the surface has hardened sufficiently to prevent an excess of fines being drawn to the surface. Troweling shall produce a dense, smooth, uniform surface free from blemishes and trowel marks.

3-5.04. Application of Evaporation Reducer. Concrete flatwork subject to rapid evaporation due to hot weather, drying winds, and sunlight shall be protected with an evaporation reducer. The evaporation reducer shall form a continuous film on the surface of fresh, plastic concrete to reduce evaporation.

Immediately following screeding, evaporation reducer shall be sprayed over the entire surface of fresh, plastic concrete flatwork at a rate of not less than 200 square feet per gallon, in accordance with the manufacturer's recommendations. The spray equipment shall have sufficient capacity to continuously spray the product at approximately 40 psi with a suitable nozzle as recommended by the manufacturer.

The sprayable solution shall be prepared as recommended by the manufacturer.

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Under severe drying conditions, additional applications of evaporation reducer may be required following each floating or troweling, except the last finishing operation.

3-6. CURING. Concrete shall be protected from loss of moisture for at least 7 days after placement unless indicated otherwise. Curing of concrete shall be done by methods which will keep the concrete surfaces adequately wet for the specified curing period.

3-6.01. Water Curing. Water curing shall be performed for concrete in liquid-containing structures and for all concrete containing slag cement. Other forms of curing will not be acceptable in these applications. Water curing shall be in accordance with ACI 308.1 except as modified herein.

Water saturation of concrete surfaces shall begin as soon as possible after initial set. The rate of water application shall be regulated to provide complete surface coverage with a minimum of runoff.

Water curing shall continue for 14 days for concrete containing slag cement, and for 7 days for other types of concrete. However, when concrete is being protected from low temperatures, the duration of water curing may be shortened to 1 day less than the duration of cold weather protection.

When forms are removed before the specified curing duration is completed, measures shall be taken to immediately continue water curing and to provide adequate thermal protection for the concrete.

3-6.02. Membrane Curing. Unless otherwise specified, membrane curing compound may be used instead of water curing on concrete in non-liquid-containing structures which will not be stained or etched, covered with chemical resistant linings, covered with additional concrete, or indicated in the Architectural drawings to be covered with a finish flooring material.

Membrane curing compound shall be evenly sprayed at a coverage rate of not more than 300 square feet per gallon. The spray equipment shall have sufficient capacity to continuously spray curing compound at approximately 40 psi with a suitable nozzle as recommended by the manufacturer. Unformed surfaces shall be covered with the first coat of curing compound within 30 minutes after final finishing. A second coat of curing compound shall be applied when the first coat has become tacky to the touch and shall be applied at right angles to the first coat.

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Curing compound shall be suitably protected against abrasion during the curing period.

3-6.03. Film Curing. Unless otherwise specified, film curing with white polyethylene sheeting may be used instead of water curing on concrete in nonliquid-containing structures which will be covered later with mortar or additional concrete, or which will otherwise not be exposed to view.

Film curing shall begin as soon as possible after initial set of the concrete. The concrete surfaces shall be completely covered with polyethylene sheeting. Sheeting shall overlap the edges of the concrete for proper sealing and anchorage, and joints between sheets shall be sealed. All tears, holes, and other damage shall be promptly repaired. Covering shall be anchored continuously at edges and as necessary to prevent billowing on the surface.

3-7. REPAIRING DEFECTIVE CONCRETE. Defective concrete shall be defined as any surface with undesirable visible effects in excess of that permitted by the relevant formed concrete surface category (CSC), except as indicated otherwise herein.

Defects in formed concrete surfaces shall be repaired to the satisfaction of Engineer within 24 hours of form removal. Surface repair work shall conform to Article 5.3.7 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing of the surrounding concrete. Surface repair material shall be adequately cured.

Defects in concrete that are more than 3 inches deep shall be brought to the attention of Engineer prior to any repair work. Contractor shall submit a proposed repair material and procedure for review by Engineer. The repair material and procedure required by Engineer may be more extensive than the process described in Article 5.3.7 of ACI 301.

3-8. OWNER'S FIELD CONTROL TESTING. Field control tests shall be performed by Engineer or Owner's testing laboratory personnel, at the expense of Owner. Contractor shall provide access to all facilities and the services of one or more employees as necessary to assist with the field control testing.

Field control testing will not be performed for concrete used in ductbanks, pipe blocking, pipe encasement, or other non-structural applications unless Owner specifically requests and schedules such testing. Other special inspection requirements applicable for these types of concrete will still be performed.

3-8.01. Air Content. An air content test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Air content shall be determined in accordance with ASTM C231.

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3-8.02. Slump. A slump test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Slump shall be determined in accordance with ASTM C143.

3-8.03. Test Cylinders. Compression test specimens shall be made, cured (standard curing method), stored, and delivered to the laboratory in accordance with ASTM C31 and C39. Compressive strength tests will be evaluated in accordance with ACI 318 and as specified herein.

One set of concrete test cylinders shall be cast for each concrete pour. A set of test cylinders shall consist of four or six cylinders depending on the cylinder size selected. Half of the cylinders shall be tested at 7 days, and the remaining half shall be tested at 28 days. All concrete required for testing shall be furnished by, and at the expense of, Contractor.

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ANCHORAGE IN CONCRETE

PART 1 - GENERAL

1-1. SCOPE. This section covers the design and installation of anchors in concrete. It includes cast-in-place anchor bolts and anchor rods, adhesive anchors for both threaded rods and reinforcing bars, expansion anchors, screw anchors, and undercut anchors.

1-2. GENERAL.

1-2.01. Anchors Designed by Engineer. Cast-in-place and post-installed anchors that are fully detailed on the Drawings have been designed by Engineer, unless noted otherwise.

Anchors detailed on the Drawings as cast-in-place shall not be changed to a post-installed type without approval of Engineer.

Post-installed anchors identified on the Drawings as a specific manufacturer and product shall not be changed to a different post-installed manufacturer or product without approval of Engineer.

Post-installed anchors identified on the Drawings as a specific anchor type, but indicating no specific product, may use any of the listed products of that anchor type.

Contractor shall reimburse Engineer, through Owner, for Engineer's design costs related to evaluating alternative anchor types, products, or details.

1-2.02. Anchors Designed by Contractor or Contractor's Suppliers. Contractor or Contractor's material suppliers shall be responsible for design of anchors for delegated design items such as railings, ladders, equipment, pipe supports, pre-engineered structures, and other manufactured items, as indicated in the Drawings and Specifications.

Cast-in-place anchors shall be used unless post-installed types are indicated on the Drawings or accepted by Engineer.

Adhesive anchors used in vibrating applications shall only be used if the anchor manufacturer submits documentation indicating that the product is suitable for the anticipated service conditions.

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Anchors shall be designed for loads due to all operating conditions, plus relevant snow, wind, and seismic loadings as indicated in the Meteorological and Seismic Design Criteria section.

Seismic anchorage design for non-structural components shall include the overstrength factors indicated in ASCE 7, Tables 13.5-1 and 13.6-1, when applicable.

Design of anchorage into concrete shall be in accordance with ACI 318 Chapter 17, shall consider concrete to be cracked, and shall not include the strengthening effects of supplementary reinforcement or anchor reinforcement unless approved by Engineer.

Post installed anchors shall be designed in accordance with the anchor manufacturer's research report, and shall consider the applicable effects of anchor spacing, edge distances, embedment depths, and temperature.

Anchorage calculations performed by Contractor's suppliers shall utilize design tools applicable to the specific anchorage products intended to be used by Contractor.

1-2.03. Materials. Unless otherwise indicated, anchors of structural steel members connected to concrete shall have a diameter of at least 3/4 inch. Anchors for ladders and equipment shall have a diameter of at least 1/2 inch. Anchors for pedestrian railing systems shall have a diameter of at least 3/8 inch.

Unless otherwise indicated on the Drawings, anchors used in the following locations and applications shall be of the indicated materials.

Cast-In-Place Anchor Bolts and Anchor Rods

Submerged locations	Stainless steel.
Locations subject to splashing	Stainless steel.
Buried locations	Stainless steel.
Anchorage of structural steel columns	Galvanized steel.
Other exterior locations	Galvanized steel.
Interior locations not subject to corrosion	Carbon steel.

Adhesive, Expansion, Screw, and Undercut Anchors

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Submerged locations	Stainless steel.
Locations subject to splashing	Stainless steel.
Buried locations	Stainless steel.
Anchorage of structural steel columns	Stainless steel.
Other exterior locations	Stainless steel.
Interior locations not subject to corrosion	Carbon steel.

1-3. SUBMITTALS. All submittals shall be made in accordance with the Submittal Procedures section.

The following items shall be submitted, as a minimum.

Manufacturer's information for all products supplied under this section, in the form of manufacturer's research reports (from independent organizations such as ICC-ES or IAPMO UES), technical data sheets, and certificates of compliance.

Shop drawings for anchor bolts, anchor rods, and post-installed anchors, including anchor manufacturer, products, and embedment depth. Shop drawings for anchors designed by Contractor's suppliers shall be sealed by a professional engineer licensed in the state of the project.

Anchorage calculations performed by Contractor's suppliers. Calculations shall be prepared and sealed by a professional engineer licensed in the state of the project.

1-4. DELIVERY, STORAGE, AND HANDLING. Materials shall be handled, transported, and delivered in a manner which will prevent damage or corrosion. Damaged materials shall be promptly replaced. Materials shall be shipped and stored in original manufacturer's packaging.

PART 2 - PRODUCTS

2-1. MATERIALS. Unless otherwise indicated on the drawings, materials shall be as indicated below.

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Cast-In-Place Anchor Bolts and Anchor Rods	
Carbon steel	ASTM F1554, Grade 36 with compatible nuts.
Galvanized steel	ASTM F1554, Grade 36 with compatible nuts; hot-dip galvanized, ASTM F2329.
Stainless steel	Bolts, ASTM F593, Alloy Group 1 or 2 (minimum yield strength of 45 ksi); nuts, ASTM F594, Alloy Group 1 or 2.
Flat Washers	ANSI B18.22.1; of the same material as anchor bolts and nuts.
Expansion Anchors in Concrete	Products shall be single component anchors tested in accordance with ICC AC193 and shall have a manufacturer's research report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete, and for resisting seismic forces.
Carbon Steel	Hilti "Kwik-Bolt TZ2", Simpson "Strong-Bolt 2", or DeWalt "Power-Stud+SD2".
Stainless Steel	Hilti "Kwik-Bolt TZ2 SS304", Hilti "Kwik-Bolt TZ2 SS316", Simpson "Strong-Bolt 2", DeWalt "Power-Stud+SD4", or DeWalt "Power-Stud+SD6".
Screw Anchors in Concrete	Products shall be single component anchors tested in accordance with ICC AC193 and shall have a manufacturer's research report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete, and for resisting seismic forces.
Carbon Steel	Hilti "KH-EZ", Simpson "Titen HD", or DeWalt "Screw-Bolt+".
Stainless Steel	Hilti "KH-EZ".

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Undercut Anchors in Concrete	Products shall be tested in accordance with ICC AC193 and shall have a manufacturer's research report in compliance with the applicable building code.
Carbon Steel	Hilti "HDA Undercut Anchor", Simpson "TCA Undercut Anchor", or DeWalt "CCU+ Undercut Anchor".
Stainless Steel	Hilti "HDA-R Undercut Anchor".
Adhesive Anchors in Concrete	Products shall be tested in accordance with ICC AC308 and shall have a manufacturer's research report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete, and for resisting seismic forces.
Threaded Rods and Nuts (Carbon Steel)	ASTM A307 or ASTM F1554 Grade 36.
Threaded Rods and Nuts (Stainless Steel)	ASTM F593, CW.
Reinforcing Bars	ASTM A615, Grade 60, deformed.
Reinforcing Bars, weldable	ASTM A706, Grade 60, deformed.
Adhesive (Epoxy)	Hilti "HIT-RE 500 V3", Simpson "SET-3G", or DeWalt "Pure 110+".
Adhesive (Acrylic)	Hilti "HIT-HY 200 V3", Simpson "AT-XP", or DeWalt "AC200+".

2-2. ANCHORS.

2-2.01. Cast-in-Place Anchor Bolts and Anchor Rods. Cast-in-place anchor bolts and anchor rods shall have forged heads or embedded nuts and washers. Anchors shall be delivered in time to permit setting prior to the placing of structural concrete. Anchor sleeves shall not be used unless acceptable to Engineer. Unless installed in sleeves, anchor bolts and anchor rods shall be provided with sufficient threads to permit a nut to be installed on the concrete side of the concrete form or the supporting template. Two nuts, a jam nut, and a

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washer shall be furnished for cast-in-place anchor bolts and anchor rods indicated on the Drawings to have locknuts; two nuts and a washer shall be furnished for cast-in-place anchor bolts and anchor rods without locknuts.

2-2.02. Adhesive, Expansion, Screw, and Undercut Anchors. Unless otherwise noted, single nuts and washers shall be provided with adhesive anchors, expansion anchors, screw anchors, and undercut anchors. Adhesive anchors shall be free of coatings that would weaken the bond with the adhesive.

PART 3 - EXECUTION

3-1. GENERAL. Anti-seize thread lubricant shall be liberally applied to projecting, threaded portions of stainless steel anchors immediately before tightening of the nuts.

3-1.01. Compliance With Manufacturer's Instructions. Post-installed anchors shall be installed in accordance with the manufacturer's printed installation instructions and all applicable requirements of the manufacturer's research report for the specific anchor system. If conflicts are found between the Drawings, the manufacturer's printed installation instructions, and the manufacturer's research report installation requirements, Contractor shall notify Engineer for resolution.

3-2. CAST-IN-PLACE ANCHOR BOLTS AND ANCHOR RODS. Cast-in-place anchor bolts and anchor rods shall be carefully positioned with templates and secured in the forms prior to placing concrete. Contractor shall verify that anchorage devices are positioned in accordance with the Drawings and with applicable equipment or structure submittal drawings.

Threads, bolts, and nuts spattered with concrete during placement shall be cleaned prior to final installation of the bolts and nuts.

Sleeves shall be filled with non-shrink grout.

3-3. ADHESIVE ANCHORS. Adhesive shall be statically mixed in the field during application. All proportioning and mixing of the components shall be in accordance with the manufacturer's recommendations.

Anchors or bars shall be installed in holes hammer drilled into hardened concrete. Diameter of holes shall be 1/16 inch larger than the outside diameter of the rod or bar unless recommended otherwise by the anchor system manufacturer. Holes shall be prepared by removing all dust and debris using procedures recommended by the adhesive manufacturer.

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Adhesive anchors and holes shall be clean, dry, and free of grease and other foreign matter at the time of installation. The adhesive shall be placed and the rods or bars shall be set in accordance with the recommendations of the manufacturer. Care shall be taken to ensure that all spaces and cavities are filled with adhesive, without voids.

3-3.01. Concrete Installation. Unless indicated otherwise on the Drawings, reinforcing bars shall be embedded to a depth of 15 bar diameters, and threaded rods shall be embedded to a depth that will develop the yield strength of the rod.

Adhesive anchors in concrete shall be installed under the following conditions.

Minimum Age of Concrete Prior to Anchor Installation	21 days.
Concrete Temperature Range	Maximum short-term temperature 162 F, maximum long-term temperature 110 F.
Moisture Condition	Dry concrete.
Type of Lightweight Concrete	N/A
Hole Drilling and Preparation	Hammer drill only.

Installation of adhesive anchors into concrete that are either horizontal or upwardly inclined shall be performed only by personnel certified by the ACI/CRSI Adhesive Anchor Installation Certification Program.

3-4. EXPANSION, SCREW, AND UNDERCUT ANCHORS. Expansion, screw, and undercut anchors shall be installed using all procedures and accessory devices recommended by the anchor manufacturer.

End of Section

PART 1 - DOWNHOLE CONSTRUCTION

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SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for clearing of all areas within the Contract limits and other areas shown, including work designated in permits and other agreements, in accordance with the requirements of Division 1.

B. Related Work Specified in Other Sections Includes:

1. Section 02 40 00 - Demolition
2. Section 31 23 16 - Excavation - Earth and Rock
3. Section 31 23 23 - Backfilling
4. Section 32 92 00 – Lawn Restoration

1.2 DEFINITIONS

A. Clearing: Clearing is the removal from the ground surface and disposal, within the designated areas, of trees, brush, shrubs, down timber, decayed wood, other vegetation, rubbish and debris as well as the removal of fences.

B. Grubbing: Grubbing is the removal and disposal of all stumps, buried logs, roots larger than 1-1/2 inches, matted roots and organic materials.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 TREES AND SHRUBS TO BE SAVED

A. Protection: Protect trees and shrubs within the construction site that are so delineated or are marked in the field to be saved from defacement, injury and destruction.

1. Work within the limits of the tree drip line with extreme care using either hand tools or equipment that will not cause damage to trees.

a. Do not disturb or cut roots unnecessarily. Do not cut roots 1-1/2 inches and larger unless approved.

PART 1 - DOWNHOLE CONSTRUCTION

b. Immediately backfill around tree roots after completion of construction in the vicinity of trees.

c. Do not operate any wheeled or tracked equipment within drip line.

2. Protect vegetation from damage caused by emissions from engine-powered equipment.

3. During working operations, protect the trunk, foliage and root system of all trees to be saved with boards or other guards placed as shown and as required to prevent damage, injury and defacement.

a. Do not pile excavated materials within the drip line or adjacent to the trunk of trees.

b. Do not allow runoff to accumulate around trunk of trees.

c. Do not fasten or attach ropes, cables, or guy wires to trees without permission. When such permission is granted, protect the tree before making fastening or attachments by providing burlap wrapping and softwood cleats.

d. The use of axes or climbing spurs for trimming will not be permitted.

e. Provide climbing ropes during trimming.

4. Remove shrubs to be saved, taking a sufficient earth ball with the roots to maintain the shrub.

a. Temporarily replant if required, and replace at the completion of construction in a condition equaling that which existed prior to removal.

b. Replace in kind if the transplant fails.

5. Have any tree and shrub repair performed by a tree surgeon properly licensed by the State of Florida and within 24 hours after damage occurred.

3.2 CLEARING AND GRUBBING

A. Clearing: Clear all items specified to the limits shown and remove cleared and grubbed materials from the site.

1. Do not start earthwork operations in areas where clearing and grubbing is not complete, except that stumps and large roots may be removed concurrent with excavation.

PART 1 - DOWNHOLE CONSTRUCTION

2. Comply with erosion, sediment control and storm management measures as specified in Division 1.

B. Grubbing: Clear and grub areas to be excavated, areas receiving less than 3 feet of fill and areas upon which structures are to be constructed.

1. Remove stumps and root mats in these areas to a depth of not less than 18 inches below the subgrade of sloped surfaces.

2. Fill all depressions made by the removal of stumps or roots with material suitable for backfill as specified in Section 31 23 23.

C. Limited Clearing: Clear areas receiving more than 3 feet of fill by cutting trees and shrubs as close as practical to the existing ground. Grubbing will not be required.

D. Dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris away to an approved dump. The cost of disposal (including hauling) of cleared and grubbed material and debris shall be considered a subsidiary obligation of the Contractor; the cost of which shall be included in the prices bid for the various classes of work.

3.3 TOPSOIL

A. Stripping: Strip existing topsoil from areas that will be excavated or graded prior to commencement of excavating or grading and place in well-drained stockpiles in approved locations.

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

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SECTION 31 23 16

EXCAVATION - EARTH AND ROCK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for performing opencut excavations to the widths and depths necessary for constructing structures, pipelines and conduits including excavation of any material necessary for any purpose pertinent to the construction of the Work.

B. Related Work Specified In Other Sections Includes:

1. Section 31 10 00 - Site Clearing
2. Section 31 40 00 - Shoring, Sheeting and Bracing
3. Section 31 23 23 - Backfilling
4. Section 03 30 53 – Miscellaneous Cast-in-Place Concrete

1.2 DEFINITIONS

A. Earth: "Earth" includes all materials which, in the opinion of the ENGINEER, do not require blasting, barring, wedging or special impact tools for their removal from their original beds, and removal of which can be completed using standard excavating equipment. Specifically excluded are all ledge and bedrock and boulders or pieces of masonry larger than one cubic yard in volume.

B. Rock: "Rock" includes all materials which, in the opinion of the ENGINEER, require blasting, barring, wedging and/or special impact tools such as jack hammers, sledges, chisels, or similar devices specifically designed for use in cutting or breaking rock for removal from their original beds and which have compressive strengths in their natural undisturbed state in excess of 300 psi. Boulders or masonry larger than one cubic yard in volume are classed as rock excavation.

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

A. Dewatering Excavation Plan: Develop an excavation dewatering plan that considers site ground and groundwater conditions, the type and arrangement of the equipment to be used and the proper method of groundwater disposal. Prepare the dewatering plan before beginning excavations below groundwater. Maintain one copy of the dewatering plan at the project site to be available for inspection while all dewatering operations are underway.

PART 1 - DOWNHOLE CONSTRUCTION

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 GENERAL

A. Clearing: Clear opencut excavation sites of obstructions preparatory to excavation. Clearing in accordance with Section 31 10 00, includes removal and disposal of vegetation, trees, stumps, roots and bushes, except those specified to be protected during trench excavation.

B. Banks: Shore or slope banks to the angle of repose to prevent slides or cave-ins in accordance with Section 31 40 00.

C. Safety: Whenever an excavation site or trench is left unattended by the CONTRACTOR or when an area is not within 100 feet of observation by the CONTRACTOR, the excavation site or trench shall be filled and/or, at the OWNER's discretion, protected by other means to prevent accidental or unauthorized entry. Such protection shall include barricades and other protection devices requested by the ENGINEER or OWNER, including temporary fencing, snow fencing, or temporary "structure" tape. Such safety items shall not relieve the CONTRACTOR of any site safety requirements or liabilities established by Federal, State and local laws and agencies, including OSHA, but is intended as additional safety measures to protect the general public.

D. Hazardous Materials: If encountered, take care of hazardous materials not specifically shown or noted in accordance with Section 01 57 00.

E. During excavation and any site work, storm water pollution prevention measures shall be taken to ensure that water quality criteria are not violated in the receiving water body and all state and local regulatory requirements are met.

3.2 STRUCTURE EXCAVATION

A. Excavation Size: Provide excavations of sufficient size and only of sufficient size to permit the Work to be economically and properly constructed in the manner and of the size specified.

B. Excavation Shape: Shape and dimension the bottom of the excavation in earth or rock to the shape and dimensions of the underside of the structure or drainage blanket wherever the nature of the excavated material permits.

C. Compaction: Before placing foundation slabs, footings or backfill, proof roll the bottom of the excavations to detect soft spots.

PART 1 - DOWNHOLE CONSTRUCTION

1. For accessible areas, proof roll with a ten wheel tandem axle dump truck loaded to at least 15 tons or similarly loaded construction equipment.

2. For small areas, proof roll with a smooth-faced steel roller filled with water or sand, or compact with a mechanical tamper.

3. Make one complete coverage, with overlap, of the area.

4. Overexcavate soft zones and replace with compacted select fill in accordance with Part 3, Section 3.9.

3.3 TRENCH EXCAVATION

A. Preparation: Properly brace and protect trees, shrubs, poles and other structures which are to be preserved. Unless shown or specified otherwise, preserve all trees and large shrubs. Hold damage to the root structure to a minimum. Small shrubs may be preserved or replaced with equivalent specimens.

B. Adequate Space: Keep the width of trenches to a minimum, however provide adequate space for workers to place, joint and backfill the pipe properly.

1. The minimum width of the trench shall be equal to the outside diameter of the pipe at the joint plus 8-inches for unsheeted trench or 12 inches for sheeted trench.

The maximum width of trench, measured at the top of the pipe, shall not exceed the outside pipe diameter plus 2 feet, unless otherwise shown on the drawing details or approved by the ENGINEER. Trench walls shall be maintained vertical from the bottom of the trench to a line measured one foot above the top of the pipe. From one foot above the top of the pipe to the surface the trench walls shall conform with OSHA Regulations.

2. In sheeted trenches, measure the clear width of the trench at the level of the top of the pipe to the inside of the sheeting.

3. Should the maximum trench widths specified above be exceeded without written approval, provide concrete cradle or encasement for the pipe as directed. No separate payment will be made for such concrete cradle or encasement.

C. Depth:

1. Excavate trenches to a minimum depth of 8 inches below the bottom of the pipe or the bottom of encasement for electrical ducts, unless otherwise shown, specified or directed, so that bedding material can be placed in the bottom of the trench and shaped to provide a continuous, firm bearing for duct encasement, pipe barrels and bells.

2. Standard trench grade shall be defined as the bottom surface of the utility to be constructed or placed within the trench. Trench grade for utilities in rock or

PART 1 - DOWNHOLE CONSTRUCTION

other non-cushioning material shall be defined as additional undercuts backfilled with #57 stone compacted in 6-inch lifts, below the standard 8-inches minimum trench undercut. Excavation below trench grade that is not ordered in writing by the ENGINEER shall be backfilled to trench grade and compacted.

D. Unstable or Unsuitable Materials: If unstable or unsuitable material is exposed at the level of the bottom of the trench excavation, excavate the material in accordance with the subsection headed "Authorized Additional Excavation".

1. Material shall be removed for the full width of the trench and to the depth required to reach suitable foundation material.

2. When in the judgment of the ENGINEER the unstable or unsuitable material extends to an excessive depth, the ENGINEER may advise, in writing, the need for stabilization of the trench bottom with additional select fill material, crushed stone, washed shell, gravel mat or the need to provide firm support for the pipe or electrical duct by other suitable methods.

3. Crushed stone, washed shell and gravel shall be as specified in Section 31 23 23.

4. Payment for such trench stabilization will be made under the appropriate Contract Items or where no such items exist, as a change in the Work.

E. Length of Excavation: Keep the open excavated trench preceding the pipe or electrical duct laying operation and the unfilled trench, with pipe or duct in place, to a minimum length which causes the least disturbance. Provide ladders for a means of exit from the trench as required by applicable safety and health regulations.

F. Excavated Material: Excavated material to be used for backfill shall be neatly deposited at the sides of the trenches where space is available. Where stockpiling of excavated material is required, the Contractor shall be responsible for obtaining the sites to be used and shall maintain his operations to provide for natural drainage and not present an unsightly appearance.

G. Water: Allow no water to rise in the trench excavation until sufficient backfill has been placed to prevent pipe or duct flotation.

3.4 SHORT TUNNEL EXCAVATION

A. Short Tunnel Requirements: In some instances, trees, shrubs, utilities, sidewalks and other obstructions may be encountered, the proximity of which may be a hindrance to opencut trench excavation. In such cases, excavate by means of short tunnels in order to protect such obstructions against damage.

1. Construct the short tunnel by hand, auger or other approved method approximately 6 inches larger than the diameter of pipe bells or outer electrical duct encasement.

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2. Consider such short tunnel work incidental to the construction of pipelines or conduits and all appurtenances. The need for short tunnels will not be grounds for additional payment.

3.5 ROCK EXCAVATION

A. Rock Excavation: Excavate rock within the boundary lines and grades as shown, specified or required.

1. Rock removed from the excavation becomes the property of the CONTRACTOR. Transport and dispose of excavated rock at an off site disposal location. Obtain the off site disposal location.

2. Remove all shattered rock and loose pieces.

B. Structure Depths: For cast-in-place structures, excavate the rock only to the bottom of the structure, foundation slab, or drainage blanket.

C. Trench Width: Maintain a minimum clear width of the trench at the level of the top of the pipe of the outside diameter of the pipe barrel plus 4 feet, unless otherwise approved.

D. Trench Depth: For trench excavation in which pipelines or electrical ducts are to be placed, excavate the rock to a minimum depth of 8 inches below the bottom of the pipe or duct encasement. Provide a cushion of sand or suitable crushed rock. Refill the excavated space with pipe bedding material in accordance with Section 31 23 23. Include placing, compacting and shaping pipe bedding material in the appropriate Contract Items.

E. Manhole Depths: For manhole excavation, excavate the rock to a minimum depth of 8 inches below the bottom of the manhole base for pipelines 24 inches in diameter and larger and 6 inches below the bottom manhole base for pipelines less than 24 inches in diameter. Refill the excavated space with pipe bedding material in accordance with Section 31 23 23. Include placing, compacting and shaping pipe bedding material for manhole bases in the appropriate Contract Items.

F. Over-excavated Space: Refill the excavated space in rock below structures, pipelines, conduits and manholes, which exceeds the specified depths with 2,500 psi concrete, crushed stone, washed shell, or other material as directed. Include refilling of over-excavated space in rock as part of the rock excavation.

G. Other Requirements: Follow, where applicable, the requirements of the subsections on "Trench Excavation" and "Structure Excavation".

H. Payment: Rock excavation, including placing, compacting and shaping of the select fill material, will be paid for under the appropriate Contract Items or where no such items exist, as a change in the Work.

I. Blasting is not permitted for this project.

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1. Cover each blast with a woven wire cable mat weighted with heavy timbers. Blasting will not be permitted within 25 feet of existing or of the completed pipeline or structure. Control blasts in tunnels so that the material surrounding the tunnel base proper is not loosened or displaced.

2. Discontinue blasting whenever it is determined that further blasting may injure or damage adjacent rock, masonry, utility lines, or other structures. In such cases, excavate the remaining rock by barring, wedging, or other approved methods.

3. Where sewers, gas, water, steam, or other utility ducts or lines, catch basin connections, or other structures have been exposed during excavation, adequately protect such structures from damage before proceeding with the blasting. Promptly repair any structure damaged by blasting at no addition to the Contract Price.

4. Take due precautions to prevent accidental discharge of electric blasting caps from current induced by radar, radio transmitters, lightning, adjacent powerlines, dust storms or other sources of extraneous electricity.

5. Keep a sufficient quantity of explosives on hand to avoid delay to the Work on the site when rock excavation is in progress. At no time keep a quantity in excess of that which will be required for use within the following 12 hours.

6. Store, handle and use such explosives in conformity with all laws, ordinances, and regulations of the County or governing body governing the storage and use of explosives at the construction site.

7. Provide a magazine keeper to keep accurate daily records and account for each piece of explosive, detonator and equipment from time of delivery at the magazine until used or removed from the site. Abandon no explosives or blasting agents.

8. Take sole responsibility for the methods of handling, use, and storage of explosives and any damage to persons or property resulting therefrom. Approval of these methods or failure to order that blasting be discontinued does not relieve the CONTRACTOR of any of this responsibility.

3.6 FINISHED EXCAVATION

A. Finish: Provide a reasonably smooth finished surface for all excavations, which is uniformly compacted and free from irregular surface changes.

B. Finish Methods: Provide a degree of finish which is ordinarily obtainable from blade-grade operations, except as otherwise specified in Section 31 23 23.

3.7 PROTECTION

A. Traffic and Erosion: Protect newly graded areas from traffic and from erosion.

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B. Repair: Repair any settlement or washing away that may occur from any cause, prior to acceptance. Re-establish grades to the required elevations and slopes.

C. It shall be the CONTRACTOR's responsibility to acquaint himself with all existing conditions and to locate all structures and utilities along the proposed utility alignment in order to avoid conflicts. Where actual conflicts are unavoidable, work shall be coordinated with the facility owner and performed so as to cause as little interference as possible with the service rendered by the facility disturbed. Facilities or structures damaged in the prosecution of the work shall be repaired and/or replaced immediately, in conformance with current standard practices of the industry, or according to the direction of the owner of such facility, at the CONTRACTOR's expense.

D. Other Requirements: Conduct all Work in accordance with the environmental protection requirements specified in Division 1.

3.8 AUTHORIZED ADDITIONAL EXCAVATION

A. Additional Excavation: Carry the excavation to such additional depth and width as authorized in writing, for the following reasons:

1. In case the materials encountered at the elevations shown are not suitable.

2. In case it is found desirable or necessary to go to an additional depth, or to an additional depth and width.

B. Refill Materials: Refill such excavated space with either authorized 2500 psi concrete or compacted select fill material, in compliance with the applicable provisions of Section 31 23 23.

C. Compaction: Where necessary, compact fill materials to avoid future settlement. As a minimum, unless otherwise specified or directed, backfill layers shall not exceed 6-inches in thickness for the full trench width and compaction shall equal 95% of maximum density, or 98% if under paved area of roadway, as determined by using ASTM D 1557. Compaction density tests shall be made at all such backfill areas with spacing not to exceed 100 feet apart and on each 6-inch compacted layer.

D. Payment: Additional earth excavations so authorized and concrete or select fill materials authorized for filling such additional excavation and compaction of select fill materials will be paid for under the appropriate Contract Items or where no such items exist, as a change in the Work.

3.9 UNAUTHORIZED EXCAVATION

A. Stability: Refill any excavation carried beyond or below the lines and grades shown, except as specified in the subsection headed "Authorized Additional Excavation", with such material and in such manner as may be approved in order to provide for the stability of the various structures.

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B. Refill Materials: Refill spaces beneath all manholes, structures, pipelines, or conduits excavated without authority with 2500 psi concrete or compacted select fill material, as approved.

C. Payment: Refill for unauthorized excavation will not be measured and no payment will be made therefor.

3.10 SEGREGATION STORAGE AND DISPOSAL OF MATERIAL

A. Stockpiling Suitable Materials: Stockpile topsoil suitable for final grading and landscaping and excavated material suitable for backfilling or embankments separately on the site in approved locations.

B. Stockpile Locations: Store excavated and other material a sufficient distance away from the edge of any excavation to prevent its falling or sliding back into the excavation and to prevent collapse of the wall of the excavation. Provide not less than 2 feet clear space between the top of any stockpile and other material and the edge of any excavation.

C. Excess Materials: CONTRACTOR shall be responsible to transport and dispose of surplus excavated material and excavated material unsuitable for backfilling or embankments at an off site disposal location secured by the CONTRACTOR.

3.11 REMOVAL OF WATER

A. Water Removal: At all times during the excavation period and until completion and acceptance of the WORK at final inspection, provide ample means and equipment with which to remove promptly and dispose of properly all water entering any excavation or other parts of the WORK. Removal of water from the site may be limited during portions of the year depending on wet or dry season. Contractor shall coordinate with OWNER and ENGINEER on discharge locations.

B. Dry Excavations: Keep the excavation dry.

C. Water Contact: Allow no water to rise over or come in contact with masonry and concrete until the concrete and mortar have attained a set and, in any event, not sooner than 12 hours after placing the masonry or concrete.

D. Discharge of Water: Dispose of water pumped or drained from the Work in a safe and suitable manner without damage to adjacent property or streets or to other work under construction.

E. Protection: Provide adequate protection for water discharged onto streets. Protect the street surface at the point of discharge.

F. Sanitary Sewers: Discharge no water into sanitary sewers.

G. Storm Sewers: Discharge no water containing settleable solids into storm sewers.

PART 1 - DOWNHOLE CONSTRUCTION

H. Repair: Promptly repair any and all damage caused by dewatering the Work.

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

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SECTION 31 23 23

BACKFILLING

PART 1 GENERAL

1.1 SUMMARY

A. General Requirements: Backfill all excavation to the original surface of the ground or to such other grades as may be shown or required. For areas to be covered by topsoil, leave or stop backfill (12) inches below the finished grade or as shown. Obtain approval for the time elapsing before backfilling against masonry structures. Remove from all backfill, any compressible, putrescible, or destructible rubbish and refuse and all lumber and braces from the excavated space before backfilling is started. Leave sheeting and bracing in place or remove as the work progresses.

B. Equipment Limitations: Do not permit construction equipment used to backfill to travel against and over cast-in-place concrete structures until the specified concrete strength has been obtained, as verified by concrete test cylinders. In special cases where conditions warrant, the above restriction may be modified providing the concrete has gained sufficient strength, as determined from test cylinders, to satisfy design requirements for the removal of forms and the application of load.

C. Related Work Specified in Other Sections Includes:

1. Section 31 10 00 - Site Clearing
2. Section 31 23 16 - Excavation – Earth and Rock

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM D 1557 - Standard Test Methods for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures Using 10 lb Rammer and 18 in Drop

PART 2 PRODUCTS

2.1 BACKFILL MATERIAL - GENERAL

A. General: Backfill with sound materials, free from waste, organic matter, rubbish, boggy or other unsuitable materials.

B. General Materials Requirements: Conform materials used for backfilling to the requirements specified. Follow common fill requirements whenever drainage or

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select fill is not specified. Determine and obtain the approval of the appropriate test method where more than one compaction test method is specified.

C. Frozen Materials: Do not use frozen material for backfilling.

2.2 DRAINAGE FILL

A. Materials for Drainage Fill: Use clean gravel, crushed stone, or other suitable material conforming to the gradation specified for drainage fill. Clay and fine particles are unacceptable in drainage fill. Provide drainage fill of a grade between the following limits:

U.S. Standard Sieve	Percent Passing By Weight
1-1/2 inch	100
1 inch	95-100
1/2 inch	45-65
#4	5-15
#16	0-4

2.3 SELECT FILL

A. Materials for Select Fill: Use clean gravel, crushed stone, washed shell, or other granular or similar material as approved which can be readily and thoroughly compacted to 95 percent of the maximum dry density obtainable by ASTM D 1557.

1. Allowed Materials: Grade select fill between the following limits:

U.S. Standard Sieve	Percent Passing By Weight
2 inch	100
1-1/2 inch	90-100
1 inch	75-95
1/2 inch	45-70
#4	25-50
#10	15-40
#200	5-15

2. Unallowed Materials: Very fine sand, uniformly graded sands and gravels, sand and silt, soft earth, or other materials that have a tendency to flow under pressure when wet are unacceptable as select fill.

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2.4 COMMON FILL

A. Materials for Common Fill: Material from on-site excavation may be used as common fill provided that it can be readily compacted to 90 percent of the maximum dry density obtainable by ASTM D 1557, and does not contain unsuitable material. Select fill may be used as common fill at no change in the Contract Price.

B. Granular Materials On-Site: Granular on-site material, which is fairly well graded between the following limits may be used as granular common fill:

U.S. Standard Sieve	Percent Passing by Weight
3 inch	100
#10	50-100
#60	20-90
#200	0-20

A. Cohesive Materials On-Site: Cohesive site material may be used as common fill.

1. The gradation requirements do not apply to cohesive common fill.

2. Use material having a liquid limit less than or equal to 40 and a plasticity index less than or equal to 20.

B. Material Approval: All material used as common fill is subject to approval. If there is insufficient on-site material, import whatever additional off-site material is required which conforms to the specifications and at no additional cost.

2.5 UTILITY PIPE BEDDING

A. Initial Bedding: Use #57 stone located 8-inches under pipe and to springline of pipe as shown on the drawings.

B. Final Bedding: Use select fill in 6-inch lifts from springline to backfill zone as shown on the drawings.

C. Backfill Zone: Use select fill in 6-inch lifts from final bedding to ground surface as shown on the drawings.

PART 1 - DOWNHOLE CONSTRUCTION

PART 3 EXECUTION

3.1 ELECTRICAL DUCT AND PRECAST MANHOLE BEDDING

A. Bedding Compaction: Bed all electrical ducts and precast manholes in well graded, compacted, select fill conforming to the requirements except as otherwise shown, specified, or required. Extend electrical duct bedding a minimum of 6 inches below the bottom of the duct encasement for the full trench width. Compact bedding thickness no less than 6 inches for precast concrete manhole bases.

B. Concrete Work Mats: Cast cast-in-place manhole bases and other foundations for structures against a 2500 psi concrete work mat in clean and dry excavations, unless otherwise shown, specified or required.

C. Bedding Placement: Place select fill used for bedding beneath electrical ducts and precast manhole bases, in uniform layers not greater than 9 inches in loose thickness. Thoroughly compact in place with suitable mechanical or pneumatic tools to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.

D. Use of Select Fill: Bed existing underground structures, tunnels, conduits and pipes crossing the excavation with compacted select fill material. Place bedding material under and around each existing underground structure, tunnel, conduit or pipe and extend underneath and on each side to a distance equal to the depth of the trench below the structure, tunnel, conduit or pipe.

3.2 PIPE BEDDING AND INITIAL BACKFILL

A. Hand Placement: Place select fill by hand for initial pipe backfill from top of bedding to 1 foot over top of pipes in uniform layers not greater than 6 inches in loose thickness. Tamp under pipe haunches and thoroughly compact in place the select fill with suitable mechanical or pneumatic tools to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.

B. Stone Placement: Do not place large stone fragments in the pipe bedding or backfill to 1 foot over the top of pipes, nor nearer than 2 feet at any point from any pipe, conduit or concrete wall.

C. Unallowed Materials: Pipe bedding containing very fine sand, uniformly graded sands and gravels, sand and silt, soft earth, or other materials that have a tendency to flow under pressure when wet is unacceptable.

3.3 BEDDING PLACEMENT AND BACKFILL FOR PIPE IN SHORT TUNNEL

A. Bed pipelines or electrical ducts placed in short tunnels in select fill or 2500 psi concrete. Completely fill the remainder of the annular space between the outside of the pipe wall and the tunnel wall with select fill, suitable job-excavated material, or 2500 psi concrete, as approved. Suitably support pipelines or ducts in short tunnels to permit placing of backfill suitably tamped in place.

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3.4 TRENCH BACKFILL

A. General: Backfill material shall be clean earth fill composed of sand, clay and sand, sand and stone, crushed stone, or an approved combination thereof. Backfilling shall be accomplished under two specified requirements: First Lift, from trench grade to a point 12 inches above the top of the utility, and, Second Lift, from the top of the First Lift to the ground surface. Where thrust blocks, encasements, or other below-grade concrete work have been installed, backfilling shall not proceed until the concrete has obtained sufficient strength to support the backfill load.

B. First Lift: Fine material shall be carefully placed and tamped around the lower half of the utility. Backfilling shall be carefully continued in compacted and tested layers not exceeding 6 inches in thickness for the full trench width, until the fill is 12 inches above the top of the utility, using the best available material from the excavation, if approved. The material for these first layers of backfill shall be lowered to within 2 feet above the top of pipes before it is allowed to fall, unless the material is placed with approved devices that protect the pipes from impact. The "First Lift" shall be thoroughly compacted and tested before the "Second Lift" is placed. Unless otherwise specified, compaction shall equal 98% of maximum density, as determined by ASTM D 1557. The "First Lift" backfill shall exclude stones, or rock fragments larger than the following:

Pipe Type	(Greatest Dimension-Inches) Fragment Size (Inches)
Steel	2
Concrete	2
Ductile Iron	2
Plastic	1
Fiberglass	1

C. Second Lift: The remainder of the trench, above the "First Lift", shall be backfilled and tested in layers not exceeding 6 inches. The maximum dimension of a stone, rock, or pavement fragment shall be 6 inches. When trenches are cut in pavements or areas to be paved, compaction, as determined by ASTM D 1557, shall be equal to 98% of maximum density, with compaction in other areas not less than 95% of maximum density in unpaved portions of the Rights-of-Way or 90% of maximum density in other areas.

As an alternative, or if required under roadways, Flowable Fill may be substituted. If Flowable Fill is to be used, a fabric mesh shall be installed between the “first lift” and the Flowable Fill. Flowable Fill shall be in accordance with Section 4.7.AH of the Lee County Utilities Operations Manual.

D. Compaction Methods: The above specified compaction shall be accomplished using accepted standard methods (powered tampers, vibrators, etc.), with exception that the first two feet of backfilling over the pipe shall be compacted by hand-operated tamping devices. Flooding or puddling with water to consolidate backfill is not

acceptable, except where sand is the only material utilized and encountered and the operation has been approved by the OWNER.

E. Density Tests: Density tests for determination of the above specified compaction shall be made by an independent testing laboratory and certified by a Florida Registered, Professional ENGINEER at the expense of the Developer or CONTRACTOR. Test locations will be determined by the OWNER but in any case, shall be spaced not more than 100 feet apart where the trench cut is continuous. If any test results are unsatisfactory, the CONTRACTOR shall re-excavate and re-compact the backfill at his expense until the desired compaction is obtained. Additional compaction tests shall be made to each site of an unsatisfactory test, as directed, to determine the extent of re-excavation and re-compaction if necessary.

Copies of all density test results shall be furnished on a regular basis by the ENGINEER, to Lee County Utilities. Failure to furnish these results will result in the project not being recommended for acceptance by Lee County

F. Dropping of Material on Work: Do trench backfilling work in such a way as to prevent dropping material directly on top of any conduit or pipe through any great vertical distance. Do not allow backfilling material from a bucket to fall directly on a structure or pipe and, in all cases, lower the bucket so that the shock of falling earth will not cause damage.

G. Distribution of Large Materials: Break lumps up and distribute any stones, pieces of crushed rock or lumps which cannot be readily broken up, throughout the mass so that all interstices are solidly filled with fine material.

3.5 STRUCTURE BACKFILL

A. Use of Select Fill: Use select fill underneath all structures, and adjacent to structures where pipes, connections, electrical ducts and structural foundations are to be located within this fill. Use select fill beneath all pavements, walkways, and railroad tracks, and extend to the bottom of pavement base course or ballast.

1. Place backfill in uniform layers not greater than 8 inches in loose thickness and thoroughly compact in place with suitable approved mechanical or pneumatic equipment.

2. Compact backfill to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.

B. Use of Common Fill: Use common granular fill adjacent to structures in all areas not specified above, unless otherwise shown or specified. Select fill may be used in place of common granular fill at no additional cost.

1. Extend such backfill from the bottom of the excavation or top of bedding to the bottom of subgrade for lawns or lawn replacement, the top of previously existing ground surface or to such other grades as may be shown or required.

PART 1 - DOWNHOLE CONSTRUCTION

2. Place backfill in uniform layers not greater than 8 inches in loose thickness and thoroughly compact in place with suitable equipment, as specified above.

3. Compact backfill to not less than 90 percent of the maximum dry density as determined by ASTM D 1557.

C. Use of Clay: In unpaved areas adjacent to structures for the top 1 foot of fill directly under lawn subgrades use clay backfill placed in 6-inch lifts. Compact clay backfill to not less than 90 percent of the maximum dry density as determined by ASTM D 1557.

1. Use clay having a liquid limit less than or equal to 40 and a plasticity index less than or equal to 20.

3.6 EARTH EMBANKMENTS

A. Use of Cohesive Materials: Make all earth embankments of approved cohesive common fill material.

1. Place fill in uniform layers not greater than 10 inches in loose thickness. Compact in place with suitable approved mechanical equipment.

2. Compact earth embankments to not less than 90 percent of the maximum dry density as determined by ASTM D 1557.

3. Do not use cohesionless, granular material as earth embankment backfill, unless otherwise shown or required.

3.7 COMPACTION EQUIPMENT

A. Equipment and Methods: Carry out all compaction with suitable approved equipment and methods.

1. Compact clay and other cohesive material with sheep's-foot rollers or similar equipment where practicable. Use hand held pneumatic tampers elsewhere for compaction of cohesive fill material.

2. Compact low cohesive soils with pneumatic-tire rollers or large vibratory equipment where practicable. Use small vibratory equipment elsewhere for compaction of cohesionless fill material.

3. Do not use heavy compaction equipment over pipelines or other structures, unless the depth of fill is sufficient to adequately distribute the load.

3.8 BORROW

A. Should there be insufficient material from the excavations to meet the requirements for fill material, borrow shall be obtained from pits secured and tested by the CONTRACTOR and approved by the OWNER. Copies of all test results shall be

PART 1 - DOWNHOLE CONSTRUCTION

submitted to Lee County Utilities.

3.9 FINISH GRADING

A. Final Contours: Perform finish grading in accordance with the completed contour elevations and grades shown and blend into conformation with remaining natural ground surfaces.

1. Leave all finished grading surfaces smooth and firm to drain.

2. Bring finish grades to elevations within plus or minus 0.10 foot of elevations or contours shown.

B. Surface Drainage: Perform grading outside of building or structure lines in a manner to prevent accumulation of water within the area. Where necessary or where shown, extend finish grading to ensure that water will be carried to drainage ditches, and the site area left smooth and free from depressions holding water.

3.10 RESPONSIBILITY FOR AFTERSETTLEMENT

A. Aftersettlement Responsibility: Take responsibility for correcting any depression which may develop in backfilled areas from settlement within one year after the work is fully completed. Provide as needed, backfill material, pavement base replacement, permanent pavement, sidewalk, curb and driveway repair or replacement, and lawn replacement, and perform the necessary reconditioning and restoration work to bring such depressed areas to proper grade as approved.

3.11 INSPECTION AND TESTING OF BACKFILLING

A. Sampling and Testing: Provide sampling, testing, and laboratory methods in accordance with the appropriate ASTM Standard Specification. Subject all backfill to these tests.

B. Compaction density tests shall be made at all such backfill areas with spacing not to exceed 100 feet apart and on each 6-inch compacted layer.

C. Correction of Work: Correct any areas of unsatisfactory compaction by removal and replacement, or by scarifying, aerating or sprinkling as needed and recompaction in place prior to placement of a new lift.

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

SECTION 31 40 00

SHORING, SHEETING AND BRACING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Work required for protection of an excavation or structure through shoring, sheeting, and bracing.

B. Related Work Specified in Other Sections Includes:

1. Section 31 23 16 - Excavation - Earth and Rock
2. Section 31 23 23 - Backfilling

1.2 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. CONTRACTOR's Submittals: All sheeting and bracing shall be the responsibility of the CONTRACTOR to retain qualified design services for these systems, and to be completed with strict adherence to OSHA Regulations. Submit complete design calculations and working drawings of proposed shoring, sheeting and bracing which have been prepared, signed and sealed by a Licensed Professional Engineer experienced in Structural Engineering and registered in the State of Florida, before starting excavation for jacking pits and structures. Use the soil pressure diagram shown for shoring, sheeting and bracing design. ENGINEER's review of calculations and working drawings will be limited to confirming that the design was prepared by a licensed professional engineer and that the soil pressure diagram shown was used.

1.3 REFERENCES

A. Design: Comply with all Federal and State laws and regulations applying to the design and construction of shoring, sheeting and bracing.

B. N.B.S. Building Science Series 127 "Recommended Technical Provisions for Construction Practice in Shoring and Sloping Trenches and Excavations.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Do work in accordance with the U.S. Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54), and the Florida Trench Safety Act. The

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CONTRACTOR shall also observe 29 CFR 1910.46 OSHA's regulation for Confined Space Entry.

PART 2 PRODUCTS

2.1 MANUFACTURERS AND MATERIALS

A. Material Recommendations: Use manufacturers and materials for shoring, sheeting and bracing as recommended by the Licensed Professional Engineer who designed the shoring, sheeting, and bracing.

PART 3 EXECUTION

3.1 SHORING, SHEETING AND BRACING INSTALLATION

A. General: Provide safe working conditions, to prevent shifting of material, to prevent damage to structures or other work, to avoid delay to the work, all in accordance with applicable safety and health regulations. Properly shore, sheet, and brace all excavations which are not cut back to the proper slope and where shown. Meet the general trenching requirements of the applicable safety and health regulations for the minimum shoring, sheeting and bracing for trench excavations.

1. CONTRACTOR's Responsibility: Sole responsibility for the design, methods of installation, and adequacy of the shoring, sheeting and bracing.

B. Arrange shoring, sheeting and bracing so as not to place any strain on portions of completed work until the general construction has proceeded far enough to provide ample strength.

C. If ENGINEER is of the opinion that at any point the shoring, sheeting or bracing are inadequate or unsuited for the purpose, resubmission of design calculations and working drawings for that point may be ordered, taking into consideration the observed field conditions. If the new calculations show the need for additional shoring, sheeting and bracing, it should be installed immediately.

D. Monitoring: Periodically monitor horizontal and vertical deflections of sheeting. Submit these measurements for review.

E. Accurately locate all underground utilities and take the required measures necessary to protect them from damage. All underground utilities shall be kept in service at all times as specified in Division 1.

F. Driven Sheeting: Drive tight sheet piling in that portion of any excavation in paved or surface streets City collector and arterial streets and in State and County highways below the intersection of a one-on-one slope line from the nearest face of the excavation to the edge of the existing pavement or surface.

PART 1 - DOWNHOLE CONSTRUCTION

G. Sheeting Depth: In general drive or place sheeting for pipelines to a depth at elevation equal to the top of the pipe as approved.

1. If it is necessary to drive sheeting below that elevation in order to obtain a dry trench or satisfactory working conditions, cut the sheeting off at the top of the pipe and leave in place sheeting below the top of the pipe.

2. Cut off sheeting not designated as "Sheeting Left in Place". The cut ends of sheeting left adjacent to the pipe will be paid for as "Sheeting Left in Place".

3. Do not cut the sheeting until backfill has been placed and compacted to the top of the pipe.

H. Sheeting Removal: In general, remove sheeting and bracing above the top of the pipe as the excavation is refilled in a manner to avoid the caving in of the bank or disturbance to adjacent areas or structures. Sheeting shall be removed as backfilling progresses so that the sides are always supported or when removal would not endanager the construction of adjacent structures. When required to eliminate excessive trench width or other damages, shoring or bracing shall be left in place and the top cut off at an elevation 2.5 feet below finished grade, unless otherwise directed.

1. Carefully fill voids left by the withdrawal of the sheeting by jetting, ramming or otherwise.

2. No separate payment will be made for filling of such voids.

I. Permission for Removal: Obtain permission before the removal of any shoring, sheeting or bracing. Retain the responsibility for injury to structures or to other property or persons from failure to leave such shoring, sheeting and bracing in place even though permission for removal has been obtained.

J. Preload internal braces to 50 percent of the design loads.

K. Proof test tie backs to 133 percent of the design loads and lock off tie backs at 75 percent of the design loads.

3.2 SHEETING LEFT IN PLACE FOR PROTECTION

A. Ordered Left in Place: In addition to sheeting specified or shown to be left in place, the ENGINEER may order, in writing, any or all other shoring, sheeting or bracing to be left in place for the purpose of preventing injury to the structures, pipelines or to other property or to persons.

PART 1 - DOWNHOLE CONSTRUCTION

1. Cutoff sheeting left in place at the elevation shown or ordered, but, in general, at least 2.5 feet below the final ground surface.

2. Drive up tight any bracing remaining in place.

B. Right to Order: Do not construe the right to order shoring, sheeting and bracing left in place as creating any obligation to issue such orders.

C. Payment: Shoring, sheeting and bracing left in place, by written order, will be paid for under the appropriate Contract Items or where no such items exist, as changes in the work.

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

SECTION 32 10 01

PAVEMENT REPAIR AND RESTORATION

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and remove and replace pavements over trenches excavated for installation of pipelines as shown on the drawings and/or specified herein.

1.2 GENERAL

A. All damage, as a result of work under this project, done to existing pavement, driveways, paved areas, curbs and gutters, sidewalks, shrubbery, grass, trees, utility poles, utility pipe lines, conduits, drains, catch basins, or stabilized areas or driveways and including all obstructions not specifically named herein, shall be repaired in a manner satisfactory to the ENGINEER. Bid prices shall include the furnishing of all labor, materials, equipment, and incidentals necessary for the cutting, repair, and restoration of the damaged areas unless pay items for specific types of repair are included in the Bid Form.

B. Keep the surface of the backfilled area of excavation in a safe condition and level with the remaining pavement until the pavement is restored in the manner specified herein. All surface irregularities that are dangerous or obstructive to traffic are to be removed. The repair shall conform to applicable OWNER or State requirements for pavement repair and as described herein.

C. All materials and workmanship shall be first class and nothing herein shall be construed as to relieve the CONTRACTOR from this responsibility. The OWNER reserves the right to require soil bearing or loading tests or materials tests, should the adequacy of the foundation or the quality of materials used be questionable. Costs of these tests shall be borne by the OWNER, if found acceptable; the costs of all failed tests shall be borne by the CONTRACTOR.

D. All street and road repair shall be made in accordance with the details indicated on the drawings and in accordance with the applicable requirements of these Specifications and meeting the permit requirements and approval of the governing Department of Transportation agencies.

E. Pavement or roadway surfaces cut or damaged shall be replaced by the CONTRACTOR in equal or better condition than the original, including stabilization, base course, surface course, curb and gutter or other appurtenances. The CONTRACTOR shall obtain the necessary permits prior to any roadway work.

PART 1 - DOWNHOLE CONSTRUCTION

Additionally, the CONTRACTOR shall provide advance notice to the appropriate authority, as required, prior to construction operations.

1. Roadway Restoration (within Lee County Department of Transportation & Engineering jurisdiction): Restoration shall be in accordance with the requirements set forth in the “Right-of-Way Utility Construction Activities Policy” and these Standards. The materials of construction and method of installation, along with the proposed restoration design for items not referred or specified herein, shall receive prior approval from Lee County DOT.

    a. Where existing pavement is to be removed, the surface shall be mechanical saw cut prior to trench excavation, leaving a uniform and straight edge parallel or perpendicular to the roadway centerline with minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimal.

    b. Immediately following the specified backfilling and compaction, a temporary sand seal coat surface shall be applied to the cut areas. This temporary surfacing shall provide a smooth traffic surface with the existing roadway and shall be maintained until final restoration. Said surfacing shall remain for a minimum of ten (10) days in order to assure the stability of the backfill under normal traffic conditions. Thirty (30) days following this period and prior to sixty (60) days after application, the temporary surfacing shall be removed and final roadway surface restoration accomplished.

    c. In advance of final restoration, the temporary surfacing shall be removed and the existing pavement mechanically sawed straight and clean to the stipulated dimensions, if needed. Following the above operation, the CONTRACTOR shall proceed immediately with final pavement restoration in accordance with the requirements set forth by Lee County Department of Transportation.

2. Roadway Restoration (outside Lee County Department of Transportation jurisdiction) – Work within the rights-of-way of public thoroughfares which are not under jurisdiction of Lee County, shall conform to the requirements of the Governmental agency having jurisdiction or the Florida Department of Transportation, if no governmental agencies have jurisdiction. Work within State Highway right-of-way shall be in full compliance with all requirements of the permit drawings, and to the satisfaction of the Florida Department of Transportation.

1.3 QUALITY ASSURANCE

A. Applicable provisions of the latest version of the Florida Department of Transportation "Standard Specifications for Road and Bridge Construction", and Supplemental Specifications hereunder govern the work under this Section. The Florida Department of Transportation will hereafter be referred to as FDOT.

PART 1 - DOWNHOLE CONSTRUCTION

PART 2 PRODUCTS

2.1 MATERIALS

A. All materials utilized in flexible base pavement and base course shall be as specified in the latest version of the Florida Department of Transportation "Standard Specifications for Road and Bridge Construction".

PART 3 EXECUTION

3.1 CUTTING PAVEMENT

A. Cut and remove pavement as necessary for installing the new pipelines and appurtenances and for making connections to existing pipelines.

B. Before removing pavement, the pavement shall be marked for cuts nearly paralleling pipelines and existing street lines. Asphalt pavement shall be cut along the markings with a jackhammer, rotary saw, or other suitable tool, leaving a uniform and straight edge with minimum disturbance to the remaining adjacent surface.

C. No pavement shall be machine pulled until completely broken and separated along the marked cuts.

D. The pavement adjacent to pipeline trenches shall neither be disturbed nor damaged. If the adjacent pavement is disturbed or damaged, irrespective of cause, remove the damaged pavement and shall replace it at his own expense.

3.2 GENERAL RESTORATION

A. The restoration of existing street paving, driveways, etc., shall be restored, replaced or rebuilt using the same type of construction as was in the original. Be responsible for restoring all such work, including sub-grade and base courses where present. Obtain and pay for such local or other governmental permits as may be necessary for the opening of streets. Meet any requirements other than those herein set forth which may effect the type, quality and manner of carrying on the restoration of surfaces by reason of jurisdiction of such governmental bodies.

B. In all cases, maintain, without additional compensation, all permanent replacement of street paving, done by him under this Contract until accepted by the OWNER, including the removal and replacement of such work wherever surface depressions or underlying cavities result from settlement of trench backfill.

C. Complete all the final resurfacing or re-paving of streets or roads, over the excavations and relay paving surfaces of roadbed that have failed or been damaged prior to acceptance by the OWNER. Backfilling of trenches and the preparation of sub-grades shall conform to the requirements of Section 31 23 23.

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D. All re-paving or resurfacing shall be done in accordance with Florida Department of Transportation Specifications, to which the following requirement of trench backfill will be added: Where pipeline construction crossed paved areas such as streets, the top 24 inches of trench below the road bases or concrete slabs shall be backfilled with compacted A-4 or better matter that will provide a bearing value of not less than 75 when tested by the Florida Department of Transportation Soil Bearing Test Methods.

3.3 PRIME AND TACK COATS

A. The work shall consist of the application of bituminous prime and tack coats on the previously prepared base course in accordance with Section 300 of the FDOT Specifications.

3.4 WEARING COURSE

A. The work shall consist of the construction of plant-mixed hot bituminous pavement to the thickness indicated in the drawings conforming to Type III asphaltic concrete in accordance with Section 333 of the FDOT Specifications. The requirements for plant and equipment are specified in Section 320 and the general construction requirements for asphaltic concrete pavement are contained in Section 330 of the FDOT specifications.

3.5 TESTING

A. All field testing shall be performed by an independent laboratory employed by the OWNER. All materials shall be tested and certified by the producer. Tests repeated because sub-grade or base does not meet specified compaction shall be at the CONTRACTOR's expense.

3.6 MISCELLANEOUS RESTORATION

A. Sidewalks cut or damaged by construction shall be restored in full sections or blocks to a minimum thickness of four inches. Concrete curb or curb gutter shall be restored to the existing height and cross section in full sections or lengths between joints. Concrete shall be as specified on the drawings. Grassed yards, shoulders and parkways shall be restored to match the existing sections with grass seed or sod of a type matching the existing grass.

PART 1 - DOWNHOLE CONSTRUCTION

3.7 CLEANUP

A. After all repair and restoration or paving has been completed, all excess asphalt, dirt, and other debris shall be removed from the roadways. All existing storm sewers and inlets shall be checked and cleaned of any construction debris.

END OF SECTION

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SECTION 32 92 00

LAWN RESTORATION

PART 1 GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. The work in this section consists of furnishing all labor, material and equipment to replace and maintain all areas disturbed during construction by establishing a stand of grass, within the areas called for by the furnishing and placing grass sod, or seeding, or seeding and mulching.

1.2 REFERENCE DOCUMENTS

A. The materials used in this work shall conform to the requirements of Florida Department of Transportation Standard Specifications for Road and Bridge Construction as follows:

1. Sod - Section 981-2
2. Fertilizer - Section 982
3. Water - Section 983

1.3 SUBMITTALS

A. Submit certifications and identification labels for all sodding supplied as specified in Section 01 33 00.

PART 2 PRODUCTS

2.1 SODDING

A. Types: Sod may be of either St. Augustine or Argentine Bahia grass or as that disturbed, as established prior to construction. It shall be well matted with roots. When replacing sod in areas that are already sodded, the sod shall be the same type as the existing sod.

B. Sod shall be provided as required in accordance with Florida Department of Transportation Specifications 575 and 981. The CONTRACTOR shall furnish sod equal to and similar in type as that disturbed. Placement and watering requirements shall be in accordance with FDOT Specifications Section 575.

C. The sod shall be taken up in commercial-size rectangles, preferably 12-inch by 24- inch or larger, except where 6-inch strip sodding is called for.

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D. The sod shall be sufficiently thick to secure a dense stand of live grass. The sod shall be live, fresh and uninjured at the time of planting. It shall have a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary handling. It shall be reasonably free of weeds and other grasses. It shall be planted as soon as possible after being dug and shall be shaded and kept moist from the time it is dug until it is planted.

E. Sod should be handled in a manner to prevent breaking or other damage. Sod shall not be handled by pitch forks or by dumping from trucks or other vehicles. Care shall be taken at all times to retain the native soil on the roots of each sod roll during stripping and handling. Sod that has been damaged by handling during delivery, storage or installation will be rejected.

2.2 FERTILIZER

A. Chemical fertilizer shall be supplied in suitable bags with the net weight certification of the shipment. Fertilizer shall be 12-8-8 and comply with Section 982 of the FDOT Standard Specification for Road and Bridge Construction.

B. The numerical designations for fertilizer indicate the minimum percentages (respectively) of (1) total nitrogen, (2) available phosphoric acid and (3) water soluble potash, contained in the fertilizer.

C. The chemical designation of the fertilizer shall be 12-8-8, with at least 50 percent of the nitrogen from a nonwater-soluble organic source. The nitrogen source may be a unreaformaldehyde source provided it is not derived from a waste product of the plastic industry.

2.3 EQUIPMENT

A. The device for spreading fertilizer shall be capable of uniformly distributing the material at the specified rate.

2.4 NETTING

A. Netting is fabricated of material similar to Geoscope Landscape Fabric or approved equal.

2.5 GRASSING

A. The CONTRACTOR shall grass all unpaved areas disturbed during construction which do not require sod. All grassing shall be completed in conformance with FDOT Specifications Sections 570 and 981. The grassed areas shall be mulched and fertilized in accordance with FDOT Specifications.

B. Grass seed shall be Argentine Bahia, 60 #/acre March 1 to November 1, 50 #/acre with 20 #/acre of rye grass seed November 1 to March 1. Argentine Bahia seed shall be a scarified seed having a minimum active germination of 40% and total of 85%.

PART 1 - DOWNHOLE CONSTRUCTION

C. Mulch material shall be free of weeds and shall be oat straw or rye, Pangola, peanut, Coastal Bermuda, or Bahia grass hay.

2.6 TOPSOIL

A. Topsoil stockpiled during excavation may be used. If additional topsoil is required to replace topsoil removed during construction, it shall be obtained off site at no additional cost to the OWNER. Topsoil shall be fertile, natural surface soil, capable of producing all trees, plants, and grassing specified herein.

2.7 MULCH

A. Mulch shall be fresh cypress mulch. Rate of application specified herein shall correspond to depth not less than 1-inch or more than 3-inches according to texture and moisture content of mulch material.

2.8 WATER

A. It is the CONTRACTOR'S responsibility to supply all water to the site, as required during seeding and sodding operations and through the maintenance period and until the work is accepted. The CONTRACTOR shall make whatever arrangements may be necessary to ensure an adequate supply of water to meet the needs for his work. Internal plant non-potable water is available for irrigating on the plant site. There are existing connections on-site. He shall also furnish all necessary hose, equipment, attachments, and accessories for the adequate irrigation of lawns and planted areas as may be required. Water shall be suitable for irrigation and free from ingredients harmful to plant life.

PART 3 EXECUTION

3.1 SOD BED PREPARATION

A. Areas to be sodded and/or seeded shall be cleared no all rough grass, weeds, and debris, and brought to an even grade.

B. The soil shall then be thoroughly tilled to a minimum 8-inch depth.

C. The areas shall then be brought to proper grade, free of sticks, stones, or other foreign matter over 1-inch in diameter or dimension. The surface shall conform to finish grade, less the thickness of sod, free of water-retaining depressions, the soil friable and of uniformly firm texture.

3.2 INSPECTION

A. Verify that soil preparation and related preceding work has been completed.

B. Do not start work until conditions are satisfactory.

PART 1 - DOWNHOLE CONSTRUCTION

3.3 SOD HANDLING AND INSTALLATION

A. During delivery, prior to planting, and during the planting of sod areas, the sod panels shall at all times be protected from excessive drying and unnecessary exposure of the roots to the sun. All sod shall be stacked during construction and planting so as not to be damaged by sweating or excessive heat and moisture.

B. After completion of soil conditioning as specified above, sod panels shall be laid tightly together so as to make a solid sodded lawn area. On mounds and other slopes, the long dimension of the sod shall be laid perpendicular to the slope. Immediately following sod laying the lawn areas shall be rolled with a lawn roller customarily used for such purposes, and then thoroughly watered.

C. Sod shall be placed at all areas where sod existed prior to construction, on slopes of 3 horizontal on 1 vertical (3:1) or greater, in areas where erosion of soils will occur, and as directed by the ENGINEER. On areas where the sod may slide, due to height and slope, the ENGINEER may direct that the sod be pegged, with pegs driven through the sod blocks into firm earth, at suitable intervals.

3.4 USE OF SOD ON ROADWAY PROJECTS

A. In accordance with the FDOT District One Standard Practice, permanent green grass shall be established at the completion of roadway construction and maintenance work. The following shall apply to all restoration involving State or County roadways:

1. Sod in lieu of seed and mulch shall be used on all roadways with urban (raised curb) typical sections.
2. One inch water per week shall be required for a minimum of four (4) consecutive weeks for the purpose of establishing sod. This can be waived during construction, if and only if there is a minimum of one inch of rain per week on all sod on the project.
3. Sod shall be placed on slopes 1:3 or greater. Staked sod shall be placed on slopes 1:2 or greater.
4. On all curves with superelevation, sod shall be placed from the edge of pavement to the toe of slope on the downhill side(s) for the entire length of the superelevated roadway. On multi-lane divided rural facilities, sod shall be placed in the median and on the inside of the curve in the superelevated areas. This does not apply to reverse crowns.
5. For all projects with less than 10,000 square yards grass area, sod shall be used.
6. On tangent sections and on outside of curves, sod shall be used between the edge of pavement and a point 4 feet beyond the shoulder break point.
7. The entire width of sod should not exceed 15 feet from the edge of pavement.
8. Sod is to be used to eliminate narrow seed and mulch areas. Areas less than 6 feet in width shall be sodded.
9. Sod shall be placed around drainage structures as per the standard Indexes and extended to the edge of pavement.

PART 1 - DOWNHOLE CONSTRUCTION

3.5 SOD MAINTENANCE

A. The sod shall produce a dense, well established growth. The CONTRACTOR shall be responsible for the repair and re-sodding of all eroded or bare spots until project acceptance. Repair to sodding shall be accomplished as in the original work.

B. Sufficient watering shall be done by the CONTRACTOR to maintain adequate moisture for optimum development of the seeded and sodded areas. Sodded areas shall receive no less than 1.5 inches of water per week for at least 2 weeks. Thereafter, the CONTRACTOR shall apply water for a minimum of 60 days as needed until the sod takes root and starts to grow or until final acceptance, whichever is latest.

3.6 CLEANING

A. Remove debris and excess materials from the project site.

END OF SECTION

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SECTION 33 26 01

FLUID MANAGEMENT (FORMATION WATER CONTROL AND DISCHARGE SYSTEM)

PART 1 GENERAL

1.01 RELATED WORK

A. This section covers formation water discharged to a settling tank(s) then developed settled water will be conveyed to the storage tank overflow drain located on the north side of the Three Oaks WRF as specified in the Drawings. This corresponds to the injection well under construction in accordance with **Section 01 11 00 - Summary of Work**, **Section 33 26 04 - Well Drilling** and **Section 33 26 10, Well Development.**

1.02 THE REQUIREMENT

A. The CONTRACTOR may utilize equipment as detailed below. CONTRACTOR shall provide all piping and valves to convey discharge water to and from the on Site settling tank(s) and control flow rates so as not to surcharge the capacity of the tank(s).

B. The CONTRACTOR shall submit to the ENGINEER and LCU a plan for drilling, development, and test water disposal. The plan shall consist of pipe lengths, diameters, and materials, meter installation locations; turbidity barrier and erosion control measure manufacturer, design and placement; monitoring station identification, location, sample method, laboratory, and list of water quality analyses and sample frequency in accordance with the requirements of these specifications.

C. Multiple settling methods may be required by the CONTRACTOR before the formation water enters the Three Oaks WRF storage tank drain. The CONTRACTOR may consider using two or more methods simultaneously to meet these requirements.

D. The CONTRACTOR shall meet or exceed LCU's discharge water quality standards and meet the following requirements:

1. 200 mg/l Total Suspended Solids (TSS) or less.
2. Parameters to be continuously monitored and recorded every 15 minutes using a local data logger are flow, TSS, turbidity and conductivity. The CONTRACTOR is responsible for providing the instruments and calibrating these on a quarterly basis or as requested by LCU. Data shall be provided to LCU on a weekly basis.
3. Chloride concentration shall be measured and reported to the plant regularly and as requested by LCU.
4. Owner requests that Contractor provide two TSS meters.
5. Sand content shall not exceed 50 mg/L.
6. Maximum flow into the Three Oaks WRF process stream shall not exceed 500 gpm.

E. In the event any of the Owner's discharge water quality standards or requirements stated above, the Contractor shall stop formation water discharge

PART 1 - DOWNHOLE CONSTRUCTION

to water reclamation facility and / or injection well system until requirements are met.

PART 1 PRODUCTS

1.01 GENERAL

A. Provide all labor, materials, equipment, and temporary facilities to manage settled formation water discharges to the Three Oaks WRF storage tank.

1.02 EQUIPMENT

A. The CONTRACTOR shall provide, maintain, and operate internal baffled steel or fiberglass settling tanks with a minimum total capacity of 100,000 gallons for settling of solids from the formation water drilling and testing operation as specified. The multiple tanks shall be connected in series using the uppermost discharge port(s) to provide sufficient retention time for solid separation. A filtration system that meets the Total Suspended Solids (TSS) level approved by LCU shall be used in-line after flow through the onsite retention tank(s) but before discharge to the Three Oaks WRF storage tank. The CONTRACTOR may propose an alternate filtration and retention system by submitting to the ENGINEER the applicable design drawings and material specifications. The proposed system must be approved by the ENGINEER.

B. The CONTRACTOR shall provide all necessary transmission piping, coupling, pumps, and other items needed to assemble, operate, and maintain the formation water filtration retention system.

C. The CONTRACTOR shall provide, maintain, and operate de-silting/de-sanding cyclone-type separators in conjunction with mechanical filtration (e.g., bag system) devices in combination with the retention system to reduce formation water turbidity to acceptable levels prior to discharge.

D. Furnish and install the length of 12- or 16-inch diameter temporary piping and appurtenances to convey the produced formation waters to the Three Oaks WRF storage tank or as approved by the ENGINEER.

E. The CONTRACTOR shall furnish and install an in-line flowmeter with a flow rate indicator and totalizer that has been calibrated within the last 60 days and capable of measuring discharge rates as approved by the ENGINEER.

PART 2 EXECUTION

2.01 GENERAL

A. Configure and construct the temporary control and discharge system as appropriate to meet these requirements. The removal and replacement of minor above-ground obstructions such as fence posts, or concrete posts, conduit, and similar items shall be anticipated and accomplished.

B. Inspect and maintain filtration retention discharge system for leaks and make repairs as necessary or as directed by the ENGINEER.

C. Clean settling tanks and sludge tanks of solids and turbid waters as necessary and dispose at the FDEP approved disposal site. Accomplishing this task shall be considered incidental to the Work and will not result in additional compensation to the CONTRACTOR.

D. The CONTRACTOR shall coordinate formation water discharge activities with the ENGINEER. Operate the system using water quality readings obtained from the onsite-monitoring program. If monitoring data indicates non-compliance, discharges shall be discontinued until parameter levels are below limits specified herein. This time shall be considered incidental to the Work and will not result in additional compensation to the CONTRACTOR.

E. The CONTRACTOR shall monitor and maintain the in-line flowmeter installed on the discharge pipe. Flowmeter readings shall be obtained before the start of discharge activities and at the end of each workday. The drilling Superintendent shall report these readings on the daily activity sheets. The CONTRACTOR shall ensure that the discharge line is full for accurate flowmeter reading by employing an appropriate back-pressure device such as orifice or throttling valve.

F. The control and discharge system may require modifications based on site activity and associated quality and quantity of settled formation water (e.g., reverse-air drilling). The CONTRACTOR will not be compensated for these modifications and these costs should be considered as part of the lump sum associated with mobilization, demobilization, and site restoration.

END OF SECTION

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SECTION 33 26 02

EROSION CONTROL BARRIER

PART 1 -- GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide erosion control barriers, complete and in place, in accordance with the Contract Documents

1.2 CONTRACTOR SUBMITTALS

A. Submittals shall be in accordance with **Section 01 33 00 – Submittals**.

B. **Product Data:** Manufacturer's catalog sheets on geotextile fabrics.

PART 2 -- PRODUCTS

2.1 FABRIC

A. Fabric may be woven or non-woven, made from polypropylene, polyethylene, or polyamid, and shall contain sufficient UV inhibitors so that it will last for 2 years in outdoor exposure.

B. Fabric shall have the following properties:

Parameter	**Standard Method**	**Value**
Grab tensile strength	ASTM D 4632	100 lb
Burst strength	ASTM D 3786	200 psi
Apparent opening size	ASTM D 4751	Between 200 and 70 sieve size

C. Fabric Manufacturer, or equal

1. **TenCate Geosynthetics**

2.2 POSTS

A. Posts shall be wood, at least 2-inch by 2-inch, at least 6-foot long.

B. Posts shall be steel, 1-1/2-inch, T-shaped, at least 6-foot long with protective coating.

2.3 FENCING

A. Woven wire fabric fencing shall be galvanized, mesh spacing of 6-inch, maximum 14-gauge, at least 30-inch tall.

2.4 FASTENERS

A. Fasteners to wood posts shall be steel, at least 1-1/2-inch long.

B. Fasteners to steel posts shall be galvanized clips.

PART 3 -- EXECUTION

3.1 PREPARATION

A. Provide erosion control barriers at the indicated locations and as required to prevent erosion and silt loss from the Site.

B. CONTRACTOR shall not commence clearing, grubbing, earthwork, or other activities which may cause erosion until barriers are in place.

3.2 INSTALLATION

A. Barrier systems shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

B. Attach the woven wire fencing to the posts that are spaced a maximum of 6-foot apart and embedded a minimum of 12-inch. Install posts at a slight angle toward the source of the anticipated runoff.

C. Trench in the toe of the filter fabric barrier with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow. Lay fabric along the edges of the trench. Backfill and compact.

D. Securely fasten the fabric materials to the woven wire fencing with tie wires.

E. Reinforced fabric barrier shall have a height of 18-inch.

F. Provide the filter fabric in continuous rolls and cut to the length of the fence to minimize the use of joints. When joints are necessary, splice the fabric together only at a support post with a minimum 6-inch overlap and seal securely.

3.3 MAINTENANCE

A. Regularly inspect and repair or replace damaged components of the barrier. Unless otherwise directed, maintain the erosion control system until final acceptance; then remove erosion and sediment control systems promptly.

B. Remove sediment deposits when silt reaches a depth of 6-inch or 1/2 the height of the barrier, whichever is less. Dispose of sediments on the Site, if a location is indicated on the Contract Drawings, or at a site arranged by the CONTRACTOR which is not in or adjacent to a stream or floodplain.

END OF SECTION

SECTION 33 26 03

PAD MONITORING WELLS

PART 1 GENERAL

1.01 RELATED WORK

A. **Section 33 26 13 – Water Quality Analyses** and **Section 33 26 10 – Well Development.**

1.02 THE REQUIREMENT

A. These Specifications cover the work necessary for construction of the surficial aquifer monitoring wells around the drilling pads, complete.

B. The CONTRACTOR shall furnish all labor, materials, tools, and equipment necessary to drill and complete the wells, including drilling, casing, sealing, filter pack, and completion of well head, and all other work required to complete the Work as specified herein and as shown on the Drawings.

C. The CONTRACTOR shall install four (4) 4-inch diameter PVC shallow water table monitoring wells around each injection well and monitoring well pad.

PART 2 PRODUCTS

2.01 CASING, SCREENS, AND APPURTENANCES

A. Pad Monitoring Well Casing: Each well casing shall be 4-inch nominal diameter Schedule 40 PVC pipe with ASTM threads according to ASTM F 480. The blank PVC shall be factory-assembled in 10-foot lengths. Smaller lengths of 5- to 10-foot shall also be furnished to accommodate the final well design. The blank PVC casing surface shall be free of solvents, oils, grease, paint, and dirt and shall be certified clean from factory. Sections of casing shall be received from the supplier wrapped in polyethylene protective wrappers with sealed ends to limit exposure to potential contaminants. Casing shall not be removed from the wrapping until immediately before placing it in the borehole.

B. Casing Joints: Casing joints shall be ASTM thread and shall be attached in accordance with the requirements of ASTM F 480. The CONTRACTOR shall not utilize glued joints.

C. Well Screen

1. Design: The **Drawing M-1**, shows the well design, indicating slot size, screen design, and other details. The design may need to be changed on the field based on the lithology collected from each borehole.

2. Each well screen assembly shall be 4-inch nominal diameter, 0.010 inches, slotted Schedule 40 PVC. The screen shall be supplied in 5-ft lengths. Screen openings shall widen inward so as to be non-clogging. Final screen length and positioning will be approved by the ENGINEER and is subject to change based on observed field

conditions. The well screen shall be sufficient size and design to hold back and support the filter pack and in-situ soils surrounding the screen. Field-constructed screen is not acceptable and will be rejected. The well screen surface shall be free of solvents, oils, grease, paint, and dirt and shall be certified clean from the factory. The well screen shall have smooth, sharp-edged openings free of burrs, chipped edges, or broken pieces on the interior and exterior surface of the pipe. Sections of screen shall be received from the supplier wrapped in polyethylene protective wrappers with sealed ends for limiting exposure to potential contaminants. Wrapping shall not be removed until screen is to be used.

D. Above-Ground Completion/Well Heads: Wellheads shall be constructed as indicated in **Drawing M-1**.

2.02 SEALING MATERIAL

A. Cement: Material used in sealing of the surface casing and borehole annular space shall consist of neat cement grout using Type II Portland cement conforming to ASTM C 150 or Type 1L cement.

1. Additives: No additives will be mixed with the sealing material to speed setting time or to expand the material.

2.03 FILTER PACK MATERIAL

A. Primary Filter Pack material: The filter pack shall be #20/30 filter pack material. The CONTRACTOR shall furnish distribution curves of proposed filter pack material prior to mobilization. The filter pack material shall be a product of commercial sand and gravel manufacturer and shall be composed of hard, well rounded, water worn, 90 percent or greater siliceous sand, free of flat or elongated pieces, organic matter, and other foreign matter.

B. Filter pack material shall be protected from contaminants prior to placement by either sorting it in plastic-lined paper bags or in a location protected from the weather and contamination on plastic sheeting. Filter pack materials shall be transported to the well in a manner preventing contamination by other soils, oils and grease, and other chemicals.

C. Bentonite Seal: One foot of bentonite pellets shall be placed above the filter pack to protect the filter pack during grouting.

PART 3 EXECUTION

3.01 WELL CONSTRUCTION

A. General: The CONTRACTOR shall install wells in the drilled boreholes at locations indicated.

B. Well Design/Well Screen Placement: Install 10-foot of screen and necessary casing to reach the desired total depth of the well. The casing/screen assembly shall be installed as follows:

1. The well casing, including the sump and screen, shall be lowered into the center of the borehole and suspended at the desired depth.

2. The well casing/screen shall be plumb, true, and centered in the borehole

3. The top of the well casing shall be set at the depth indicated.

C. Filter Pack Installation: After the well casing and screen have been positioned to the design depth inside the borehole, the filter pack shall be placed. The CONTRACTOR shall install a uniform and continuous filter pack in the full length of the well screen intervals.

1. The filter pack material shall be tremmied to the bottom of the annulus between the well casing and the borehole. The level of filter pack material in the annulus will be verified periodically at the direction of the ENGINEER by tag-line measurement during emplacement. The volume of filter pack material versus annular volume will be compared to verify proper placement of the filter pack.

2. Following placement of the filter pack emplace 1-foot of bentonite pellets on top of the filter pack using a tremie pipe. At no time shall the filter pack material be allowed to free fall from the bottom of the tremie pipe more than 2-foot during placement. Allow sand and bentonite pellets to settle for a minimum of 20 minutes then tag the depth.

D. Failure to Complete: If the casing cannot be landed in the correct position or at a depth approved by the ENGINEER, the CONTRACTOR shall construct another well immediately adjacent to the original location and complete it in accordance with the Contract Documents as part of the Work. The abandoned borehole shall be sealed in accordance with SFWMD regulations.

3.02 WELL DEVELOPMENT

A. Develop the pad monitoring wells in accordance with **Section 33 26 10 – Well Development.**

B. Surficial monitoring wells are required at each corner of each injection well and monitoring well drilling pad. Each well shall be identified by location (NE, NW, SE, and SW). The wells will be completed as a stick-up well, with casing at least two feet above land surface, or if located in a traffic area, the well head must be protected by either a traffic rated cover, or an aluminum cover surrounded by bollards. The covers for each well must be lockable and identified with the specific well name and the designation “Monitoring Well”.

1. The surficial monitoring wells shall be sampled and analyzed prior to drilling the injection wells and monitoring wells in accordance with **Section 33 26 13 – Water Quality Analyses**. In addition, depth to water measurements will be conducted at the time of sampling. All monitoring wells will be surveyed to NAVD 88 elevations to correct water levels to mean sea level.

2. The surficial monitoring wells are to remain in service and will be sampled weekly during drilling and through testing operations. The CONTRACTOR is responsible for collecting the samples weekly and having the analysis completed. In the event, that the water quality samples indicate influence from drilling and testing operations, the CONTRACTOR will be required to conduct additional sampling. The CONTRACTOR is responsible for any remediation that may be required due to changes in water quality caused by the drilling and testing operations.

3.03 WELL ABANDONMENT

A. After substantial completion of the Project is attained by the CONTRACTOR, and with the direction of the ENGINEER and County, the CONTRACTOR shall inform the FDEP of the intent of plugging and abandoning the shallow water table monitoring wells. The CONTRACTOR shall continue testing the water quality of the monitoring wells by the direction of the FDEP until the FDEP approves their plugging and abandonment. No monitoring wells shall be plugged and abandoned without the written approval by the FDEP.

B. The price of plugging and abandonment of the monitoring wells, and all prices associated with the Work and materials necessary to successfully plug and abandon the monitoring wells, shall be included in the CONTRACTORS price for demobilization.

END OF SECTION

SECTION 33 26 04

INJECTION WELL DRILLING

PART 1 GENERAL

1.01 RELATED WORK

A. Section 33 26 01 – Fluid Management, Section 33 26 05 – Well Casing, Section 33 26 06 – Geophysical Logging, Section 33 26 07 – Grouting, Section 33 26 08 – Coring, Section 33 26 09 – Packer Testing, Section 33 26 10 – Well Development and Section 33 26 13 – Water Quality Analyses.

1.02 WORK INCLUDED

A. This Section covers the Work, material, and equipment necessary for drilling the well bore of the injection well complete.

B. The following information and requirements, though not all-inclusive, are provided to assist the CONTRACTOR in the evaluation of the Work required to meet the Project objectives.

C. Specific tasks not completely described in this Section that are necessary or normally required as part of the Work described, or that are necessary or required to make the installation satisfactorily or legally operable, shall be performed by the CONTRACTOR as incidental work without extra cost. The expense of such Work shall be included in the applicable unit or unit prices for the Work described.

D. The CONTRACTOR shall perform a due diligence investigation to determine anticipated subsurface conditions and consider this information in regard to drilling and testing operations and construction activities. This information shall also be factored into the submitted unit costs, as necessary. Submitted unit costs shall be balanced and reflect all costs incurred plus profit to provide the specific service(s) and/or material.

E. Wells shall be drilled into aquifers containing saline water under artesian pressure. The shallow aquifer contains potable water at the well site. Saltier water from the deep aquifers shall be handled so that there will be no spills upon the ground. Requirements are set forth in these specifications regarding the handling of salty water, drilling fluids, and cuttings. Requirements also are set forth for controlling the flow of the well during construction and providing a closed, steel lined circulation system for all drilling operations. Drilling pads will be required and shall be constructed to retain spillage of water from drilling and related operations. Pad monitoring wells shall be installed around each pad and spillage of water resulting from drilling these wells, shall also be contained in the drilling pads. Precautions should be taken to prevent spills; any spillage of fluids shall be returned to the circulation systems.

F. At the completion of drilling, the CONTRACTOR shall remove the circulation system and its appurtenances which are not part of each completed well and leave each site in good condition acceptable to the OWNER.

G. Information regarding subsurface conditions is intended to assist the CONTRACTOR in establishing a price for the Work. The OWNER does not guarantee its accuracy or that it is necessarily indicative of conditions to be encountered in drilling the well. The CONTRACTOR shall satisfy himself regarding all local conditions affecting his Work by personal investigation and neither the information on local geology, nor that derived from maps or plans nor from the OWNER or his agents or employees shall act to relieve the CONTRACTOR of any responsibility hereunder or from fulfilling any and all of the terms and requirements of the Contract Documents.

H. All Work shall be performed by a Water Well Contractor, licensed by the State of Florida, and under the supervision of a pre-approved Drilling Superintendent. CONTRACTOR shall construct the well in strict conformance with all laws, rules, regulations, and standards related to the construction of wells in the State of Florida, Lee County, and the South Florida Water Management District (SFWMD).

I. The CONTRACTOR shall furnish sound proofing barriers, provide mufflers on equipment, and take whatever other steps necessary during drilling, pumping, testing, and all other Work incidental thereto to ensure that noise levels conform to the Lee County Ordinance Regarding Noise Sec. 14-18 or any applicable noise ordinances.

J. The CONTRACTOR shall take necessary measures to limit access to drilling sites to minimize hazards to the public.

1.03 REMEDIAL WORK

A. If remedial work proves to be necessary to make a well acceptable and come within the governing regulations and/or Contract Documents because of an accident, loss of tools, defective material or for any other cause, the CONTRACTOR shall propose a method of correcting the problem, in writing. Suggested methods shall be reviewed and accepted by the ENGINEER before work proceeds. Such work shall be performed at no additional cost to the OWNER and it shall not extend the length of the Contract. The CONTRACTOR is notified that all requirements of the Contract Documents shall be met, including borehole straightness and setting of casings to the points designated by the ENGINEER.

1.04 GUARANTEE

A. The CONTRACTOR guarantees that the Work and service to be performed under the Contract and all workmanship, materials, and equipment performed, furnished, used, or installed in the Work shall be free from defects and flaws, and shall be performed and furnished in strict accordance with the Contract Documents; that the strength of all parts of all manufactured equipment shall be adequate and as specified; and that performance test requirements of the

PART 1 - DOWNHOLE CONSTRUCTION

Contract Documents shall be fulfilled. The CONTRACTOR shall repair, correct, or replace all damage to the Work resulting from failures covered by the guarantee. The guarantee shall remain in effect for one year from the date of final acceptance by the OWNER.

1.05 CALIBRATION DATA

A. Calibration Data: Calibration records for each measuring instrument used in the construction of the well shall be submitted to the ENGINEER for review prior to the installation or use of the instruments. Calibration of instruments shall have been performed within 60 days prior to use in testing. The calibration records shall contain the following information:

1. Inclination Tools: Each down-hole instrument used in testing the well during construction shall demonstrate calibration acceptable to the ENGINEER before use. Where possible, this calibration record shall be included on the output of the test or on the log.

PART 2 PRODUCTS

2.01 GENERAL

A. All equipment shall be in good working condition before drilling operations commence. Operate and maintain all equipment in conformance with manufacturer's specification. The CONTRACTOR shall submit information regarding the equipment and materials planned for use in this Project before mobilization.

B. The CONTRACTOR selected shall furnish the materials, equipment, and labor to drill the deep injection well using both standard closed-circulation mud rotary and open- or closed-circulation reverse air drilling methods. Actual casing depth of the well shall be determined by the ENGINEER after pilot-hole drilling, geophysical logging operations, and aquifer testing. Total depths shall be based on drilling, geophysical logging, and hydraulic test results as determined by the ENGINEER.

2.02 DRILLING EQUIPMENT

A. Provide standards, commercially available rotary type drilling rig with required hook-load capacity and equipment capable of performing closed-circulation mud rotary and open- or closed-circulation reverse air drilling operations.

B. The CONTRACTOR shall certify that the present hook load/weight capacity of the derrick and draw works meets the original manufacture's specifications or at a minimum 1.5 times the heaviest load anticipated to complete the work or provide API Certification. The CONTRACTOR shall submit test results that are certified by a State of Florida licensed Professional Engineer regarding the hook load capacity of the drilling rig or provide API Certification before mobilization.

C. The CONTRACTOR shall furnish, install and operate a steel rotating control header as manufactured by Washington Rotating Control Heads Inc., or equivalent of suitable size on the well to control drilling and/or formation fluids during drilling and testing conducted within the Floridan aquifer. The CONTRACTOR shall demonstrate proficiency using the flow control equipment to the satisfaction of the ENGINEER.

D. Provide secure storage facility, and all tools, drilling bits, and all other necessary equipment to conduct drilling operations.

E. In order to ensure the drilling of the well to alignment specifications, the CONTRACTOR shall furnish and employ a self-checking mechanical drift indicator to measure borehole deflection. The mechanical indicator shall be an M/D Totco Controlled Vertical Drift Indicator (CVD) available from National Oil Well Varco, Sure Shot available from Petroleum Instruments Co. or equivalent. A 3-degree unit shall be used with the indicator and the survey record shall be capable of being read to the nearest 0.1 degree.

2.03 DRILLING FLUID

A. The CONTRACTOR shall provide high-yield, fine-grained sodium bentonite (manufactured by Baroid Industrial Drilling Products or equivalent) during mud rotary drilling operations meeting API Spec 13A. The CONTRACTOR shall provide all drilling fluid additives and lost circulation material, as required. Review drilling fluids and potential additives, itemize all products, and include the appropriate material safety data sheet (MSDS) to be used during the course of drilling operations. The CONTRACTOR shall submit these items to the ENGINEER before drilling operations commence.

B. Provide an adequate potable water supply for mixing operations in accordance with **Section 01 57 00 – Construction Facilities and Temporary Controls**. Supply to the ENGINEER in writing documentation identifying the proposed source of water prior to the start of construction, which shall conform to local Department of Health requirements.

C. CONTRACTOR shall use only drilling fluids and additives specifically recommended by the manufacturer for use in water well drilling. Avoid contamination of the samples or the aquifer. Do not introduce muds, clays, or drilling aids into the well or use lime, cement, organic matter, or other material to stop circulation losses of the drilling fluid, without reviewing the proposed program with the ENGINEER.

D. Off Site discharge of fluids during the well construction and testing shall be controlled by CONTRACTOR at all times. Drilling mud and cuttings generated during mud rotary drilling shall be retained within steel mud tubs. Unlined or plastic lined pits will not be allowed. Drilling mud and cutting shall be disposed of at an approved location. The CONTRACTOR shall create, update and complete as Work progresses, a mud/cutting hauling manifest to keep record of all mud and cutting discharges and to verify that all such discharges go to the pre-approved and designated FDEP disposal site.

E. Fluids from reverse air circulation drilling and testing shall be allowed to settle and then will be conveyed to the Three Oaks WRF storage tank in accordance with **Section 33 26 01 - Fluid Management (Formation Water Control and Discharge System).**

F. Water will require settling to reduce turbidity prior to disposal. ENGINEER must approve methods of settling excess turbidity prior to commencing each pumping test. CONTRACTOR is responsible for meeting turbidity requirements prior to conveyance to the Three Oaks WRF storage tank in accordance with **Section 33 26 01 - Fluid Management (Formation Water Control and Discharge System).** No discharges are allowed without the ENGINEER's approval.

2.04 TESTING AND SAMPLING EQUIPMENT

A. The CONTRACTOR shall provide equipment to manually measure drilling fluid properties including a Marsh Funnel and a fluid density balance.

B. The CONTRACTOR shall provide 3x5-inch cloth sample bags as manufactured by Forester Supplies or equivalent. Duplicate samples will be collected from each well. ENGINEER will provide one set for delivery to the Florida Geological Survey.

C. The CONTRACTOR shall provide water sampling containers as acceptable to the ENGINEER.

D. The CONTRACTOR shall provide all equipment required for all testing activities.

PART 3 EXECUTION

3.01 GENERAL

A. Drilling equipment shall be inspected, maintained and repaired.

B. The CONTRACTOR shall be required to provide direct and reliable telephone service with the onsite drilling Superintendent at all times during drilling, construction, and testing operations. Daily progress reports shall be written and communicated from the drilling Superintendent to the ENGINEER and submitted electronically. Cellular phone communication is the required method. The CONTRACTOR shall also provide a telephone list of individuals directly involved in the daily progression of Work.

C. The CONTRACTOR shall be responsible for measuring (using industry standards) drilling parameters and drilling fluid properties during the progression of Work. These parameters shall include; weight on bit (WOB), drill string weight, rate of penetration (ROP), mud density (mud in – mud out), drilling depth, mud flow rates (flow in – flow out), mud resistivity, and mud pump pressure. Equipment shall be calibrated and certified by the manufacturer or appropriate testing facility before the start of drilling and shall be operational throughout drilling. Improper operation or lack of measured and recorded data is sufficient cause to suspend drilling, at ENGINEER'S discretion.

PART 1 - DOWNHOLE CONSTRUCTION

3.02 DRILLING

A. The ENGINEER shall be given at least 7 days' notice with a schedule of activities prior to mobilization. All drilling activities shall be performed on a 24-hour basis Monday through Sunday or as approved by the ENGINEER. The CONTRACTOR shall provide adequate lighting during nighttime work activities. Lighting levels shall comply with applicable Federal and State regulations**.**

B. The well is to be of the type and characteristics described in **Section 01 11 00 – Summary of Work**. The exact depth of well and length of casings are to be determined in the field in accordance with information obtained from the pilot hole drilling operations. Casing setting depths shall be approved by the FDEP and/or TAC when required by the UIC Well Construction Permit.

C. The well shall be drilled by the rotary method using closed mud circulation through the unconsolidated and soft formations to a depth of approximately 515 feet bls. Open- or closed-circulation reverse-air drilling, as directed by the ENGINEER, shall be used below the depth of approximately 515 feet bls to total depth of the well. Drilling mud shall be completely removed from the borehole and casing prior to beginning reverse-air drilling. The ENGINEER will be the sole determiner of whether all drilling mud is removed and must approve the start of reverse-air drilling.

D. Drill a maximum 12.25-inch diameter pilot hole in stages in accordance with detailed construction sequence provided in **Section 01 11 00 – Summary of Work**, and as determined by the ENGINEER. Prepare the borehole for geophysical logging. Borehole preparation shall include, but not be limited to:

1. Continuation of circulation until drill cuttings have been removed from the borehole, and
2. Circulation of the drilling mud in the borehole until it is uniform, and the drill pipe has been removed from the borehole. The CONTRACTOR shall make all reasonable efforts to leave the borehole free from obstructions in preparation for geophysical logging.

E. Drill the boreholes of the dimensions and at the location shown on the well construction drawing.

F. The boreholes shall be drilled (straight and plumb) to permit the installation of the casing to the tolerances specified in this Section under 3.03 and **Section 33 26 05 - Well Casing.**

G. Use only drilling fluids and additives specifically recommended by the manufacturer for use in water well drilling. Avoid contamination of the samples and the aquifer. Do not introduce muds, clays, or drilling aids into the well or use lime, cement, organic matter, or other material to stop drilling fluid loss, without reviewing the proposed program with the ENGINEER. Additives to reduce drilling fluid loss may require approval by the FDEP and/or TAC. No standby time shall be charged by the CONTRACTOR during review and approval of CONTRACTOR's plan for use of special drilling fluid additives to control fluid loss.

H. Prior to reaming, all casing joints shall be approved and matched onsite with their respective approved mill certificates and heat numbers.

I. Pilot holes shall be back plugged from 1,425 feet to 490 feet below land surface (bls) and from 2,150 feet to 1,400 feet bls. Back-plugging the full length of the pilot hole will be conducted with ASTM C150, Type II or ASTM C595M-21 Type 1L cement containing 12 percent bentonite (by weight). Pilot holes below the final casing depth above the injection zone will be sealed by a bridge plug as approved by the ENGINEER.

J. CONTRACTOR shall prevent cuttings from entering the well during open- or closed-circulation reverse-air drilling. Linear shakers, hydrocyclones, settling tanks, etc., shall be used as needed, based on conditions encountered.

K. Flowing artesian conditions exist at the Project Site within the Floridan Aquifer System. The CONTRACTOR shall provide for all the tools, piping, equipment, and operations necessary to prevent the uncontrolled flow of groundwater from the well during drilling and testing.

L. It is the intent of this Contract that no drilling fluids or groundwater produced during construction escape the confines of the drilling pad.

M. Periodically, but at least daily during reverse-air drilling, the CONTRACTOR shall measure the static water level in the borehole daily during reverse-air drilling. Water level and the time measurement was taken shall be recorded on the daily drilling report.

3.03 ALIGNMENT REQUIREMENTS – PLUMBNESS AND ALIGNMENT TESTING

A. Pilot and reamed boreholes shall be drilled round, straight, and plumb throughout so casings are installed without sticking or binding.

B. A mechanical drift indicator shall be run in the pilot hole and reamed boreholes at intervals no greater than 90 feet. The tool shall be centralized in the drill pipe during the survey.

C. The drift from vertical shall not be more than 0.5 of one degree between any two consecutive surveys, and not more than one degree over the entire well length. The CONTRACTOR at his own expense shall correct borehole deviation in plumbness. Drift indicator data (e.g., Sure Shot discs) and plots shall be maintained by the CONTRACTOR for the duration of this Project and shall be supplied to the ENGINEER as part of the driller's daily logs. The ENGINEER may inspect the tool, and require that it be disassembled, recalibrated, or tested at any time during the Project, with or without cause. Any deviation from plumbness greater than 0.5 of one degree shall be corrected by the CONTRACTOR at his sole expense.

D. The ENGINEER may modify the requirements for plumbness and straightness if, in his judgment:

1. Deviations are due to subsurface conditions and the CONTRACTOR has exercised all possible care to avoid deviations,
2. The deviations will not materially affect the usefulness or performance of the well or further drilling operations, including setting of casings and future testing.

3.04 COMPLIANCE WITH GOVERNMENTAL REGULATIONS

A. The CONTRACTOR shall fully inform themselves of all local ordinances, State and Federal laws and regulations, and interpretations of these laws, ordinances and regulations by a governmental body or agency, including but not limited to, the Florida Department of Environmental Protection (FDEP), the United States Environmental Protection Agency (USEPA), the South Florida Water Management District (SFWMD), and applicable County regulations, which in any manner affect the Work specified herein.

B. The CONTRACTOR shall at all times comply with said ordinances, laws and regulations, and protect and indemnify the ENGINEER and their officers and agents against any claim or liability arising from or based on the violation of such laws, ordinances, or regulations. All permits, licenses, and inspection fees necessary for protection and completion of the Work shall be secured and paid for by the CONTRACTOR unless otherwise specified. The required FDEP UIC well drilling permit shall be obtained and paid by the OWNER.

C. The CONTRACTOR shall acquire all SFWMD, generic surface water discharge permits, and permissions necessary to enter onto the site and perform the Work. The CONTRACTOR shall obtain any other local, State, or Federal drilling permits or occupational licenses and provide notifications to local municipalities prior to the start of well construction activities.

3.05 FORMATION SAMPLES AND TESTING

A. Formation samples shall be collected at 10-foot intervals during pilot hole drilling of the injection well and at changes of formations. The CONTRACTOR shall collect representative cuttings samples in order to provide an indication and classification of geological formations penetrated.

B. The CONTRACTOR shall take two large representative samples of the cuttings every ten (10) feet and at formation changes and shall label and preserve each sample in the specified sample bags. All sample bags shall be labeled to indicate well number, date, time, and the exact depth from which the sample was taken. Samples shall be stored in a manner to prevent damage or loss. Two (2) sets of geologic samples should be collected by the CONTRACTOR and stored in cloth sample bags as directed by the ENGINEER.

C. The CONTRACTOR will be responsible for sending, at the direction of the ENGINEER, one complete labeled set of geologic cuttings to David Paul, P.G., Geological Sample Acquisition & Management Section, Florida Geological Survey, Florida Department of Environmental Protection, 3915 Commonwealth Blvd., Tallahassee, Florida, 32399.

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D. The second complete set of geologic cuttings will be delivered to the OWNER.

E. Drill cuttings and drilling fluid from mud rotary drilling shall be removed from the drilling site by the CONTRACTOR by hauling to a FDEP approved disposal site. Fluids from reverse air circulation drilling and testing shall be allowed to settle and then will be conveyed to the Three Oaks WRF storage tank. Drill cuttings from reverse air drilling shall be removed from the drilling site by the CONTRACTOR by hauling to a FDEP approved disposal Site. The fluid displaced from the borehole during cementing operations shall be considered excess drilling fluid and shall be disposed of as noted above. It shall be the CONTRACTOR's responsibility to obtain FDEP approval for the proposed disposal site and submit a notice of FDEP approval to the ENGINEER prior to commencing Work.

F. The CONTRACTOR shall provide the ENGINEER safe and unobstructed access to collect the formation samples at his discretion, in addition to the formation samples collected by the CONTRACTOR. The ENGINEER representative reserves the right to evaluate the safety of the sample collection site and shall have the authority to stop drilling operations until the safety concerns are addressed and met.

3.06 WATER SAMPLES AND TESTING

A. While drilling with the reverse air circulation drilling method, the CONTRACTOR shall collect water quality samples every 45 feet (average length of drill rod) or as directed by the ENGINEER. A reasonable amount of time (approximately 5 to 10 minutes) shall be given to the ENGINEER to measure certain water quality parameters from the reverse air samples. The CONTRACTOR shall accommodate the ENGINEER in retrieving representative samples, including but not limited to, moderating drill rates and circulation times as necessary.

B. Sample bottles shall be clearly labeled in an indelible way with the well name, depth, time, sampler's name, and date. It shall be the CONTRACTOR's sole responsibility to collect, protect, and deliver the water samples, properly labeled and properly stored under refrigeration or on ice immediately after collection, to the ENGINEER. The CONTRACTOR shall be responsible for hiring and paying for a NELAP certified analytical laboratory to perform water quality analyses of the collected water and to provide a timely report of the data. Water quality analyses shall be performed in accordance with **Section 33 26 13 – Water Quality Analyses**.

C. Native groundwater collected from the packer tests shall be delivered to the Florida Geological Survey in accordance with **Section 33 26 09 - Packer Testing**.

3.07 PROTECTION OF WATER QUALITY

A. Take all necessary precautions to prevent brackish water, saltwater, diesel fuel, gasoline, or other deleterious substances from entering the well or surficial aquifer, either through the opening or by seepage through the ground surface. Maintain precautions during and after construction of the well until accepted by the ENGINEER.

B. The drilling will be accomplished using circulation systems designed and constructed so that under no conditions shall there be an overflow. The CONTRACTOR is required to take all necessary steps to prevent accidental spillages from occurring. Aboveground, leak proof, steel, or fiberglass (or comparable impermeable material) drilling fluid storage tanks shall be used during closed circulation mud rotary drilling and reverse-air drilling operations. Tanks for the circulation system shall be constructed of steel or fiberglass and be leak-proof. The entire drilling and circulation system for each well shall be within the enclosed steel secondary containment system. Before mobilization, the CONTRACTOR shall submit design drawings of the drilling fluid circulation system. The circulation system shall be capable of storing no less than 100,000 gallons) of fluid and cuttings.

3.08 DRILLING AND WELL LOGS

A. The CONTRACTOR shall maintain a detailed daily log of his operations during the construction of the industrial injection well. The log shall be on IADC (International Association of Drilling Contractors) Forms or equal as approved by the ENGINEER and shall provide a brief and accurate description of the following: geologic materials and depths encountered, depths of lost circulation zone(s) and methods of regaining circulation, drilling rate, time, depth, description of any unusual occurrences or problems during drilling, diameters and lengths of casing installed, complete record of drilling fluids added, mud weights and viscosities, cementing operations, geophysical logs runs, repair time, static water levels, and any other work performed at the site. The CONTRACTOR shall keep the log up to date with the progress of drilling. The log shall also include tabulation of quantities for each unit price pay item and a description of all approvals made by the ENGINEER. Failure to keep this record up-to-date (maximum 48 hours from occurrence) shall be grounds for the ENGINEER to stop drilling operations.

B. Prepare a final well log which includes borehole diameters, depth of the borehole and casing seats, casing diameter and wall thickness, cemented zones and cement pumping summary, and any/all information pertinent to well construction and testing activities.

C. The CONTRACTOR must submit copies of daily logs to the ENGINEER on a daily basis. Additional copies of the daily logs shall be submitted with each request for partial payment as a condition of payment.

D. The CONTRACTOR shall submit the original geolograph strip or electronic charts and mechanical drift indicator discs to the ENGINEER daily or as frequently as requested by the ENGINEER. Final payment is contingent upon receipt of all required supporting data.

E. File all drilling and well records and reports with the proper agencies required by Federal, State, County, and local permits, codes or regulations. Assist ENGINEER, as necessary, with any additional well completion reports required by the regulatory agencies.

3.09 DRILLING FLUID AND SALTWATER DISPOSAL

A. During closed-circulation mud rotary drilling, no discharge of drilling fluid shall be allowed at the drill Site. Spent drilling fluids used during mud rotary drilling operations shall be disposed of by hauling the solid and liquid phases to a predetermined FDEP-approved disposal Site provided by the CONTRACTOR in accordance with **Section 33 26 01 - Formation Water Control and Discharge System**. The CONTRACTOR shall create, update and complete as work progresses, a mud/cutting hauling manifest to keep record of all mud and cutting discharges and to verify that all such discharges go to the pre-approved and designated FDEP disposal site.

B. During reverse air drilling, the drilling fluid shall be compressed air and water. Bentonite or other materials shall not be utilized without approval by the ENGINEER. If utilization of these materials is necessary due to lost circulation or other drilling problems that may arise, the CONTRACTOR shall submit the procedure to the ENGINEER for review. Adequate fluid tanks shall be employed by the CONTRACTOR to settle out drill cuttings and to ensure that a minimum of silt and clay is returned to the drill hole. The CONTRACTOR shall create, update and complete as work progresses, a cutting hauling manifest to keep record of all cutting discharges and to verify that all such discharges go to the pre-approved and designated FDEP disposal site.

C. Drilling mud and barite will be permitted during the drilling in the Upper Floridan aquifer with the Engineer of Record's approval as well as FDEP, but no salt will be used in order to preserve the natural water quality in the aquifer as much as possible.

D. No discharge to land surface or surface waters of drilling fluid, saltwater, or produced groundwater will be allowed at the drilling Site.

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

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SECTION 33 26 05

INJECTION WELL CASING

PART 1 GENERAL

1.01 RELATED WORK

A. **Section 33 26 04 – Well Drilling, Section 33 26 06 – Geophysical Logging, Section 33 26 07 – Grouting, Section 33 26 11 – MIT.**

1.02 SCOPE

A. This section covers the work, materials, and equipment necessary for furnishing and installing steel well casing.

1.03 THE REQUIREMENT

A. Commercial Standards: All work specified herein shall conform to or exceed the requirements of the applicable codes and standards relating to the referenced portions of the following documents only to the extent that the requirements therein are not in conflict with the provisions of this section. Where such documents have been adopted as a code or ordinance by the public agency having jurisdiction, such a code or ordinance shall take precedence.

B. State Standards: SFWMD and FDEP rules and regulations for water wells in the Florida Administrative Code (FAC).

C. Commercial Standards:

1.	ASTM A139	Specification for Electric-Fusion (Arc)-Welded Steel Pipe (Sizes 4-Inch Diameter and Over).
2.	ANSI/AWS D1.1	Structural Welding Code – Steel.
3.	AWS D10.9	Specification for qualification of welding procedures and welders for piping and tubing
4.	ASTM A53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
5.	ASTM312/A312M	Standard specification for seamless, welded, and heavily cold worked austenitic stainless steel pipes

6.	ASTM409	Standard specification for welded large diameter austenitic steel pipe for corrosive or high temperature service
7.	API 5L	Specification for Line Pipe.
8.	API 5CT	Specifications for casing and tubing
9.	ASTMD1784	Specification for Rigid PVC Compounds and Chlorinated PVC Compounds.
10.	ASTM D2837	Standard Test Method For Obtaining Hydrostatic Design Basis For Thermoplastic Pipe Materials.
11.	ASTM D2996	Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
12.	ASTM D2310	Standard Classification for Machine-Made “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
13.	ASTM F480	Specification for Thermoplastic Well Casing Pipe and Couplings Made In Standard Dimension Ratios (SDR), SCH 40, and SCH 80.
14.	AWWA A100	Standard for Water Wells.
15.	AWWA C200	Steel water pipe, 6” and larger
16.	AWWA C206	Field Welding of Steel Water Pipe.
17.	AWWA C207	Steel pipe flanges for waterworks service, sizes 4” through 144”
18.	API SPEC. 10D	Specification for Bow-Spring Casing Centralizers.

1.04 CONTRACTOR SUBMITTALS

1. **Welding**: Prior to the start of Work, the CONTRACTOR shall submit a list of the welders it proposes to use during well construction and the type of welding for which each has been qualified, along with current certification documents for each welder listed.

PART 1 - DOWNHOLE CONSTRUCTION

a. All welders and welding operators shall be qualified at the CONTRACTOR's sole expense by a qualified testing laboratory before performing any welding under this section. Qualification tests shall be in accordance with ANSI/AWS D10.9. Welders and operators shall be qualified for making groove welds in carbon steel and stainless steel pipe in positions 6G for each welding process to be used.

b. CONTRACTOR shall retest any welders at any time ENGINEER considers the quality of the welder's work substandard. When the ENGINEER requests the retest of a previously qualified welder, the labor costs for the retest will be at the CONTRACTOR's expense.

c. CONTRACTOR shall provide appropriate WPS for casing installation and temporary wellhead completion.

d. Welding Inspector Qualifications: A certified welding inspector (CWI) shall be required for the installation of components associate with the final casing as well as landing joints and injection wellhead. The CWI shall hold an active CWI certification in accordance with the AWS QCI, Standard for AWS Certification of Welding Inspectors. Alternate welding inspector qualifications require approval by the ENGINEER.

B. **Mill Certificates**: Casing mill certificates showing manufacturing standards, dimensions, wall thickness, heat numbers, hydrostatic test pressure and results, and metallurgical test results shall be submitted to the ENGINEER for all casings no less than seven (7) days prior to the beginning of reaming operations. Heat numbers on casing joints shall be readily visible and legible or the casing will not be accepted by the ENGINEER. Any casing joint not having legible, traceable identification will be rejected.

C. **Fittings**: Provide all fittings; drive shoe and centering guides as specified or as necessary to complete the well.

D. **Operations**: The CONTRACTOR shall submit for the ENGINEER's approval plans for cementing operation and casing installation at least 72 hours prior to commencing work on those operations. These plans shall include the following information:

1. Tabulation of casing on Site

2. Length of each section,

3. Weight of each joint,

4. Cumulative string weight,

PART 1 - DOWNHOLE CONSTRUCTION

5. Order of installation of casing sections

6. Locations of centralizers and casing tabs.

7. Estimated number of cement stages, cement type to be used and amount of cement to be pumped.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide all materials and equipment necessary for joining and installing casing as specified.

B. Steel Casing shall be as follows:

Injection Well

	Casing Diameter (nominal inches)		**Casing Wall Thickness (inches)**	**Weight (lbs/Foot)**	**Casing Depth (+/- Feet bls)**
	Inside	**Outside**			
Pit Casing	53	54	TBD by Contractor	TBD	TBD
Surface Casing	43	44	0.500	232.51	490
Intermediate Casing	33	34	0.500	179.06	1,400
Final Steel Casing	23	24	0.500	125.61	2,100

2.02 STEEL CASING

A. Pit Casing: The CONTRACTOR shall furnish pit casing at the well Site to isolate surficial deposits from the borehole and to prevent collapse of the drilled hole. Costs for furnishing and installation shall be included in the CONTRACTOR's lump sum mobilization costs. The pit casing shall be installed to such a depth as CONTRACTOR judges necessary to prevent washout or undermining of the drill pad during construction of the well. The pit casing shall be installed by auger or rotary drilling and shall be cemented in place by the pressure grout method in accordance with **Section 33 26 07 - Grouting**.

B. Pit casing on the injection well shall conform to ASTM A36 Grade B, or better. All casing material shall be new. No used or rusted casing will be accepted. The casing shall have plain ends beveled for welding. Casing joints shall be welded in accordance with ANSI/AWS D1.1.

C. Surface and Intermediate Casings I on the injection well shall meet the requirements of ASTM A139 Grade B or AWWA C200 meeting the

requirements of ASTM A139 Grade B. The ends of each joint shall be machine beveled to ensure straightness of each assembled section. Casing joints shall be welded in accordance with ANSI/AWS D1.1. All casing material shall be new. No used or rusted casing will be accepted.

D. Final casing on the injection well shall meet the requirements of API 5L Grade B or ASTM A53 Grade B, seamless. The final 10 feet of the injection well final casing shall be new, unused 316L stainless steel conforming to the requirements of ASTM A312/A312M, Type 316L. The ends of each joint shall be machine beveled to ensure straightness of each assembled section. Casing joints shall be welded in accordance with ANSI/AWS D1.1. All casing material shall be new. No used or rusted casing will be accepted.

2.03 DRILLABLE BRIDGE PLUG

A. Provide manufactured or fabricated drillable bridge plug that will seal off the pilot hole at the base of the 24-inch diameter final steel casing. The drillable bridge plug must be capable of supporting the first few small stages of cement required for setting the drillable bridge plug.

1.02 FITTINGS

A. Centralizers shall be welded to steel casing and made of the same material as the casing. Casing centralizers shall meet the requirements of API Specification 10D. All centralizer groups shall be vertically aligned one above the other in order to permit the passage of tremie pipes alongside the casing to the bottom of the borehole. Casing centralizers shall be fitted on all casings as stipulated under the Execution section.

PART 3 EXECUTION

1.01 GENERAL

A. The Work shall be performed by a competent crew with equipment that is adequate to complete all phases of well construction.

B. All casing shall be installed by a method appropriate to Drawings as selected by the CONTRACTOR.

C. Casing lengths shall be joined watertight so that the resulting joint shall the same structural integrity as the casing itself.

D. Installation of casing in boreholes:

1. The pit casing may be drilled or augered into place.

2. The depths and lengths for casings shall be as indicated unless otherwise determined by the ENGINEER. Payment will be based

on actual quantities furnished, installed, or constructed, in accordance with the schedule of values.

3. All work required to be repeated, resulting from the CONTRACTOR's performance, or lack thereof, including all additional materials, labor and equipment required, shall be furnished at the expense of the CONTRACTOR and no claim for additional compensation shall be made or be allowed therefore, except as specifically provided herein.

E. In the event of any unreasonable delay, the CONTRACTOR shall not remove the reamer assembly and shall continue reaming/conditioning the borehole until installation of the casing commences.

1.02 CASING

A. Casing Installation: When the reaming operation and geophysical logging has been completed, casing will be installed. The lengths and intervals of each casing type, except for the pit casings, will be determined by the ENGINEER.

B. Tension: The casing shall be suspended in tension from the surface. The bottom of the casing shall be at a sufficient distance above the bottom of the reamed hole as to insure that none of the casing will be supported from the bottom of the hole. The casings shall be lowered into the borehole open-ended and the weight of the casing shall be supported by the drilling rig. The CONTRACTOR shall certify that the present hook load/weight capacity of the derrick and draw works meets the original manufacture's specifications or at a minimum 1.5 times the heaviest load anticipated to complete the work. The CONTRACTOR shall submit test results that are certified by a State of Florida licensed Professional Engineer regarding the hook load capacity of the drilling rig before mobilization.

C. Failure to Complete: If the casing cannot be landed in the correct position or at a depth acceptable to the ENGINEER, the CONTRACTOR shall construct another well immediately adjacent to the original location and complete this well in accordance with the Contract Documents at no additional cost to the OWNER. The abandoned hole shall be sealed in accordance with all State of Florida regulations.

D. Collapsed Casing: If the casing should collapse for any reason prior to well completion, it shall be withdrawn and replaced at the CONTRACTOR's expense.

E. Centralizers:

1. Fabricated centralizers for steel casing shall be constructed of a minimum of 12-inch long, 2-inch wide, a minimum of 0.5-inch thick with a radius of 12-inch and welded with the concave surface

against the casing to provide a minimum of 4-inch of clearance around the casing.

2. Spaced at 90 degrees for casing larger than 12-inch in diameter.

3. Vertical separation of centralizers during casing installation are as follows:

   a. One at 5 feet above the bottom end
   b. One at 20 feet above the bottom end
   c. One at 40 feet above the bottom end
   d. One at every joint thereafter.

1.03 WELDING

A. The standards of the American Welding Society, Structural Welding Code (AWS D1.1) shall apply for all welded joint casing and accessories.

B. All welded casing joints shall be made by welders certified in the State of Florida.

C. The certified welder shall perform and be responsible for the integrity of all steel casing welds. The CONTRACTOR must provide the ENGINEER proof of welders' certifications 72 hours before any welding is performed. The reamer assembly shall remain in the borehole to complete reaming or condition the borehole until proof of welders' certification is provided to the ENGINEER.

D. Any surface defects that shall affect the weld shall be chipped or ground out. A power driven wire brush shall be used to thoroughly clean each layer of weld prior to each additional weld metal, including the final pass.

E. Welded joints shall be allowed to cool to less than 430 degrees Fahrenheit before the weld is placed in contact with water. This requirement can be met my maintaining the water level in the well deep enough so the hot weld joint can be lower for the next casing joint and not reach the water. CONTRACTOR shall use temperature melt sticks or infrared thermometer to verify weld temperature to meet the conditions of this requirement.

F. Welding of the casing and pipes shall be done in accordance with the specifications. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all 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. The welding rod or wire shall match the material being welded and shall be approved by the ENGINEER.

G. Field Joints: All field joints shall be welded during installation by qualified welders in accordance with the requirements of ANSI/ASW D1.1.

1.04 ALIGNMENT AND SPACING

A. The CONTRACTOR shall align pipe ends to be joined within commercial tolerance limits on diameters, wall thickness, and out-of-roundness. Record the amount of offset and degrees of circumference not matching within 0.10 –inches or less between the two joints. Provide record to the ENGINEER.

B. The CONTRACTOR shall demonstrate that the installed casing is free hanging and can be rotated and reciprocated prior to grouting operations.

C. The shielded metal-arc process shall be used for all carbon steel field welding.

D. No welding shall be performed if there is impingement of any rain or high wind on the weld area, or if the ambient temperature is below 32°F. If the ambient temperature is less than 32°F, local preheating to a temperature that is warm to the hand is required.

E. Tack welds, if not made by a qualified welder using the same procedure as for the completed weld, must be completely removed. Tack welds which are not removed shall be made with an electrode that is the same as, or equivalent to, the electrode to be used for the first weld pass. Tack welds that have cracked shall be removed.

F. Each layer of deposited weld metal shall be thoroughly cleaned prior to the deposition of each additional layer of weld metal, including the final pass, with a power-driven wire brush. Surface defects which will affect the soundness of the weld shall be chipped out or ground out.

END OF SECTION

SECTION 33 26 06

GEOPHYSICAL LOGGING

PART 1 GENERAL

1.01 RELATED WORK

A. Section 33 26 01 – Fluid Management, Section 33 26 04 – Well Drilling, Section 33 26 05 – Well Casing, Section 33 26 07 – Grouting, Section 33 26 11 – MIT, Section 33 26 12 – Injection Testing

1.02 THE REQUIREMENT

A. This section covers the work, materials, and equipment necessary to conduct geophysical logging and video surveys of the borehole and well during construction and testing.

B. Applicable regulations from the United States Nuclear Regulatory Commission (U.S. NRC) (i.e. 10 CFR PART 39—LICENSES AND RADIATION SAFETY REQUIREMENTS FOR WELL LOGGING) shall apply for all specialty logging tools that require a neutron emitter.

1.03 CONTRACTOR SUBMITTALS

A. **General:** All CONTRACTOR submittals shall conform to the applicable requirements of **Section 01 33 00 - Submittals** and the supplementary requirements specified. Each item listed below shall be submitted to the ENGINEER with a clear explanation or depiction of why or how the requirements, as listed, will be fulfilled by the products or services provided by the CONTRACTOR. This list is not considered all-inclusive and may be extended by the OWNER, ENGINEER, or CONTRACTOR.

B. Geophysical Logging Firm: All geophysical logs shall be performed by a company licensed and experienced in the performance of such logs. The geophysical logging firm and the personnel must be pre-approved by the ENGINEER. The geophysical logging personnel shall be able to interpret the geophysical logs and/or have access to an experienced geophysical logger within the geophysical logging firm who can interpret the geophysical logs. The resume of the experienced geophysical loggers shall be provided to the ENGINEER for approval prior to any geophysical logging. The geophysical logging personnel may not leave the jobsite until the ENGINEER approves all the geophysical logs conducted.

C. Geophysical Logging: The CONTRACTOR shall submit 3 printed field copies of all geophysical logs and also provide electronic copies in Log ASCII Standard (LAS) and Portable Document File (*.pdf) format immediately following the completion of logging operations via e-mail; final logs shall also be provided in Portable Document File (*.pdf) format on USB Flash Drive. Larger files, such as Borehole Televiewer videos, may be provided solely in a USB Flash Drive. Unless otherwise directed by the ENGINEER, for each geophysical logging suite performed, the

CONTRACTOR shall obtain from the Logging Firm, a summary report describing the logs performed and an interpretation of the results of the log or logs which will include flow interpretation and total dissolved solids plots. These logging reports shall be submitted to the ENGINEER within 72 hours of completion of logging.

D. The CONTRACTOR shall prepare a written report which provides a qualitative evaluation of annular cement placement for the 24-inch final injection well casing by comparing the results of the CBL performed on un-cemented and cemented casings. The report shall be submitted to the ENGINEER within 72 hours following completion of the standard CBL.

E. Geophysical logging tool schematic drawing for each down-hole tool used.

F. A schematic drawing of the standard cement bond logging tool and the procedure to perform the standard cement bond log shall be submitted. The tool configuration and procedure for running shall be approved the ENGINEER, subject to acceptance and approval for use by the Florida Department of Environmental Protection (FDEP).

G. Geophysical Logging Firm, as applicable, shall be identified in the CONTRACTOR'S list of specialty subcontractors as stated in the proposal instructions.

H. The ENGINEER may alter the geophysical logging schedule by adding or removing geophysical logs.

PART 2 PRODUCTS & EQUIPMENT

2.01 GENERAL

A. CONTRACTOR shall provide a sheave and appurtenances from which Geophysical Logging Firm may hang logging equipment that will be lowered into the borehole or well; the equipment shall be designed for use in wireline logging and shall have a capacity to support the weight and loads resulting from the operation.

B. CONTRACTOR shall furnish and install temporary pumping equipment and discharge valves and piping for all dynamic (pumping or flowing) geophysical logging operations.

C. CONTRACTOR shall furnish and install all temporary flow control equipment required to contain and convey groundwater produced during geophysical logging operations either by pumping or from artesian flow.

D. CONTRACTOR is advised that the well is expected to be under flowing artesian conditions during operations within the Floridan aquifer and static geophysical logging will require installation of a standpipe with wireline pack-off collar/lubricator.

2.02 GEOPHYSICAL LOGGING TOOLS

A. CONTRACTOR will provide continuous digital geophysical logging equipment capable of performing and recording digital data from the following standard geophysical logs:

1. X-Y Caliper (CAL): A four-arm (XY) caliper tool shall be used for logging. Response shall be recorded in inches in diameter and the caliper log report shall indicate borehole volume. Caliper logs shall be run under static conditions.

2. Natural Gamma Ray (GR): Response shall be recorded in American Petroleum Institute (API) units. Gamma logs shall be run under static conditions.

3. Dual-Induction (DIL), Laterolog, and Spontaneous Potential (SP): These geophysical logs, otherwise described as electric logs, shall be run under static (no flow) conditions.

4. Borehole Compensated Sonic Log with Variable Density Display (BHC/VDL): The tool shall be capable of recording formation travel time and full waveform VDL. The tool must be capable of accurately recording the compressional wave transit time in a 30-inch borehole.

5. Standard and Modified Cement Bond Log (CBL):

   a. Cement bond logging in casings with 24-inch or less diameter, shall be performed using a tool that has a single transmitter and two receivers spaced at 3-feet (the “3-foot receiver”) and the 5 feet (the “5-foot receiver”); this logging tool configuration is referred to in these specifications as a “Standard CBL” or “CBL using a standard tool”.

   b. A “Modified CBL” or “CBL using a modified tool” refers to a logging tool that has been modified for use in casings with diameters greater than 24-inch. The modified logging tool has a single transmitter with two receivers spaced 5 feet (the “5-foot receiver”) and 7 feet (the (7-foot receiver”) from the transmitter.

   c. The CBL shall be run under static (no flow) conditions.

6. Fluid Resistivity: Fluid resistivity logs shall be run under both static (no flow) and dynamic (flowing/pumped) conditions.

7. Flowmeter (FM): Flowmeter log shall be run under both static (no flow) and dynamic (flowing/pumped) conditions. A flow interpretation log will be required within 24 hours of the logging activities.

8. Temperature: Temperature logs shall be run under both static (no flow) and dynamic (flowing) conditions.

9. Color Video Survey with Side-Looking Rotating Camera: The video shall be run under dynamic (pumped) conditions to ensure video clarity.

10. Borehole Televiewer: In the event that an acceptable video survey cannot be run, a borehole televiewer log shall be substituted.

11. Radioactive Tracer Survey (RTS): Refer to **Section 33 26 11 – Mechanical Integrity Testing** for geophysical tool configuration and logging procedures.

B. CONTRACTOR will provide assistance if the United States Geological Survey (USGS) requests access to run additional geophysical logs.

C. Wireline Packoff/Lubricator Assembly:

1. The CONTRACTOR shall furnish and install a wireline pressure control device for use during geophysical logging operations conducted at depths within and below the base of the Floridan aquifer system and at times when it is necessary to conduct logging operations in pressurized well casing.

2. The wireline pressure control device shall be capable of being installed on both well casing and the pressure control stack appropriately sized and pressure rated crossovers and/or swedges shall be furnished.

3. The wireline pressure control device shall be provided with a flanged pump-in sub to allow introduction of fluids into the well and for casing pressurization. Ancillary equipment including bleed and isolation valves of equal pressure rating shall be furnished and installed for logging operations.

PART 3 EXECUTION

3.01 GENERAL

A. Geophysical logging shall be performed as soon as possible following drilling and preparing the borehole for geophysical logging. For open-hole logging, the depth intervals shall correspond to the total length of the open-hole unless otherwise directed by ENGINEER. The CONTRACTOR shall, at his own expense, clean the borehole and rerun logs if they fail to survey within 5 feet of the bottom of the borehole as measured with the drill pipe.

B. To be acceptable to the ENGINEER, each geophysical log must be run in a continuous manner between the top and bottom of the depth interval specified or selected by the ENGINEER

C. CONTRACTOR shall provide ENGINEER with a 24-hour notice prior to logging to facilitate coordination of the logging activities with OWNER and 72-hour notice prior to logging activities with regulatory agencies; regulatory agencies may require attendance at geophysical logging

events, as specified or identified in the Underground Injection Control (UIC) well construction permit.

D. The CONTRACTOR is responsible for preparing and conditioning the borehole prior to geophysical logging by circulating all drill cuttings from the borehole. The drilling fluid shall also be conditioned until field tested physical properties including mud weight and mud viscosity, if applicable, measured by the CONTRACTOR are adequate to prevent the borehole from collapsing and the well from flowing under artesian conditions.

E. Each log shall be recorded using a depth measurement that is accurate to within the depth measured by the drill pipe. Each log will be submitted to the ENGINEER with an appropriate scale of:

1. 1-inch = 100 feet

2. 2-inch = 100 feet

3. 5-inch = 100 feet

F. All logs shall be clearly labeled with all pertinent information regarding the well construction progress, location, borehole and casing depths, logging scales, dates, etc. Each log shall include a repeat section of not less than 200 feet to verify logging tool performance; the repeat section shall be performed in a depth interval where an on-scale and identifiable logging signature is present.

G. Each logging tool shall be calibrated in the presence of the ENGINEER.

H. The CONTRACTOR is responsible for providing adequate access for geophysical logging during pumping tests. Coordinate with **Section 33 26 09 - Packer Testing**. No additional compensation will be granted for removal and reinstallation of pumps to facilitate logging.

I. CONTRACTOR shall provide access to the well for the purpose of water level measurements or otherwise as requested by the ENGINEER during geophysical logging events.

J. Injection Testing of the well may be conducted concurrent with geophysical logging events. It shall be the CONTRACTOR'S responsibility to assist the ENGINEER as directed during logging events.

K. In the event that a geophysical tool becomes stuck in the well during logging operations, the CONTRACTOR shall develop a plan for retrieval. Where a nuclear source is involved in the retrieval operation, the CONTRACTOR shall provide notification and conduct retrieval or abandonment operations, as required, in accordance with 10 CFR PART 39 and any applicable Federal, State and/or Local laws. The CONTRACTOR, at his sole expense, shall be responsible for all costs associated with retrieval (fishing) operations, notification, reporting, and plugging/abandonment, repair or replacement of logging tools and equipment, as required by the Contract

Documents and governing regulations. The CONTRACTOR will not be paid standby time during this period.

L. The ENGINEER or designated representative shall have the authority to specify up-hole/down-hole logging speeds of the individual geophysical logs.

M. No standby or additional rig time shall be paid to the CONTRACTOR during geophysical logging operations.

N. Standby time shall not be paid to the CONTRACTOR for any time spent reconditioning or re-logging the borehole in the event that geophysical logs are not accomplished as specified.

O. Wireline packoff/lubricator assembly shall be furnished, installed, operated, and tested by the CONTRACTOR. Equipment inspection and testing shall be conducted as required by the manufacturer and regulatory agencies having jurisdiction over the well drilling and construction operations.

3.02 GEOPHYSICAL LOGGING OPEN BOREHOLE

A. Geophysical logging, consisting of a combination caliper and gamma ray log, shall be completed on the reamed borehole after reaming to the final casing setting depth. The CONTRACTOR shall submit the caliper and gamma ray logs as part of the casing installation plan. If a caliper survey indicates the borehole is less than the reamer bit diameter at any depth, the borehole shall be re-reamed and caliper and gamma ray log re-run. If corrective measures are required, the CONTRACTOR shall provide and pay for all corrective measures and additional geophysical logs. After the caliper and gamma ray log has been successfully run and accepted by the ENGINEER, the CONTRACTOR may proceed with the installation of the well casing. No more than eight (8) hours shall pass between the completion of the geophysical logging and the commencement of the installation of the well casing.

B. If the open borehole collapses prior to or during geophysical logging or is obstructed in any manner, the CONTRACTOR shall be responsible for satisfactorily clearing the borehole for logging operations.

C. A digitally recorded color video survey of the well shall be made from land surface to the total depth of the well in the down-hole and up-hole directions. ENGINEER shall identify any or all welds to be inspected using a sideward-looking camera with full 360° rotation capability; other features of interest, as directed by the ENGINEER, may also be inspected. The quality of the picture shall be acceptable to the ENGINEER for the entire depth of the survey. The survey shall be logged at a speed as approved by the ENGINEER and provided immediately after completion of the log in a USB Flash Drive.

3.03 DYNAMIC GEOPHYSICAL LOGGING (ARTESIAN FLOW AND/OR PUMPING CONDITIONS)

A. Dynamic geophysical logs shall include flowmeter, temperature, fluid conductance, and color television survey, where indicated on the logging schedule. Dynamic geophysical logs shall be performed while flowing, if an adequate constant flow rate exists, or pumping groundwater from the borehole, as required.

B. The CONTRACTOR shall furnish and operate the temporary pumping equipment and appurtenances necessary to perform the dynamic logs. The geophysical logging shall be conducted under static and dynamic (minimum flow of 500 gpm) conditions as specified in the Geophysical Logging Schedules.

C. The static fluid resistivity and temperature logs shall be completed before any other geophysical logging is conducted.

D. The flowmeter logs shall include a calibration section on the log showing the tool response at four (4) different velocities with the tool moving up and at four (4) different velocities with the tool moving down.

E. CONTRACTOR shall prepare a Total Dissolved Solids (TDS) log using the BHC log and DIL to present an estimated formation TDS concentration with depth. The TDS log algorithm shall apply the equations for porosity developed by Archie (Journal of Petroleum Technology, 1942) and empirical relationships developed by Reese (WRI 94-4010, 1994).

F. Produced water disposal during dynamic geophysical logging shall be the responsibility of the CONTRACTOR. The CONTRACTOR shall perform water disposal in accordance with **Section 33 26 01 – Fluid Management (Formation Water Control and Discharge).**

3.04 GEOPHYSICAL LOGGING DURING CEMENTING PROCEDURES

A. After each stage or lift of cement grout placed, as specified in **Section 33 26 07 – Grouting**, the CONTRACTOR shall conduct a combination temperature and gamma ray log to confirm the depth to the top of cement established by a hard tag made with tremie pipe.

B. All temperature logs used to evaluate the top of cement shall be run within 8 to 10 hours following the completion of each cementing stage.

C. Standard Cement Bond Log (CBL):

1. Following the installation and assembly of the final casing in the injection well and before installation of cement grout, the CONTRACTOR shall perform a standard CBL as specified in the Sequence of Construction.

2. Upon completion of the cementing operations on the final casing and following a curing period of not less than 48-hours, the CONTRACTOR shall perform a second standard CBL of the final casing. The casing shall be logged while pressurized to 250 psi; installation of a wireline packoff/lubricator assembly is required.

3. The CONTRACTOR shall provide a written report evaluating the pre- and post-cementing standard CBL's in accordance with paragraph 1.02D.

D. Standard CBL:

1. Upon completion of the installation of the steel final casing in the injection well and cementing operations to within 200 feet of land surface, the CONTRACTOR shall perform a Standard CBL. The CONTRACTOR shall prepare and submit to the ENGINEER a report which quantitatively evaluates the data and explains the presence of annular cement surrounding the exterior of the casing. The report shall be prepared and submitted in accordance with paragraph 1.02D.

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3.5 GEOPHYSICAL LOGGING SCHEDULE

A. Injection Well Geophysical Log Schedule

Injection Well(s) Geophysical Log Schedule	
Drilling Interval	**Geophysical Logs**
12.25-inch Diameter **Pilot Hole to ±515 feet bls** (Fluid: mud)	**Static Logs:** XY Caliper Natural Gamma Spontaneous Potential Dual-Induction Borehole compensated sonic w/ variable density log
Nominal 52-inch Diameter **Reamed Bore Hole to ±490 feet bls** (Fluid: mud)	**Static Logs:** XY Caliper (with calculated borehole volume) Natural Gamma
Installation of the 44-inch Diameter Surface Steel Casing to ±490 feet bls (Fluid: mud)	Cement Top Temperature and Natural Gamma Ray Logs after each cementing stage
12.25-inch Diameter **Pilot Hole to ±1,425 feet bls** (Fluid: reverse-air)	**Static Logs:** XY Caliper Natural Gamma Spontaneous Potential Dual-Induction BHC Sonic with VDL Video Survey or Borehole Televiewer Temperature Fluid Resistivity Flowmeter (including up to 4 station points) **Dynamic Logs:** Temperature Fluid Resistivity Flowmeter (including up to 4 station points) (with flow interpretation analysis)
Nominal 42-inch Diameter **Reamed Bore Hole to ±1,400 feet bls** (Fluid: reverse-air)	**Static Logs:** XY Caliper (with calculated borehole volume) Natural Gamma
Installation of the 34-inch Diameter Intermediate Steel Casing to ±1,400 feet bls (Fluid: reverse-air)	Cement Top Temperature and Natural Gamma Ray Logs after each cementing stage
12.25-inch Diameter Pilot Hole to ±2,150 feet bls (Fluid: reverse-air)	**Static Logs:** XY Caliper Natural Gamma Spontaneous Potential Dual-Induction BHC Sonic with VDL Video Survey or Borehole Televiewer Temperature Fluid Resistivity Flowmeter (including up to 4 station points) **Dynamic Logs:** Temperature Fluid Resistivity Flowmeter (including up to 4 station points) (with flow interpretation analysis)
Nominal 32-inch Diameter	Static Logs:

Reamed Bore Hole to ±2,100 feet bls (Fluid: reverse-air)	XY Caliper (with calculated borehole volume) Natural Gamma
Installation of the 24-inch Diameter Final Steel Casing to ±2,100 feet bls (Fluid: reverse-air)	Standard Cement Bond Log (prior to cementing activities) Cement Top Temperature and Natural Gamma Ray Logs after each cementing stage Standard Cement Bond Log (post cementing activities) on pressurized casing (250 psi)
Nominal 22-inch Diameter Reamed Bore Hole to ±2,860 feet bls (Fluid: reverse-air)	XY Caliper (with calculated borehole volume) Natural Gamma
MIT Internal Inspection of the 24-inch Diameter Final Steel Casing (Fluid: potable freshwater)	Color Video Survey
External MIT	High Resolution Temperature Log Radioactive Tracer Survey

END OF SECTION

SECTION 33 26 07

GROUTING

PART 1 GENERAL

1.01 RELATED WORK

A. **Section 33 26 04 – Well Drilling, Section 33 26 05 - Well Casing, Section 33 26 06 – Geophysical Logging, Section 33 26 11 – MIT.**

1.02 This Section covers the Work, materials, and equipment necessary for furnishing the cement grout seal, complete.

1.03 THE REQUIREMENT

A. Commercial Standards: All Work specified herein shall conform to or exceed the requirements of the applicable codes and standards relating to the referenced portions of the following documents only to the extent that the requirements therein are not in conflict with the provisions of this section. Where such documents have been adopted as a code or ordinance by the public agency having jurisdiction, such a code or ordinance shall take precedence.

B. State Standards: South Florida Water Management District (SFWMD) and Florida Department of Environmental Protection (FDEP) Rules and Regulations for Water Wells and Injection Wells in the Florida Administrative Code (FAC).

C. Commercial Standards:

ASTM C-150	Specification for Portland Cement.
ASTM C595M-21	Specification for Type 1L Cement
AWWA A100	Standard for Water Wells.

NSF International (NSF): Standard 60: Drinking Water Treatment Chemicals—Health Effects.

D. The cost of cement, additives, and pumping equipment shall be paid at the unit price per cubic foot of cement as stated in the proposal. This unit price shall include all necessary equipment, materials, and subcontracted services required to properly cement the casing and/or tubing as specified in this section.

1.04 CONTRACTOR SUBMITTALS

A. **Cementing Specialist:** In all cementing operations, the CONTRACTOR must provide and be assisted by a cementing specialist familiar with cementing the type of formations typically encountered at the location of the well(s) and drilled depths as specified in these Contract Documents and Technical Specifications. The CONTRACTOR shall utilize the services of a company such as Halliburton Services, Baker Hughes, or equivalent, unless

he can demonstrate the expertise and previous experience of the individuals performing such cementing operations on at least three (3) equal or larger injection well casing cementing projects in the past 5 years.

B. Data sheets on grout composition for each grout source used for cementing. Additives must be approved by the ENGINEER prior to delivery to the site.

C. A grouting plan must be submitted to the ENGINEER for approval a minimum of 48 hours before the initial pressure grout and with adequate time for review and approval. Subsequent cement stage plans must be submitted and approved before additional cement is pumped.

PART 2 PRODUCTS

2.01 GENERAL

A. The CONTRACTOR shall provide all materials and equipment necessary for placing cement grout in the annular space outside the casing or tubing.

2.02 PORTLAND TYPE I/II OR TYPE 1L NEAT CEMENT

A. Material used for sealing the casing shall consist of a cement grout using ASTM C-150 Type II Portland cement. Neat cement grout shall contain no more than 5.6 gallons of water per 94-pound sack of cement.
B. In response to the discontinuation of the Type I/II cement, FDEP considers and approves PLC/Type IL cement with a limestone content between 5% and 15% as acceptable for use in well construction permitting. The PLC Type IL must still meet the respective standards listed in ASTM C595M-21.

1. The Department considers and approves PLC/Type IL cement with a limestone content between 5% and 15% and with a specification of moderate sulfate (MS) resistance or better as acceptable when cementing Class I and Class III UIC wells as described in subsection 62-528.410(5) F.A.C. The exact designation shall be PLC Type IL (5-15%) (MS) or better in accordance with ASTM C595M-21.
2. The Department considers and approves PLC/Type IL (5-15) (MS), used in conjunction with a FDEP approved pozzolanic secondary cementitious material (SCM), as acceptable as part of the well construction permitting. Pozzolanic SCM, such as calcined clay, silica fume or other environmentally friendly (non-coal ash) material are also effective for resistance to sulfate, chloride, and other forms of attack on cement and concrete.

2.03 BENTONITE AND OTHER ADDITIVES

A. Additives may be mixed with the cement to control setting time, adjust yield, improve pumpability, or to adjust the slurry volume or weight.

1. Not more than 6 percent bentonite by weight for casing installations and not more than 12 percent bentonite by weight for pilot hole back plugging operations.

2. All additives shall be NSF approved except for naturally occurring minerals and shall be approved by the ENGINEER.

B. Provide all high-yield, fine-grained, sodium bentonite (manufactured by Baroid Industrial Drilling Products, MISwaco, or equivalent) as required for cementing in the proportions specified and directed by the ENGINEER.

C. Provide other cementing additives specifically formulated for use in water well cementing as required by the ENGINEER. Material Data Safety Sheet shall be provided to the ENGINEER for any proposed cement additives before the start of construction.

D. The cost of all cement additives, including bentonite, shall be included in the cement grout unit cost.

2.04 MIXING WATER

A. The OWNER will provide a place of temporary connection for a water supply for cementing. Temporary facilities and piping required to bring water to the point of use, and payment for such water, will be the CONTRACTOR's responsibility, as specified in **Section 0100 Construction Facilities and Temporary Controls.**

B. The CONTRACTOR shall be responsible to provide a reliable source of water for cementing, including storage and pumping equipment, to ensure cementing operations are accomplished as specified.

2.05 THIXOTROPIC CEMENT

A. Thixotropic cement may be required by the ENGINEER to bridge lost circulation zones as a result of secondary permeability and porosity. Where required for use, the cost of additives to formulate thixotropic cement grout shall be included in the unit cost for ASTM C-150 Type II cement.

B. Thixotropic cement formulations (e.g., Material Data Safety Sheet) shall be provided to the ENGINEER for approval prior to performing cementing activities.

2.06 SAND – LIMESTONE GRAVEL

A. Provide silica sand for installation in the borehole using the tremie method. Material shall be 6/20 silica sand, be well graded, and free of deleterious material. Must conform in size to SFWMD rules, regulations, or permit conditions for well abandonment and the borehole or casing diameter. The amount and placement of sand shall be determined by the ENGINEER.

B. Provide limestone gravel for installation in the borehole using the tremie method. Gravel shall be 1/4 to 3/8-inch in diameter, well sorted, and free of deleterious material. The amount and placement of the limestone gravel shall be determined by the ENGINEER.

C. Fine gravel or sand may be used during cement grouting activities to bridge through zones of lost circulation when approved by the ENGINEER.

2.07 MONITORING EQUIPMENT

A. Provide a calibrated in-line magnetic fluid densometer (or equal) and digital flowmeter, including a certified calibration report of each performed in the last 60 days. This equipment shall be able to continuously monitor the volume and density of cement grout blended and pumped during casing cementing operations.

B. The slurry density determination shall be conducted in accordance with the latest edition of API Spec 10.

C. Provide a pressurized mud scale for manual measurement of cement density.

2.08 DRILLABLE BRIDGE PLUG

A. Provide manufactured or fabricated drillable bridge plug that will seal off the pilot hole at the base of the 24-inch diameter final steel casing in the injection wells. Approval of packer by ENGINEER is required.

PART 3 EXECUTION

3.01 GENERAL

A. The Work shall be performed by a competent well cementing crew, as described in Sub-Section 1.03A of this Section, with equipment that is maintained and of adequate capacity to complete all phases of well cementing operations.

B. Cement: Samples of cement shall be collected during the cement grout blending and pumping operations for all casings installed, with the CONTRACTOR collecting both dry and mixed (ready to pump) samples of the cement grout being used. Mixed cement samples shall include at least three (3) 2-inch cubes suitable for compressive strength tests, by the OWNER.

1. Cement grout samples shall be collected a minimum of three (3) times during each cementing operation: Prior to pumping, at the middle, and

at the end of the cementing operation. The specified slurry density shall match the specified slurry density indicated on the delivery certificate or subcontract cementing service company's job proposal.

2. Only 2-inch cubes, suitable for tests of compressive strength, will be acceptable as representative cement samples.

C. Operations: The CONTRACTOR shall submit for the ENGINEER's approval plans for cementing operation and casing installation at least 72 hours prior to commencing Work on those operations. These plans shall include the following information:

1. Cementing Program: Top and bottom of each interval to be cemented, pre-flush and spacer, composition of cement to be used in each interval and volume to be pumped, method of emplacement of cement, expected fill-up, expected pressures, and any additives to be used. The cementing program shall be prepared in a spreadsheet format and no cementing work may proceed until ENGINEER and FDEP (if required by permit) approve the cementing program.

D. All Work required to be repeated, resulting from the CONTRACTOR's unsatisfactory performance, including all additional materials, labor, and equipment required, shall be furnished at the expense of the CONTRACTOR and no claim for additional compensation shall be made or be allowed therefore, except as specifically provided herein.

E. The CONTRACTOR, or his SUBCONTRACTOR, shall be responsible for calculating cement volumes prior to and following grouting operations. The ENGINEER shall review methods and volumes prior to commencing cement grout pumping.

3.02 CEMENTING OF CASING

A. Cementing of casing shall be accomplished to completely fill the annular space from the bottom of the casing or the top of the preceding cement stage, to the level shown on the Drawings, or as directed by the ENGINEER.

B. It is the CONTRACTOR's responsibility to conduct the cementing operations in such a manner that both the rated burst and collapse strengths of the casing are not exceeded; deformation of the casing is prohibited. Placement of grout for casing [44 inches through 24 inches outside diameter (OD) nominal size] shall be at an annular rate determined by the CONTRACTOR and approved by the ENGINEER, prior to the commencement of cementing operations. All piping and valving shall be capable of handling the required pumping rates and pressures. The CONTRACTOR shall select grout pipe sizes (and quantity) to obtain desired flow rates consistent with velocity limitations for the grout pipes.

C. Cement grouting operations shall be done in the presence of the ENGINEER. Full access to all cementing equipment and gauges shall be provided to the ENGINEER's representative by the CONTRACTOR before, during, and after pumping operations.

D. During all stages of cementing, the CONTRACTOR shall use a pre-flush or spacer of sufficient volume prior to pumping the cement grout. The CONTRACTOR shall submit the technical specifications of the pre-flush to the ENGINEER as part of the cementing plan submittal.

E. Pressure grouting is the required initial method of cement grout placement for each casing, followed by tremie grouting in stages, if the initial cement stage does not cause cement returns at land surface.

F. A pressure retaining steel header and minimum 2 3/8-inch diameter steel tubing shall be installed and used during pressure grouting operations; the end of the tubing shall be placed within 20 feet of the casing bottom. No method shall be permitted that does not force grout from the bottom of the space to be grouted to the surface. The grouting shall be done in a continuous manner to ensure the entire filling of the annular space around the casing.

G. Grout slurry placed by the tremie method shall use externally flush or externally upset joint steel tubing having an inside diameter of 2.0 inch or greater or size approved by the ENGINEER and shall be pumped through one pipe in the annulus. Grout pipe shall be withdrawn as the annulus is filled, and before the cement begins to set. Grout pipes shall be set not more than 3 feet above the top of the previous cement stage, as determined from tremie pipe hard tag and temperature geophysical log. The last tremie pipe single of the tremie pipe string during each cementing operation, including back plugging operations, shall be distinctively marked with a water-resistant method, to assist in accounting for all the tremie pipe string once each cementing operation is completed.

H. Maintain a positive pressure on the casing during the 8 hours following the placement of cement. Well head pressure plan shall be a part of the casing cementing plan. The heating and cooling of the cement may require water to be added or released from the casing to maintain the required internal casing pressure.

I. All casing string installations performed while using mud rotary system shall be cemented solely with ASTM C-150 Type II or ASTM C595M-21 Type 1L cement, and no bentonite or any additives shall be used, unless directed by the ENGINEER.

J. All casing string installations performed using reverse-air drilling shall be cemented using ASTM C-150 Type II or ASTM C595M-21 Type 1L cement, and no bentonite or any additives shall be used on the open borehole section, unless directed by the ENGINEER. The CONTRACTOR may use up to 6% bentonite (by weight) in the annular space between casing strings.

K. Cementing of the 34-inch diameter steel casing for the injection well shall be as follows: neat cement will be pumped in the open borehole section and into the annulus until the base of the Underground Source of Drinking Water (USDW). The CONTRACTOR may use up to 6% bentonite (by weight) upon reaching the base of the USDW.

PART 1 - DOWNHOLE CONSTRUCTION

L. During the pumping of each cement stage, the CONTRACTOR shall utilize the monitoring equipment required in 2.07(A) of this section. Measurements of cement weight shall be provided to the ENGINEER at frequent intervals prior to and during cementing operations using either a densometer or mud scale. Consistency and mixing shall be approved by ENGINEER.

M. During the pumping of each cement stage, the CONTRACTOR shall supply a secondary barrel counter for measuring/determining cement volumes installed.

N. The cementing Contractor shall upon completion of cementing operations, immediately submit to the ENGINEER the Cement Specialist's written summary of the cement pumping operations. If cement pumping summary is not submitted before the Cement Specialist leaves the site, the CONTRACTOR shall not be paid for the individual cementing job.

O. A standard cement bond log will be required on the final 24-inch diameter steel casing to determine if good bonding between the casing, cement, and formation is obtained. If the bond is unacceptable, remedial Work shall be performed to the satisfaction of the ENGINEER. In addition, the ENGINEER may request additional temperature, gamma, or cement bond logs to evaluate the effectiveness of any remedial cement grout Work performed. These operations shall be conducted at the CONTRACTOR's sole expense.

P. The uppermost 200 feet of annulus in the injection well, or to the depth approved by the ENGINEER between the 34-inch diameter casing and the 24-inch diameter final injection well casing shall not be cemented until after the completion of the standard cement bond log.

2.09 DRILLABLE BRIDGE PLUG:

A. The CONTRACTOR shall furnish equipment and personnel to install a commercially available manufactured drillable bridge plug within the borehole, as approved by the ENGINEER. Alternatively, the CONTRACTOR may construct a bridge plug in place using clean limestone formation cuttings or limestone gravel (FDOT No. 57 or 58) and placement of at least 10 feet of ASTM C150 Type II Portland OR ASTM C595M-21 Type 1L neat cement on top. The amount of cement and placement method shall be reviewed and approved by the ENGINEER.

2.10 BOREHOLE (PILOT HOLE) BACK-PLUGGING

A. All pilot holes drilled on reverse-air circulation shall be plugged using ASTM C150 Type II or ASTM C595M-21 Type 1L cement with up to 12 percent bentonite by weight prior to reaming the hole for casing installation (see **Section 33 26 05 - Well Casing**).

B. Cement grout and placement methods shall be reviewed and approved by ENGINEER.

2.11 SETTING TIME

A. No drilling operations will be permitted until the cement grout has thoroughly cured.

PART 1 - DOWNHOLE CONSTRUCTION

B. Following cement placement, the casing and borehole shall remain undisturbed for a minimum of 8 hours prior to temperature geophysical logging.

C. A minimum of 12 hours-setting time shall be required between successive cement lifts. Longer time may be necessary when high-yield cement is used.

D. All cement grout lifts shall be physically tagged by tremie pipe and confirmed using a temperature/gamma log conducted before pumping a subsequent lift.

E. The CONTRACTOR shall include cement grout curing time for each grout stage in the unit price of grout pumped in the Schedule of Values.

F. After cementing is completed on a casing, casing and well must remain undisturbed for at least 24 hours for setting of the cement prior to drilling out the cement plug in the well.

2.12 REMEDIAL WORK

A. The CONTRACTOR shall be responsible for all remedial Work and related expenses in order to meet regulatory requirements and the Technical Specifications at no additional cost to the ENGINEER or OWNER. This shall include defective materials, accident, loss of equipment or equipment malfunction, or for any other cause directly attributable to the CONTRACTOR. The ENGINEER shall be notified immediately in the event of a problem, and the following shall apply:

1. The CONTRACTOR shall, submit in writing to the ENGINEER, a method of correcting the problem. The ENGINEER shall review the method of corrective action; the CONTRACTOR shall not implement the corrective action until the plan is accepted by the ENGINEER.

2. All remedial Work shall be conducted in accordance with all applicable local, State, and Federal regulations.

3. Corrective Work shall be done at no additional cost to the ENGINEER or OWNER and shall not extend the length of the Contract.

2.13 WELL ABANDONMENT

A. If the CONTRACTOR voluntarily stops Work, and/or fails to complete the well or borehole in accordance with governing regulations or the Contract Documents, the well will be considered abandoned. The CONTRACTOR shall not be paid for all or part of the well if declared abandoned by the ENGINEER.

B. The CONTRACTOR shall propose their method of abandonment of the well or borehole in writing to the ENGINEER. The ENGINEER shall review the method of abandonment. The CONTRACTOR shall not proceed with well abandonment until the ENGINEER provides written approval of the CONTRACTOR's plan. The cost of properly plugging and sealing the well or borehole, in accordance with applicable local, State, or Federal regulations, shall be at the CONTRACTOR's sole expense.

In addition, if a well or part thereof, does not have mechanical integrity, as defined by the appropriate regulatory authorities, it must be rectified before abandonment.

C. The cost of post-abandonment monitoring, if required, shall be at the CONTRACTOR's sole expense.

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SECTION 33 26 08

CORING

PART 1 GENERAL

1.01 RELATED WORK

A. **Section 33 26 04 – Well Drilling**.

1.02 WORK INCLUDED

A. This section covers the Work, material, and equipment necessary to drill and collect rock core samples, complete.

B. All Work shall be performed by a certified water well contractor, licensed by the State of Florida. CONTRACTOR shall construct the well in strict conformance with all laws, rules, regulations, and standards related to the construction of wells in the State of Florida, County, and SFWMD.

C. Cores may be obtained during the drilling of each stage of the pilot hole in the injection well.

D. The CONTRACTOR shall submit the name of the core testing laboratory to the ENGINEER for review before analyses. A core laboratory such as **Ardaman and Associates, Inc. or approved** equal will be acceptable. The report of analytical results shall be submitted to the ENGINEER. Vertical and Horizontal Permeability and Porosity reports must be received within 30 days upon CONTRACTOR's receipt of core samples from ENGINEER. All other parameters shall be required upon substantial completion of the injection well.

E. The depth selection of the cores shall be determined by the ENGINEER.

PART 2 PRODUCTS

2.01 GENERAL

A. CONTRACTOR shall provide all materials and equipment necessary for the drilling, collecting, storing, and shipping of core samples, as specified.

B. The CONTRACTOR shall make every effort to ensure the borehole is prepared for coring. The borehole shall be circulated clean to prevent cuttings and other material at the bottom of the test hole from entering the core barrel during the coring operation.

C. The core tools shall have a 4-inch diameter and a minimum of 10-feet long with a core bit designed for the formations being cored.

D. The CONTRACTOR shall provide laboratory testing and results for core analyses of ENGINEER selected rock core samples. The ENGINEER will select up to 20

core samples for the CONTRACTOR to send for laboratory analyses. Laboratory testing shall include horizontal permeability and vertical permeability, specific gravity, unconfined compression test, and porosity.

E. Upon completion of coring and upon authorization by the ENGINEER, the CONTRACTOR shall forward the core samples to the Florida Geological Survey in Tallahassee along with any appropriate well completion reports. If sample storage becomes a problem on the Site, samples may be forwarded to the Florida Geological Survey as work progresses following procedures acceptable to the ENGINEER.

2.02 CORE BARREL AND BIT

A. A core barrel at least 10-feet long shall be used, as manufactured by the Christensen Diamond Products Company, or approved equivalent. The core barrel shall be of a double tube design. The collection and distribution of the cores shall take place as described.

2.03 CORE BOXES

A. Cores shall be stored in sturdy wooden boxes, provided by the CONTRACTOR, of the proper size for the diameter of core collected. Each core box shall be a maximum of 6-feet in length and shall hold no more than 10 feet of 4-inch diameter core per core box.

PART 3 EXECUTION

3.01 GENERAL

A. Drilling and collection of the coring shall be observed by the ENGINEER.

B. During the pilot hole drilling of the injection well cores shall be collected from the following depths intervals:

1. Four (4) cores between 515 feet to 1,425 feet bls.
2. Four (4) cores between 1,425 feet to 2,150 feet bls.

C. The exact depths of the interval to be cored will be selected by the ENGINEER based on the evaluation of rock cuttings and water quality from samples collected by the CONTRACTOR.

D. The method of coring and the sequence of coring and reaming the hole to full diameter are subject to the ENGINEER's approval and shall conform to the requirements stated in these Specifications.

E. Core handling procedures shall be in accordance with the "Sample Examination Manual," Methods in Exploration Series published by the American Association of Petroleum Geologists, Tulsa, OK 74101, or equal.

F. Cores shall be stored on Site, in sturdy wooden boxes of the proper size, until completion of the Work. Core boxes shall be clearly and permanently labeled with

the depth, the top, the bottom, and sections of the core sent to laboratory for analyses. Recovered core will be delivered to the ENGINEER for evaluation and selection prior to shipment to an approved laboratory for analysis at the CONTRACTOR's expense.

G. The laboratory analysis shall include of a maximum of 8 core samples per well that will include the measurement of the horizontal permeability and vertical permeability, specific gravity, unconfined compression test, and porosity. The cost of laboratory analyses and shipping shall be included in the CONTRACTOR's unit prices for rock cores shown in the Bid Schedule.

H. The CONTRACTOR shall identify the laboratory providing the core analyses for the ENGINEER's approval prior to core drilling.

I. The CONTRACTOR shall promptly ship cores for analysis to the approved laboratory and submit results to the ENGINEER as stated in 1.02, D of this Section. It shall be the CONTRACTOR's responsibility to ship and keep track of the laboratory schedule for required core analyses.

J. The sections of cores selected by the ENGINEER for analysis in the lab, shall be analyzed for horizontal permeability and vertical permeability, specific gravity, unconfined compression test, and porosity. Cores shall be shipped in sturdy containers that protect the cores during shipping. At the time the CONTRACTOR ships a core to the laboratory for testing, the CONTRACTOR shall include the water sample collected from the same interval. The cost of the core laboratory analyses and the shipping expenses of cores and water should be included in the unit prices.

K. The final core laboratory report shall be submitted to the ENGINEER as an electronic file in a portable document format (*.pdf) file.

L. Upon completion of the work, the CONTRACTOR shall arrange for the shipment of the cores to the Florida Geological Survey in Tallahassee, United States Geological Survey in Fort Lauderdale, Florida or to the OWNER.

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SECTION 33 26 09

PACKER TESTING

PART 1 GENERAL

1.01 RELATED WORK

A. Section 33 26 01 – Fluid Management, Section 33 26 10 – Well Development, Section 33 26 13 – Water Quality Analyses.

1.02 GENERAL REQUIREMENTS

A. This Section covers the Work, materials, and equipment necessary for performing single packer and straddle-packer tests.

B. Single packer and straddle-packer tests shall be performed in the open-hole section of the pilot hole to determine the hydrologic properties of the formations and to collect representative formation water samples.

C. Packer testing will include straddle-packer tests of specific intervals and single-packer tests to test zones above and/or below the packer.

D. Groundwater sample collection will occur during packer testing.

E. Water level measuring devices will be utilized during testing.

1.03 CONTRACTOR SUBMITTALS

A. General: All CONTRACTOR submittals shall conform to the applicable requirements of Section 01 33 00 – Submittals, and the Supplementary requirements herein. All measurements for depth shall be referenced to existing pad surface at the well location, for which the elevation above NAVD 88 is available.

B. SUBCONTRACTORS List: The CONTRACTOR shall submit a complete list of all proposed SUBCONTRACTORS to be used in the work. Each SUBCONTRACTOR shall be approved by the ENGINEER. The CONTRACTOR may be required to submit additional information or a resume of qualifications to the ENGINEER for any of the SUBCONTRACTORS proposed. The ENGINEER reserves the right to disapprove the use of any SUBCONTRACTOR proposed.

C. Instrument Calibrations: Calibration records for each measuring instrument used for the packer test shall be submitted to the ENGINEER for review prior to the installation or use of the instruments. Calibration of instruments shall have been performed within 60 days prior to use in

testing. All calibration records shall be submitted to the ENGINEER prior to use.

D. Detailed description, specifications, and drawings of packer equipment to be used including flowmeter, submersible pump, pump curve, packer, and water level data logger.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. GENERAL

1. The CONTRACTOR is responsible providing and maintaining all the equipment described below, necessary to perform all packer tests.

2. The CONTRACTOR shall be responsible for providing on site back-up equipment for all items necessary to perform a successful packer pumping test. In case of packer/pump failure, pipe blockage, or unsatisfactory performance of the CONTRACTOR'S equipment, the packer test shall be rerun at no additional cost to the OWNER.

2.02 SMALL CAPACITY PUMPS

A. The CONTRACTOR shall be responsible for providing appropriate-sized submersible pumps necessary to successfully complete each packer pumping test. Two submersible pumps shall be on site; one pump having the capability of pumping 1 to 5 gallons per minute (gpm) and the second pump having the capability of pumping 25 to 100 gpm. The pumps shall meet these flow rates with a total dynamic head of 280 feet of water.

1. The pump shall not be fitted with a foot valve.

2. Provide a plug or ball valve on the discharge side of the pump downstream of the flowmeter for adjustment of flow rate if the test pump cannot be sufficiently throttled.

3. Provide pump motors, controls, and appurtenances capable of being operated without interruption for a 24-hour period.

4. Install the pump, motor, and discharge head and to provide access for water level measurements and for possible thief sampler (geophysical logger) for sampling.

B. The CONTRACTOR shall provide all necessary electrical pump wiring and control box, and a qualified operator for the duration of each packer test.

C. The CONTRACTOR shall configure the pumping system so pumping rates may be adjusted as directed by the ENGINEER.

2.03 DISCHARGE PIPING

A. Furnish and install all piping and hardware necessary to provide a leak-free seal at the wellhead and along the discharge line to convey the formation waters produced to a specified point of discharge (POD) as specifies in **Section 33 26 01 - Formation Water Control and Discharge System** and/or **Section 33 26 10 - Well Development and Section 33 26 13 - Water Quality Analyses**.

2.04 FLOW MEASURING DEVICES

A. During packer testing, the CONTRACTOR shall furnish and install either a 5/8-inch or 2-inch diameter in-line flowmeter depending on the expected pumping rate. Each flowmeter shall have a flow rate indicator and totalizer that has been certified and calibrated within the last 60 days. Provide orifice plates capable of accurately measuring total flow from 1 to 100 gpm.

B. The 5/8-in flowmeter shall have major gradations of 1 gpm and minor gradations of 0.1 gpm. The 2-inch flowmeter shall have major gradations of 10 gpm and minor gradations of 1 gpm. Accuracy shall be within 1.5 percent of full scale.

2.05 PACKERS AND TUBING

A. The inflatable packers shall be Baski, Tam J, or equivalent, dual seal open-hole packers, of a diameter appropriate for the size of the hole actually drilled (ranging between 12 to 18-inches).

B. The pipe used between the inflatable packers shall consist of appropriate diameter steel pipe or tubing. The pipe/tubing shall be uniformly slotted; the area of the slots shall exceed 4x the area of the pipe diameter. The minimum separation between packers shoulders shall be 10 feet. For dual-seal packers, provide spacer subs and perforated pipe for packer element separations from 10 to 50 feet in 2-foot increments.

C. The inflatable packer assembly shall be connected to minimum 6-inch internal diameter drill pipe. The CONTRACTOR shall ensure the appropriate steel pipe or tubing, joints and packer(s) do not leak during testing operations.

2.06 WATER LEVEL MEASURING DEVICES

A. The CONTRACTOR will be responsible for supplying transducers (Insitu® Level Troll or equivalent) and data loggers capable of measuring and recording water levels on a logarithmic time scale. The pressure transducers/data loggers shall be able to record data in logarithmic mode or at a minimum of 1-second intervals during drawdown and recovery stages. The equipment shall have an appropriate range and accuracy for the well as approved by the ENGINEER prior to testing.

1. The pressure transducers/data loggers shall be calibrated in the well on the day that it is installed for monitoring the tests. The transducer pressures/data loggers' measurement shall be plotted against depth and a correction formula determined.

2. The CONTRACTOR will be responsible for providing access for water-level measurements using an M-scope tape or electronic probe. The CONTRACTOR shall furnish an electrical depth gauge, capable of indicating depths to water to the nearest one-hundredth foot, with a sounding tube placed to the maximum depth to water anticipated. The CONTRACTOR shall provide a clear, flexible plastic manometer tube capable of measuring all anticipated water levels above land surface.

PART 3 EXECUTION

3.01 GENERAL

A. CONTRACTOR shall provide supervision of the packer tests by qualified personnel.

B. Prior to packer testing, background water levels shall be recorded for at least 8 hours or until water levels have proven stabile as determined by the ENGINEER.

C. The test durations will be a minimum of 8-hours in duration and pumping rates will be determined by the ENGINEER. During the tests, the CONTRACTOR shall manually record the time, pumping level, and discharge rate at 5-minute intervals until readings become stable enough to take 15 minute readings. When the test is completed, the pump shall be stopped and the water level in the well shall be allowed to recover for a period of at least 24 hours or a duration determined by the ENGINEER.

D. In addition to these measurements, the ENGINEER may require the CONTRACTOR to periodically take and record field measurements (i.e. conductivity, temperature, pH) on the discharge water and/or collect water samples.

E. If the test is aborted or interrupted for any reason, the test shall be stopped, the water level allowed to recover and the test restarted. No payment will be made to the CONTRACTOR for interrupted pumping tests.

F. The CONTRACTOR shall furnish 2 copies of each test's records and results.

3.02 SINGLE AND/OR STRADDLE PACKER TESTS

A. Injection Well Packer Tests

Type of Packer	Maximum Number of Packer Tests	Approximate testing Interval (feet bls)
Single/Straddle	4	515 – 1,425
Single/Straddle	4	1,425 – 2,150

B. Packer Testing: The internal surfaces of drill pipe, casings, and other fittings used for the tests shall be free of rust, scale, and other material that could be dislodged and interfere with the packer tests.

C. Packer Test Failure: Should a test fail because of the presence of any rust or scale, or other foreign material in the tools or pipe, or due to leakage past the packer, the CONTRACTOR will not be reimbursed for the test and he will be required to clean, repair or replace the pipe, reset it and the packer, and re-run the test successfully as part of the Contract requirements at his own cost. The CONTRACTOR will be given the opportunity to evaluate the ENGINEER's packer depth selection before commencing packer setting. There will be no additional payment for rig time or standby time during these periods of well recovery.

D. Single Packer Test: A single packer will be set on open-ended drill pipe at a depth to be specified by the ENGINEER for a single packer test. The pumped interval between the single packer and the bottom of the borehole shall be equipped with a pressure transducer/data logger that will record changes in pressure. A pressure transducer/data logger shall also be located in the annular space to detect for leaks around the packer. The test is expected to be conducted for a period of 8-hours or until water levels have stabilized. The pressure data shall also be recorded in an electronic format for downloading as a Log ASCII Standard (*.las) file, Comma-Separated Values file (*.csv) and Portable Document Format (*.pdf) file to the ENGINEER. Collect background data for 12 hrs and recovery data for 24 hrs.

E. Straddle Packer Test: The tests shall be performed using two inflatable packers with a section of perforated pipe between them installed in the borehole. The pumped interval between the straddle packers shall be equipped with a pressure transducer/data logger that will record changes in pressure. The lower packer shall be equipped with a memory pressure transducer/data logger. A pressure transducer/data logger shall also be located in the annular space to detect for leaks within the packer. The pressure data shall also be recorded in an electronic format for downloading as a Log ASCII Standard (*.las) file, Comma-Separated Values file (*.csv) and Portable Document Format (*.pdf) file to the ENGINEER. The test is expected to be conducted for a period of 8-hours

or until water levels have stabilized. Collect background data for 12 hrs and recovery data for 24 hrs.

F. Development: After successfully inflating and setting the packer and before the CONTRACTOR conducts a pumping and recovery test for each packer test, the CONTRACTOR shall develop each zone so that it is free of any drilling mud/fluids (and producing representative formation water) and allow the water level in the pipes to return to static. It is anticipated that rates of between 1 and 100 gpm will be obtained during the packer testing. The water produced during development and during packer testing shall be confined to the circulation system.

G. If considerable quantities of fines are pumped out of the well during the test, CONTRACTOR shall discontinue the test and resume well development. ENGINEER shall be the sole judge as to whether such additional development is necessary.

H. Operate equipment continuously at a rate and duration as specified by the ENGINEER. Begin pumping the well at a constant-rate between 1 and 100 gpm for a period of 8 hours.

I. Just prior to completion of each packer test, after adequate development approved by the ENGINEER following FDEP Standard Operating Procedures (SOP), pursuant to Chapter 62-160, F.A.C., Field Procedures (DEP-SOP-001/01 FS 2200 Groundwater Sampling), the CONTRACTOR shall collect a water sample as directed by the ENGINEER, either from the discharge or via thief sampling and have the following analyses performed by a State-certified laboratory approved by the ENGINEER: List B in accordance to **Section 33 26 13 – Water Quality Analyses**.

J. Just prior to completion of each packer test, after adequate development has been purged from the well following FDEP Standard Operating Procedures (SOP), pursuant to Chapter 62-160, F.A.C., Field Procedures (DEP-SOP-001/01 FS 2200 Groundwater Sampling) and in accordance with **Section 33 26 10 - Well Development**, the CONTRACTOR shall collect a 100 mL water sample preserved with nitric acid for metal analysis, at the end of each packer test (where sufficient water is available). The sample shall be shipped to the Florida Geological Survey, ATTENTION: Acquisition & Management Section, 3915 Commonwealth Boulevard, Tallahassee, Florida 32399.

K. Static water level shall be allowed to recover to 95 percent of pre-pumping conditions unless otherwise directed by the ENGINEER. Remove all pressure transducers/data loggers and submersible pump from the standpipe.

L. Remove pumping equipment, deflate the packer(s), reset the next interval, inflate packer(s), and repeat packer testing as per above. The ENGINEER reserves the right to require variable spacing between packers for each test. In case of packer failure, pipe blockage, and/or

unsatisfactory performance of the CONTRACTOR'S equipment, the test shall be rerun at no additional cost to the OWNER.

3.03 WATER DISPOSAL

A. Water produced from the packer pumping test shall be discharged to the Three Oaks WRF headworks. Disposal of water shall be the responsibility of the CONTRACTOR. CONTRACTOR's method of disposal shall follow an approved route, prevent re-circulation of discharged water into the interval tested until authorized to do so, and provide for erosion control and sedimentation along the entire flow route.

B. Water will require settling to reduce turbidity prior to disposal. ENGINEER must approve methods of settling excess turbidity prior to commencing each pumping test. CONTRACTOR is responsible for meeting turbidity requirements prior to discharge to the Three Oaks WRF headworks. The CONTRACTOR shall perform water disposal in accordance with **Section 33 26 01 – Fluid Management (Formation Water Control and Discharge).**

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SECTION 33 26 10

WELL DEVELOPMENT

PART 1 GENERAL

1.01 RELATED WORK

A. **Section 33 26 01 – Fluid Management, Section 33 26 09 – Packer Testing, Section 33 26 13 – Water Quality Analyses.**

1.02 GENERAL REQUIREMENT AND STANDARDS

A. After the well has been completely constructed in accordance with the requirements of the contract documents, the CONTRACTOR shall notify the ENGINEER and shall make the necessary arrangements for conducting well development prior to sampling the injection zone.

B. State Regulations: All water quality samples shall be collected in accordance with appropriate FDEP Standard Operation Procedures (SOP), pursuant to Chapter 62-160, F.A.C.

C. State Regulation: All calibration procedures for field testing and laboratory equipment shall follow manufacturer's instrumentation manuals and satisfy the requirements of the FDEP SOPs.

D. Requirement: The CONTRACTOR will have a NELAP-Certified Laboratory sample and analyze (in accordance with FDEP SOPs) all water quality samples collected from the injection well, and pad monitoring wells throughout construction and testing.

E. Commercial Standards: all work specified herein shall conform to or exceed the requirements of the applicable codes and standards relating to the referenced portions of the following documents only to the extent that the requirements therein are not in conflict with the provisions of this section. Where such documents have been adopted as a code or ordinance by the public agency having jurisdiction, such a code or ordinance shall take precedence.

F. This section covers the work, material, and equipment necessary to develop the injection well, and water table monitoring wells.

G. Standards: South Florida Water Management District (SFWMD) And Florida Department of Environmental Protection (FDEP) Rules and Regulations for Water Wells in the Florida Administrative Code (FAC) and any local and federal standards.

H. Commercial Standards:

1. A100 Standard For Water Wells — American Water Works Association (AWWA)

1.03 CONTRACTOR SUBMITTALS

A. General: All CONTRACTOR submittals shall conform to the applicable requirements of **Section 01 33 00 – Submittals,** and the supplementary requirements specified. Each item listed below shall be submitted to the ENGINEER with a clear explanation or depiction of why or how the requirements, as listed, will be fulfilled by the products or services provided by the CONTRACTOR. This list is not considered all-inclusive and may be extended by the OWNER, ENGINEER, or CONTRACTOR.

B. Test Records: test records of the injection well shall be maintained on an hourly basis, showing production rates, static water level, pumping level, drawdown, production of sand, silt, and all other information.

1. Water Quality Analyses in accordance with **Section 33 26 13 – Water Quality Analyses**

PART 2 PRODUCTS

2.01 EQUIPMENT

A. The CONTRACTOR shall furnish all equipment, compressors, piping, pumps, and appurtenances to develop the well by reverse-air circulation, straight-air, and over-pumping.

B. The CONTRACTOR shall furnish and install a submersible or turbine pump capable of continuously pumping from 20 to 1,000 gallons per minute.

C. The CONTRACTOR shall provide all necessary electrical pumps, wiring, and control boxes as necessary and an onsite qualified operator for the duration of development.

D. The CONTRACTOR shall configure the pumping system so pumping rates may be adjusted through the specified flow range, as directed by the ENGINEER.

E. The CONTRACTOR shall furnish and install an inline flowmeter with a flow rate indicator and totalizer calibrated within the last 60 days and capable of measuring discharge rates of up to 1,000 gallons per minute.

F. The CONTRACTOR shall furnish and install a valve on the discharge side of the pump, downstream of the flowmeter, to control the discharge rate, shut off flow, and stop siphon or artesian flow.

G. The CONTRACTOR shall furnish and install a discharge pipe to convey water to a settling tank prior to disposal to the Three Oaks WRF storage tank in accordance with **Section 33 26 01 – Fluid Management**.

PART 3 EXECUTION

3.01 WELL DEVELOPMENT

A. Development by Direct-Air Method (Airlifting): After receiving the ENGINEER's authorization to proceed, the CONTRACTOR shall develop the well by pumping with direct-air and shall continue until sand production as measured using a 1,000

mL Imhoff cone is less than 20 g/L and water quality has stabilized per FDEP Standard Operating Procedures (SOP), pursuant to Chapter 62-160, F.A.C., Field Procedures (DEP-SOP-001/01 FS 2200 Groundwater Sampling)

1. The CONTRACTOR shall furnish, install, and operate an air compressor with sufficient capacity to air-lift water from the well using a minimum of 300 feet of submerged air-line installed in the well.

2. The CONTRACTOR shall be responsible for providing and maintaining all necessary tanker trucks, storage tanks, dump trucks, pipes, pumps, and equipment necessary to manage the pumped water or any cuttings encountered in accordance with **Section 33 26 01 – Fluid Management** and **Section 33 26 04 – Well Drilling**.

B. Development by Pumping: After completion of airlifting development, the CONTRACTOR shall commence well development by surging using the test pump. The CONTRACTOR shall NOT pump the well until the ENGINEER and subcontract laboratory are onsite and prepared to collect water for the water quality analyses. The sample shall be collected at a pumping rate approved by the ENGINEER to allow for field measurements during the initial pump development of the well. After collection of this sample, the pump development can proceed as directed below:

1. The initial pumping rate shall be restricted and gradually increased until the maximum rate is reached as directed by the ENGINEER. The maximum rate will be determined by the ENGINEER after consideration of the well's drawdown and discharge characteristics. At frequent intervals, the pump shall be stopped and the water in the pump column shall be allowed to surge back through the pump bowls.

2. The test pump used for sampling the final completed well shall be capable of operation for up to 24 hours continuously and shall also include a valve to regulate the flow rate during the tests. The pump shall be set to a depth that will allow for the test to be run at ENGINEER approved rates without causing cavitation. The CONTRACTOR shall also provide and install a 1-inch minimum diameter access port to allow passage of a pressure transducer, a water level probe and provide a manometer tube assembly attached at the wellhead to monitor artesian water pressure during testing.

3.02 WELL DEVELOPMENT – PAD MONITORING WELLS

A. The CONTRACTOR’s NELAP-certified laboratory shall obtain weekly water samples and water level measurements from the pad monitoring wells located around the drilling pads during the course of all drilling and testing operations in accordance with FDEP-SOP-001/01, FDEP Quality Assurance Rule, 62-160, F.A.C. FS 1000 General Sampling Procedures. CONTRACTOR is responsible for supplying and maintaining all equipment needed for the sampling and measurements of the field parameters. Each pad monitoring well shall be purged with a variable-speed peristaltic pump equipped with silicone tubing in the pump head. Intake tubing will be constructed of polypropylene or polyethylene. For submerged well screen, the intake tubing shall be placed in the middle of the well

screen. Once drawdown has stabilized, purge an additional equipment volume and analyze for stabilization parameters including temperature, pH, specific conductance, and total dissolved solids. Continue collecting stabilization parameters 2 to 3 minutes apart until 3 equipment volumes have been purged. Purging will be complete once 3 consecutive readings are within allowable stabilization parameters (FDEP-SOP-001/01, FDEP Quality Assurance Rule, 62-160, F.A.C. FS 2200 Groundwater Sampling). CONTRACTOR shall be responsible for all laboratory costs incurred to analyze water samples in accordance with **Section 33 26 13 – Water Quality Analyses**. Duplicate samples will be provided to the ENGINEER for onsite analysis of parameters in accordance with **Section 33 26 13 – Water Quality Analyses.**

B. Sample bottles shall be clearly labeled in an indelible way with the well identification, sample depth, sampler's name, sample time, date, and parameter to be tested following FDEP SOP.

3.03 WELL DEVELOPMENT – INJECTION WELL

A. General: The CONTRACTOR will be required to subcontract a State of Florida certified laboratory to collect water samples for full-suite analysis of water samples collected. All samples shall be properly collected, preserved, and analyzed within the required holding time limits. The analytical method detection limit shall be less than the drinking water maximum contaminant levels (MCL) for all analyses. All costs for water sample collection and analyses shall be paid by the CONTRACTOR. Any water samples taken during the course of this project shall follow the latest version of the FDEP-Standard Operating Procedure (SOP) FDEP-SOP-001/01, FDEP Quality Assurance Rule, 62-160, FAC.FDEP. The laboratory shall be a NELAP certified analytical laboratory by FDEP and have a current approved ComQAP on file with DOH with methods approved by DEP.

B. Reverse-Air Drilling Well Development (Injection Well): The CONTRACTOR shall be responsible to circulate the fluids at each change of drill pipe or at a minimum of every 45 feet while drilling with reverse-air circulation until drill cuttings have been removed from the discharge stream with the bit on bottom at the selected depth determined by the ENGINEER. Once the discharge stream is void of drill cuttings a water sample will be collected. Suspended solids will be allowed to settle prior to field analysis. A sample will be collected for laboratory analysis. The CONTRACTOR will also be responsible for collecting water samples from the well at the ENGINEER's direction at any time during construction. No payment will be made for water quality analyses that are not performed by a DOH certified water quality laboratory. Refer to **Section 33 26 13 – Water Quality Analysis** for the list of parameters.

1. CONTRACTOR shall collect the samples and record the date, time, well ID, sampler's name, and drilling depth when the water sample was collected.

C. Packer Test Well Development (Injection Well): The CONTRACTOR shall be responsible to collect representative water samples at the beginning, middle and end of pumping phase for each packer test. Packer testing shall be conducted in

accordance with **Section 33 26 09 – Packer Testing** and the packer test water samples shall follow the directions stated in **Section 33 26 13 – Water Quality Analyses**.

D. Final Water Quality Analyses (Injection Well): The well will be sampled by the CONTRACTOR's approved subcontracted laboratory and the water samples will be analyzed for the parameters stipulated in **Section 33 26 13 – Water Quality Analyses** by a DOH certified laboratory. After removal of a minimum of 1 well volume from the well and after field parameters have stabilized according to FDEP SOPs, the CONTRACTOR's approved subcontracted laboratory shall collect one (1) final unfiltered water sample and one (1) duplicate water sample. All samples shall be properly collected, preserved, stored on ice, and analyzed within the required hold time limits.

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SECTION 33 26 11

MECHANICAL INTEGRITY TESTING

PART 1 GENERAL

1.01 RELATED WORK

A. **Section 33 26 05 – Well Casing, Section 33 26 06 – Geophysical Logging, Section 33 26 07 – Grouting.**

1.02 SCOPE OF WORK

A. This section covers the work, materials and equipment necessary to perform the mechanical integrity tests on the injection well.

1.03 TEST REQUIREMENTS

A. The CONTRACTOR shall perform Mechanical Integrity Tests (MITs) to demonstrate well soundness prior to acceptance. Mechanical Integrity Tests will be conducted upon final completion of injection well in accordance with Florida Administrative Code (F.A.C) 62-528.300. The purpose of the MIT is as follows:

1. Confirm integrity of casing (i.e., internal MIT).
2. Confirm integrity of cement seal (i.e., external MIT).

B. A well that fails any portion of the MIT may be unacceptable and subject to immediate repair in an acceptable manner or subject to abandonment and replacement at the CONTRACTOR's sole expense.

C. The Work shall be performed by the CONTRACTOR using experienced and licensed personnel, as applicable, and with CONTRACTOR furnished equipment that is appropriate and adequate to complete all phases of the MIT testing.

D. The CONTRACTOR and their Geophysical Service SUBCONTRACTOR, if applicable, shall be currently licensed to transport and handle radioactive material in accordance with NRC and State regulations. The CONTRACTOR shall provide a qualified radiation safety officer to oversee geophysical logging operations where radioactive sources are present and used at the OWNER's well site.

1.04 CONTRACTOR SUBMITTALS

A. **General:** All CONTRACTOR submittals shall conform to the applicable requirements of **Section 01 33 00 - Submittals** and the Supplementary requirements herein.

B. SUBCONTRACTORS List: In the event that the CONTRACTOR intends to use a SUBCONTRACTOR(s) for any portion of the Work, a complete list of all proposed SUBCONTRACTORS shall be submitted to the ENGINEER in accordance with the General Conditions. Each SUBCONTRACTOR shall be approved by the ENGINEER. The CONTRACTOR may be required to submit additional information or a resume of qualifications for any of the SUBCONTRACTORS proposed. The ENGINEER reserves the right to disapprove the use of any SUBCONTRACTOR proposed.

C. Instrument Calibrations: The CONTRACTOR shall submit calibration records for the totalizing flowmeter and pressure gauge furnished for use during the MITs:

1. Flowmeter calibration records shall contain the following information:

a. Serial Number, Model Number, Gears, Test apparatus size, Meter reading and flow rate for at least three (3) steps, Percent error for each step, Tester's name, title, and date of test. Calibration shall be performed no greater than 60 days prior to testing.

2. Pressure gauge calibration records shall contain the following information:

a. Serial Number, Model Number, Scale range, Meter reading and inches of mercury for at least three steps covering the entire range of the gauge, Percent error for each step, Tester's name and title. Calibration shall be performed no greater than 60 days prior to testing.

D. Video Survey: Refer to **Section 33 26 06 - Geophysical Logging.**

E. Geophysical Logging Tool Configuration: CONTRACTOR shall submit a diagram of the Radioactive Tracer Survey (RTS) logging tool, with description of the gamma ray detectors to the ENGINEER at least one week prior to its use. Refer to **Section 33 26 06 - Geophysical Logging.**

F. Radioactive Iodine^{131}: The CONTRACTOR shall submit to the ENGINEER a copy of the assay for radioactive tracer used in to conduct the radioactive tracer survey prior to introduction into the well.

G. Records Required by Law: The CONTRACTOR shall maintain all records required by governmental agencies having jurisdiction, and shall submit such records to them as may be required.

1.05 CORRECTIVE WORK

A. If it becomes necessary to perform corrective Work prior to final acceptance, on the injection well to meet either regulatory requirements, or the Technical Specifications and Contract Documents, or both, due to defective materials, accident, loss of equipment, or equipment malfunction, or for any other cause

PART 1 - DOWNHOLE CONSTRUCTION

directly attributable to the CONTRACTOR's actions, the CONTRACTOR shall bear the entire cost of the corrective Work, including any necessary Engineering Services and associated costs to support OWNER for compliance with permit and other regulatory requirements. Should the CONTRACTOR suspect or observe a condition where the Work does not comply with the Technical Specifications, the ENGINEER shall be notified immediately, and the following shall apply:

1. The CONTRACTOR shall propose a method of correcting the non-compliance, in writing, to the OWNER.

2. The ENGINEER and OWNER shall review the method of corrective action proposed by the CONTRACTOR in a written Corrective Action Plan.

3. If the CONTRACTOR's proposed corrective action is acceptable to the OWNER and ENGINEER, the ENGINEER will provide a written approval, after which, the CONTRACTOR may proceed with the Corrective Action Work. At all times all Work on the well must be in accordance with all applicable local, State and Federal regulations.

4. The CONTRACTOR shall perform additional color video survey(s) of the entire well after all corrective actions are completed to verify that no damage was caused to the integrity of the well. The video survey(s) shall be performed to the satisfaction of the ENGINEER and OWNER.

B. All Corrective Action Work resulting from the CONTRACTOR's non-conformance with the specifications, including all additional materials, labor, and equipment required, shall be furnished at the sole expense of the CONTRACTOR; no claim for additional time or compensation shall be made by the CONTRACTOR, except as specifically provided by the Contract Documents.

PART 2 PRODUCTS

2.01 GENERAL

A. The CONTRACTOR's logging equipment shall be clean, well maintained, and in good operating condition when delivered to and placed into service at the drill site.

B. Instruments of sufficient accuracy and resolution shall be furnished for use in testing as specified.

C. All equipment shall be provided with safety devices as required by governmental authorities having jurisdiction.

2.02 EQUIPMENT

A. Wellhead Equipment: The CONTRACTOR shall furnish and install a stripper head (wireline packoff) assembly used to conduct the color video survey,

geophysical logs, and RTS. The stripper head assembly shall be securely attached to the wellhead to prevent flow from the well at the pressures observed and recorded during drilling operations. The stripper head assembly furnished and installed shall be sized to accommodate the width and length of the longest geophysical tool or camera assembly used for conducting the tests and surveys. The CONTRACTOR shall furnish and install bleed and isolation valves so the stripper head assembly can be shut-in and isolated from the wellhead equipment. The assembly shall include a tee with 2-inch valve and appurtenances necessary for injecting potable water into the well during the surveys. The assembly shall include a pressure gauge and appurtenances for monitoring the pressure in the well during the tests.

B. Water Supply Pipeline: The CONTRACTOR shall furnish and install a temporary potable freshwater supply pipeline for use during the video survey and the radioactive tracer survey in accordance with **Section 01 57 00 Construction Facilities and Temporary Controls**. The pipeline shall be equipped with a double check valve assembly (backflow preventer) to prevent the backflow of water from the well into the water supply source. The CONTRACTOR is not allowed to use saline surface water from the site as a source of water.

C. A totalizing flowmeter (impeller type) shall be furnished and installed on the water supply pipeline. The flowmeter shall be capable of measuring flows accurately in the range of 70 to 120 gpm (approximately 3 to 5 fpm); flowmeter shall be accurate to 1.5 percent of full scale.

D. If the water supply point of delivery does not yield the flow rate required for testing, the CONTRACTOR shall furnish water storage and pumping equipment for conducting the dynamic RTS and casing flushing. Water injection during the dynamic RTS will be at a velocity of 3 to 5 feet per minute in the final casing (approximately 70 to 120 gpm).

E. The CONTRACTOR's pumping equipment and flow measuring devices shall be approved by the ENGINEER prior to their use. Flow measuring devices shall be calibrated and certified within 60 days prior to testing, and certification letter provided to the ENGINEER.

2.03 COLOR VIDEO SURVEY

A. The color video camera to be used for the video survey will be of a type that is capable of focusing on hole and casing in diameters ranging from 6-inches to 36-inches. Camera lighting shall provide variable intensity illumination sufficient for illuminating borehole and casing. Camera shall be capable of transmitting digital video images with sharp contrast and good resolution. The video camera will be equipped with a wide-angle fixed lens for vertical down-hole views and a side-looking, rotating lens, for horizontal views of the well casing and borehole wall.

2.04 INFLATABLE PACKER CASING PRESSURE TEST

A. CONTRACTOR shall furnish and install a pressure header for conducting the casing pressure test using down-hole inflatable packer. The header shall seal around the drill pipe supporting the inflatable packer and maintain pressure inside the casing being tested. CONTRACTOR'S wellhead equipment shall be approved by the ENGINEER prior to use.

B. CONTRACTOR shall supply a Baker Single-Set Production Injection Packer, Baski, TAM J Packer; or approved equal. The packer shall be of a diameter appropriate for the size of well casing to be pressure tested. The packer shall seal tightly against the casing walls to prevent leakage and to effectively isolate the well casing from the open-hole below the casing. ENGINEER will be the sole judge as to the effectiveness of the packer element's' isolation of the well casing. The packer shall be run on drill pipe or tubing as approved by the ENGINEER.

C. CONTRACTOR shall provide a minimum 6-inch diameter pressure gauge for use in the casing pressure tests. The gauge shall have a scale of 0 to 200 psi, a minimum increment of 1 psi and an accuracy of 0.25 percent. The gauge shall have a serial number easily located on its main body. The gauge shall be calibrated by an independent entity specializing in pressure gauge manufacturing and/or testing. A calibration certificate having the same serial number as found on the gauge to be furnished to provide to the ENGINEER within seven (7) days prior to testing, a calibration certificate as described in paragraph 1.3C, 2a. and shall have been calibrated within the previous 60 days.

2.05 GEOPHYSICAL LOGGING EQUIPMENT

A. The geophysical recording equipment shall be capable of time driven recording with multiple settings for time interval adjustment. The presentation of the logs shall be such that the response remains on scale.

B. The geophysical recording equipment shall be capable of printing log output in real time with background gamma ray log superimposed.

C. The RTS logging tool shall be configured with three gamma detectors positioned one above and two below the ejector port, and a casing collar locator (CCL) device.

D. One of the three gamma ray detectors on the RTS logging tool shall be used for the background gamma log.

E. The tracer will be medicinal-grade Iodine^{131}. Only tracer within one half-life of the production assay date will be used for the survey.

F. All materials outside of the well that come in contact with the radioactive tracer shall be collected, containerized, and removed from the OWNER's property by the CONTRACTOR or the geophysical service company immediately. The

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collected materials shall be disposed of by the CONTRACTOR in accordance with applicable regulations for the handling, transporting and disposing of radioactive materials at no additional cost to the OWNER.

PART 3 EXECUTION

3.01 GENERAL

A. Notification of Mechanical Integrity Testing: CONTRACTOR shall notify the ENGINEER at least 72-hours prior to initiating all MIT activities unless otherwise indicated. The ENGINEER will notify the FDEP.

B. Disposal of Waste Fluids: The CONTRACTOR shall provide all facilities, equipment, and materials required for the removal of waste fluids from the well Site.

C. Geophysical Logs: The geophysical logs will be run using digital down-hole tools and recording instruments with a resolution sufficient to detect the presence of radioactive tracer behind the well casing and annular cement. The high-resolution temperature probe will be checked by comparing the response to the temperature measured by a thermometer scaled in 1 degree increments immersed in the same medium. The logs will be run at no more than 30 feet per minute with a 2 second time constant. A repeat section will be run on a section representing a significant feature for each geophysical log to demonstrate repeatability and the sensitivity of the instrument. Refer to **Section 33 26 06 - Geophysical Logging.**

3.02 VIDEO SURVEY

A. For a period of 24 hours and immediately prior to conducting the video survey, potable water will be pumped into the well at a rate specified by the ENGINEER through the 2-inch diameter valve located on the stripper head assembly. Potable freshwater shall be pumped into the well to clear the water column for the survey; the lower density freshwater, as compared to formation water, will also provide an upward buoyant force required for conducting the subsequent radioactive tracer survey. A minimum of three well volumes of potable freshwater shall be pumped into the well. If, after 24 hours of pumping potable water into the well, the concentration of particulates suspended in the water column does not permit a clear video of the well (casing and open-hole), the CONTRACTOR may be required to perform additional pumping and/or cleaning of the well to remove suspended solids to ensure the video survey produces a clear image for inspection of the well casing and open-hole.

B. During the video survey, water will be pumped into the well at a flow rate of ranging from 20 to 250 gpm. Water will continue to be pumped throughout the survey. If during the video survey, the clarity of the water column declines, the CONTRACTOR shall stop the video survey to allow continued displacement down-hole of water containing solids. During the video survey, the CONTRACTOR shall stop the camera where potential defects in the casing and

welds/couplings are observed to allow for thorough examination using the side-looking camera.

C. After completing the down-hole run with the video camera, and upon reaching the total depth of the well, the CONTRACTOR shall remove the camera from the well, if the video survey is determined to be satisfactory by the ENGINEER. The CONTRACTOR shall provide 2 field copies of the video via USB 2.0 flash drive or OWNER's approved format.

D. The video survey shall be performed by the CONTRACTOR or his qualified and approved subcontract service company.

E. The video survey will be conducted in the presence of the ENGINEER.

F. The video survey schedule for injection well shall be as follows:

1. Injection Well Video Survey Schedule

	Injection Well Color Video Surveys
	Nominal 22-inch diameter open borehole and 24-inch outside diameter (OD) Final Steel Casing.

3.03 CASING PRESSURE TESTS

A. The CONTRACTOR shall install the testing packer at a depth approved by the ENGINEER, which shall be below the lowermost casing joint. The CONTRACTOR shall submit to the ENGINEER, a pipe tally, including down-hole equipment, to verifying the packer set depth. The packer tubing and well tubing or casing shall be sealed at the surface with a temporary wellhead capable of maintaining an air and water-tight seal exceeding the anticipated test pressure.

B. The CONTRACTOR shall conduct a preliminary pressure test to ensure the equipment is free from leaks and operates properly. The CONTRACTOR shall notify the ENGINEER at least 24 hours before running the preliminary test. This test will be run following the same procedure and protocol as the acceptance pressure test described below.

C. The acceptance pressure test shall be observed and certified in writing by the ENGINEER.

D. Prior to beginning the pressurization, the casing and wellhead fittings shall be completely filled with water. Following pressurization, valves and fittings installed on the wellhead shall be bled to remove any remaining air; and pressure shall be bled and shut-in at the prescribed test pressure.

E. The 60-minute duration pressure test shall be performed by the CONTRACTOR on the indicated casings or tubing to test the internal mechanical integrity of the well. The maximum allowable variation in observed pressure is ±5 percent of the starting test pressure. If the pressure changes beyond the allowable pressure variation, or if leakage is observed in the piping or equipment, the CONTRACTOR shall take steps to locate the leak and make repairs in a manner satisfactory to the ENGINEER.

F. Upon the conclusion of the pressure test, the CONTRACTOR shall slowly bleed off water pressure released from the casing during pressurization. The water shall be collected by the CONTRACTOR with the volume measured in a manner satisfactory to the ENGINEER.

G. The pressure testing schedule for shall be as follows:

1. Injection Well Pressure Testing Schedule

Injection Well Pressure Tests	
Casing Test	**Target Pressure**
24-inch Final Steel Casing	±150 psi

3.04 GEOPHYSICAL LOGGING

A. Prior to conducting the RTS, the CONTRACTOR's designated radiation safety officer shall perform a background Geiger counter survey of the work site.

B. Install on the wellhead a standpipe, stripping head, and other necessary piping for logging tool isolation and flow prevention from the nominal 24-inch diameter final casing. If the RTS is not conducted immediately following the completion of the color video survey, the well may need to be charged with freshwater.

C. CONTRACTOR shall furnish, install, and operate temporary piping and pumping equipment for flushing the well.

D. Prior to proceeding with RTS, flush the well by pumping three (3) casing volumes of potable water into the well.

E. The well shall sit undisturbed for a minimum of 24 hours after pumping water and before commencing the background gamma ray log.

F. Perform background gamma ray, temperature, and casing collar locator log (CCL) prior to loading the tool with 5 mCi of medicinal grade Iodine^{131}.

G. Load medicinal grade Iodine^{131} into the tool and prepare for the RTS.

H. Perform dynamic RTS for evaluation of external mechanical integrity. Testing shall be completed as follows:

1. After positioning the ejector port approximately 5 feet above the base of the casing, inject freshwater at a velocity of 3 to 5 fpm.

2. Eject 1 mCi of medical grade Iodine^{131} and monitor gamma ray detector count for 1 hour while the tool is held stationary and recording in time-drive mode.

a. In the event the that tracer is detected in the upper gamma detector at any time during time-drive logging, move the tool upward while logging to a point approximately 20 feet above the previous position and resume time-drive logging.
b. If upward tracer movement is detected, repeated the previous step until the tracer movement is no longer detected.

3. Log upward out of position to a point 200 feet above the highest point at which tracer is detected.
4. Flush the casing with one casing volume of water, less if the point of tracer eject returns to background gamma ray levels.
5. Run a gamma ray log, following flushing, from 1 foot below the base of casing to at least 200 feet above the highest point at which tracer is detected.
6. Perform a second dynamic RTS as previously described beginning at step number 1 above, except eject 2 mCi of medical grade Iodine^{131}. The duration of the monitoring will be reduced to 30 minutes.
7. Upon completion of the two dynamic RTS, lower the tool a minimum of 100 feet below the base of the base of the casing, to a high transmissivity receiving zone, if possible, and eject the remaining tracer while flushing the well with a minimum of one casing volume of water and log upward out of position.
8. Perform a final gamma ray log from the total completed depth of the well to land surface to confirm that tracer has been displaced from the well casing and has not migrated above the confining interval. Assess testing results and obtain RTS acceptance and approval from the regulatory representative prior to demobilization of RTS equipment. Additional RTS tests may be necessary to obtain regulatory acceptance and approval.
9. Remove RTS tool from the well and perform a final Geiger survey of the site.
10. Install injection wellhead and shut-in well.

I. All logs shall be clearly labeled with all pertinent information regarding the well, location, depths, scales, etc. Provide the ENGINEER with two field copies at the time of logging and a PDF file. Provide one electronic copy of RTS files in LAS II or equivalent format and Adobe Acrobat (as a .pdf file).

END OF SECTION

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SECTION 33 26 12

INJECTION TESTING

PART 1 GENERAL

1.01 THE REQUIREMENT

A. This Section covers the work, materials and equipment necessary for injection testing complete.

B. The estimated length of the constant rate injection test is 12 hours. The rate will be determined by the ENGINEER in the field.

C. The ENGINEER will determine the time to begin the constant rate injection test within the time constraints of the Contract period. Work shall be performed as specified herein or as directed by the ENGINEER.

D. The water source for the injection test shall be High Level Disinfection (HLD) effluent from the Three Oaks Water Reclamation Facility (WRF).

E. The CONTRACTOR shall be solely responsible for the data logging.

1.02 CONTRACTOR SUBMITTALS

A. General: All CONTRACTOR submittals shall conform to the applicable requirements and the Supplementary requirements herein. All measurements for depth shall be referenced to existing pad surface at the well location, for which the elevation above NAVD is available.

B. SUBCONTRACTORS List: The CONTRACTOR shall submit a complete list of all proposed SUBCONTRACTORS to be used in the work. Each SUBCONTRACTOR shall be approved by the ENGINEER. The CONTRACTOR may be required to submit additional information or a resume of qualifications to the ENGINEER for any of the SUBCONTRACTORS proposed. The ENGINEER reserves the right to disapprove the use of any SUBCONTRACTOR proposed.

C. Instrument Calibrations: The CONTRACTOR shall submit to the ENGINEER at calibration data for each measuring instrument to be used in testing, which shall have calibrations done no more than 60 days prior to testing.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. The CONTRACTOR'S equipment shall be clean and well maintained and in good operating condition when delivered to the Site and during the entire operation.

1. The equipment shall be of adequate size, strength and horsepower to complete all phases of the testing and instruments of sufficient accuracy and resolution to identify anomalous well response to the tests.

2. In case of pump failure, pipe blockage, and/or unsatisfactory performance of the CONTRACTOR'S equipment, the injection test shall be rerun at no additional cost to the ENGINEER.

2.02 TEMPORARY PIPELINE AND BOOSTER PUMP

A. Furnish and install a temporary pipeline to convey water from the Wastewater Treatment Plant to the injection well as shown on the Drawings. The temporary pipeline shall be capable of delivering water to the injection well at a rate of 12,950 gpm at 10 fps. CONTRACTOR shall size the pipeline and pumps based on associated friction losses for the piping system, static wellhead pressure of approximately 35 psi, and casing and injection zone losses of up to 60 psi above static pressure.

B. Furnish and install an isolation/throttling valve in the pipeline. The location of the valve shall be at least five pipe diameters downstream of the flow measuring device.

C. Furnish and install a water sampling valve with hose bib on the temporary pipeline.

D. The CONTRACTOR shall be required to provide temporary booster pump(s), temporary piping, and all appurtenances from the injectate source to the injection well. This is expected to occur after completion of injection well and monitoring well construction and demobilization from the site.

E. The booster pumps and associated piping etc. shall be of sufficient size and capacity to maintain a pumping rate of 12,950 gpm to the injection well.

F. The CONTRACTOR shall provide an operator during the entire time the pump is in operation, as required by the ENGINEER, to operate the prime mover and to regulate the discharge by the throttling device during the test pumping period.

G. Furnish and install a testing pressure gauge at the wellhead or on the temporary pipeline within 5-feet of the injection well.

2.03 FLOW MEASURING DEVICE

A. Flowmeters for use in testing the well shall have a scale from 0 to 150% of the maximum flow rate, 12,950 gpm, specified with major gradations of 1,000 gpm and minor gradations of 200 gpm. All flowmeters shall be calibrated before use and flowmeter documentation along with calibration records shall be submitted to the ENGINEER prior to use for approval, as described in **Section 01 33 00 - Submittals**. Flowmeter accuracy shall be ¼ of 1 percent of full scale.

B. Flowmeter shall read instantaneous flow rate and totalize the flow.

2.04 MONITORING EQUIPMENT

A. The CONTRACTOR shall provide all monitoring equipment on the injection well for background monitoring, the injection test and all recovery phases.

B. The CONTRACTOR shall provide the services of a company to supply wellhead pressure transducers (Insitu® Level Troll or equivalent) and a down hole memory pressure transducer that can measure the bottom hole and wellhead pressures to the resolution of ±0.01 psi to record pressures on a logarithmic scale during testing and temperatures to ±0.01 degrees Celsius. Pairs of transducers shall be used concurrently to provide testing and recording redundancy. The equipment should provide the ENGINEER with a hard copy of the data accessible throughout the test, and an electronic file upon completion in EXCEL format (*.xlsx) format and Portable Document Format (*.pdf).

C. The CONTRACTOR shall compare the transducer pressure measurement to the theoretical static water pressure, and the transducer error shall be plotted against temperature or depth and a correction formula determined, if deemed necessary by the ENGINEER. The calibration report shall include the calibration process and list the transducer's calibration coefficients linearity, scale and offset.

D. The CONTRACTOR shall provide equipment and services to monitor the injectate temperature, tidal records and barometric pressure during the background and testing activities.

E. It is the responsibility of the CONTRACTOR to provide a temporary stripper-head to allow for access and placement of pressure transducers/data loggers at the injection well and the upper and lower monitoring zones on the monitoring well.

PART 3 EXECUTION

3.01 GENERAL

A. The CONTRACTOR shall be solely responsible for the data logging.

3.02 BACKGROUND MONITORING

A. After the injection well construction is completed, as determined by the ENGINEER, and after the development of the well, the CONTRACTOR shall prepare for injection testing. The CONTRACTOR shall notify the ENGINEER 2 days prior to initiating background water elevation measurement and recording required for the injection test.

B. The CONTRACTOR shall survey and establish the reference point elevations on the well for installation of water level/pressure monitoring transducers and/or transmitters. All reported data shall be presented as elevation referenced to NAVD 1988.

C. Background water elevations data shall be collected on the injection well and both zones of the monitoring well for a period of 2 days, immediately preceding injection testing. During background monitoring, the well shall remain undisturbed and water level/pressure shall be monitored and recorded.

D. CONTRACTOR shall install a temporary recording barometer for measurement of atmospheric pressure during the background, injection, and recovery periods. The barometer may be an integral component of the water level data logger.

E. A period of 48 hours of pre-test readings shall be collected. During this period, the well are to be left undisturbed and are to be monitored continuously by pressure transducers/data loggers in each well. The CONTRACTOR may use this time to prepare for the injection test and to do other site activities. In no event, shall the CONTRACTOR charge any part of the monitoring period as standby time.

F. Readings shall be collected on a schedule to be supplied by the ENGINEER prior to the start of injection testing. At a minimum, the equipment should be capable of recording readings on a schedule of variable intervals from one reading per 1 second to one reading per hour. The equipment shall be capable of logarithmic time readings at multiple steps during testing.

G. In the event of equipment failure during the 48-hour background test, the monitoring period shall be extended so 48-hours of continuous data is recorded prior to commencing the injection test. No extra time or payment will be allowed for equipment failure or operator error.

H. It is imperative that the monitoring equipment be in proper working order, and recording data throughout the entire period of time of the injection test and recovery test. Should monitoring equipment fail during the background monitoring, the monitoring period shall be extended to include readings for 48 continuous hours. No extra time or payment for any faulty equipment or operator error will be allowed.

3.03 CONSTANT RATE INJECTION TEST

A. Readings shall be collected on a schedule to be supplied by the ENGINEER prior to the start of injection testing. At a minimum, the equipment should be capable of recording readings on a schedule of variable intervals from one reading per 1 second to one reading per hour. The equipment shall be capable of logarithmic time readings at multiple steps during testing.

B. The injection test will be run for a period of approximately 12 hours or as determined by the ENGINEER.

C. At the completion of the injection test, the monitoring devices shall not be removed or disturbed for a minimum of 24 hours or as determined by the ENGINEER. No additional standby time or pumping time payment shall be awarded during period.

D. It is imperative that the monitoring equipment be in proper working order, and recording data throughout the entire period of time of the injection test and recovery test. Should monitoring equipment fail during the test period, the CONTRACTOR shall restart the test, as directed by the ENGINEER. If the test must be restarted, the CONTRACTOR must wait for well recovery prior to reinitializing the test. No extra time or payment for any faulty equipment or operator error will be allowed.

END OF SECTION

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SECTION 33 26 13

WATER QUALITY ANALYSES

PART 1 GENERAL

1.01 RELATED WORK

A. **Section 33 26 03 Pad Monitoring Wells, Section 33 26 04 – Well Drilling, Section 33 26 09 – Packer Testing, Section 33 26 10 – Well Development.**

1.02 STANDARD AND REGULATIONS

A. State Regulations: All water quality samples shall be collected in accordance with appropriate FDEP Standard Operation Procedures (SOP), pursuant to Chapter 62-160, F.A.C.

B. State Regulation: All calibration procedures for field testing and laboratory equipment shall follow manufacturer's instrumentation manuals and satisfy the requirements of the FDEP SOPs.

C. Requirement: The CONTRACTOR will have a NELAP-Certified Laboratory sample and analyze (in accordance with FDEP SOPs) all water quality samples collected from the injection well, and pad monitoring wells throughout construction and testing.

D. Commercial Standards: all work specified herein shall conform to or exceed the requirements of the applicable codes and standards relating to the referenced portions of the following documents only to the extent that the requirements therein are not in conflict with the provisions of this section. Where such documents have been adopted as a code or ordinance by the public agency having jurisdiction, such a code or ordinance shall take precedence.

E. State Standards: South Florida Water Management District (SFWMD) And Florida Department of Environmental Protection (FDEP) Rules And Regulations For Water Wells In The Florida Administrative Code (FAC) and any local and federal standards.

F. Commercial Standards:

1. A100 Standard For Water Wells — American Water Works Association (AWWA)

1.03 CONTRACTOR SUBMITTALS

A. General: All CONTRACTOR submittals shall conform to the applicable requirements of **Section 01 33 00 – Submittals,** and the supplementary requirements specified. Each item listed below shall be submitted to the ENGINEER with a clear explanation or depiction of why or how the requirements, as listed, will be fulfilled by the products or services provided by the CONTRACTOR. This list is not considered all-inclusive and may be extended by the OWNER, ENGINEER, or CONTRACTOR.

B. Water Quality Analyses: The CONTRACTOR shall submit an Adobe (.PDF) document of laboratory reports for the analyses of the water quality samples within 2 weeks of receipt of samples by the laboratory.

1. All water quality analyses will be performed by a laboratory certified with the State of Florida for analysis of drinking water with a current National Environmental Laboratory Accreditation Program (NELAP) certification on file with DOH in accordance with methods and reporting format approved by DEP.

2. If required by the ENGINEER, under special circumstances such as for casing seat requests, the CONTRACTOR is required to obtain preliminary water quality results from the laboratory, including pH, temperature, total dissolved solids (TDS), specific conductance and chloride for ENGINEER's use and submittal to FDEP. Preliminary water quality data shall be submitted to the ENGINEER within 3 days of sample collection. If casing seat or packer test depth selection cannot be completed due to CONTRACTOR's delay in submitting preliminary water quality results, the associated delay shall not be considered standby time.

3. All water quality analyses by the lab shall be for the parameters lists provided below.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. The water quality samples shall be collected in accordance with appropriate FDEP Standard Operation Procedures (SOP), pursuant to Chapter 62-160, F.A.C.

B. The CONTRACTOR is responsible providing and maintaining all the equipment necessary to obtain the field water quality parameters and water level readings as directed by the ENGINEER. Said equipment shall be provided to the OWNER at the end of the project.

PART 3 EXECUTION

3.01 WATER SAMPLING – WATER TABLE MONITORING WELLS

A. The CONTRACTOR will be required to sample the pad monitoring wells in accordance with **Section 33 26 10 – Well Development**. CONTRACTOR shall

be responsible for all laboratory costs incurred to sample and analyze water samples from List C. Duplicate samples will be provided to the ENGINEER for onsite analysis.

B. Sample bottles shall be clearly labeled in an indelible way with the well identification, sample depth, sampler's name, sample time, date and parameter to be analyzed.

C. The laboratory report shall include field notes including a groundwater sampling log (DEP-SOP-001/01, FS 2200 Groundwater Sampling, Form FD 9000-24, GROUNDWATER SAMPLING LOG) for each well sampled.

3.02 WATER SAMPLING – INJECTION WELL

A. General: The CONTRACTOR will be required to collect water samples in accordance with **Section 33 26 10 – Well Development**. All samples shall be properly collected, preserved, and analyzed within the required holding time limits. The analytical method detection limit shall be less than the drinking water maximum contaminant levels (MCL) for all analyses. All costs for water sample collection and analyses shall be paid by the CONTRACTOR. Any water samples taken during the course of this project shall follow the latest version of the FDEP-Standard Operating Procedure (SOP) FDEP-SOP-001/01, FDEP Quality Assurance Rule, 62-160, F.A.C.FDEP. The laboratory shall be NELAP certified analytical laboratory by FDEP and have a current approved ComQAP on file with DOH with methods approved by DEP.

B. Reverse-Air Drilling Water Samples (Injection Well): The CONTRACTOR shall be responsible for all laboratory costs incurred to sample and analyze water samples from List A. Duplicate samples will be provided to the ENGINEER for onsite analysis.

C. Packer Test Water Quality Samples: The CONTRACTOR shall be responsible to collect representative water samples at the beginning and middle of the packer test for List A parameters and at the end of the packer test for List B parameters. CONTRACTOR shall collect the samples and record the date, time, well ID, sampler's name, and drilling depth when the sample was collected. The laboratory shall be NELAP certified analytical laboratory by FDEP and have a current approved ComQAP on file with DOH with methods approved by FDEP. Duplicate samples will be provided to the ENGINEER for onsite analysis.

D. Final Water Quality Analyses (Injection Well): The CONTRACTOR shall be responsible for collecting water samples at the end of the injection zone development for List D parameters. In the event that injection has started in the existing municipal injection well at Three Oaks WRF, List E parameters shall be analyzed for at the end of development of the injection well. After removal of a minimum of 1 well volume from the well and after field parameters have stabilized according to FDEP SOPs, the CONTRACTOR's approved subcontracted laboratory shall collect one (1) final unfiltered water sample and one (1) duplicate water sample. All samples shall be properly collected, preserved, stored on ice, and analyzed within the required hold time limits, following the latest version of the FDEP-Standard Operating Procedure (SOP) FDEP-SOP-001/01, FDEP Quality Assurance Rule, 62-160, F.A.C.FDEP.

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E. Sample Bottles: Samples for which laboratory analyses are required shall be collected in specially designated and approved sample containers provided by the CONTRACTOR's laboratory.

F. Labeling: The sample containers shall be clearly labeled with the well identification, the depth or interval below land surface from which the sample was collected, sampler's name, the parameters to be analyzed, and the time and date of sample collection.

G. Delivery: Samples shall be collected and stored in the appropriate manner as instructed by the laboratory and delivered to the laboratory in accordance with the laboratory's instructions.

H. Chain of Custody: Chain of Custody forms shall be completed for all water samples. Copies of the Chain of Custody forms shall be submitted to the ENGINEER within five days of delivery of the samples to the laboratory and included with the final water quality report. All persons handling the samples shall be required to sign the Chain of Custody form.

I. Holding Times: The CONTRACTOR shall be aware of applicable water sampling holding times for the samples for which he is responsible and ensure that the samples are transmitted to the laboratory within these time periods, following the latest version of the FDEP-Standard Operating Procedure (SOP) FDEP-SOP-001/01, FDEP Quality Assurance Rule, 62-160, F.A.C.FDEP. For samples collected by the laboratory, the CONTRACTOR shall be responsible for the performance of the sub-contractor's service and analysis of the samples within required hold times.

3.03 WATER QUALITY SAMPLING PARAMETERS

A. List A - During reverse-air drilling of the injection well at every drill pipe change or not more than 45-foot intervals, as described in **Section 33 26 04 - Well Drilling** and end of each step of variable rate pump test:

1. Chloride
2. Specific Conductance
3. Total Dissolved Solids (TDS)
4. Sulfate
5. pH[1]
6. Temperature[1]
7. 7. Total Kjeldahl nitrogen (collected and analyzed not more than every 90 feet)
8. 8. Ammonia (collected and analyzed not more than every 90 feet)

B. List B - During packer testing of the injection well as described in **Section 33 26 09 - Packer Testing**:

1. List A parameters (analyzed prior to remaining Parameter B list)
2. Iron

3. Calcium
4. Magnesium
5. Total Alkalinity
6. Total Nitrogen
7. Ammonia
8. Total Kjeldahl nitrogen
9. Total and Noncarbonate Hardness

C. List C – Shallow Groundwater Monitoring Wells sampling parameters will be collected weekly. Increased frequency of sampling and analysis may be required depending on laboratory analytical results and/or site activities:

1. Chloride
2. Specific Conductance[1]
3. Total Dissolved Solids (TDS)
4. temperature[1]
5. pH[1]

D. List D – Final Background Analysis upon completion and development of injection well:

List A and B Parameters,

Primary Drinking Water Standards – Listed below:

1. Alachlor
2. Aldicarb
3. Aldicarb sulfoxide
4. Aldicarb sulfone
5. Aroclors (Polychlorinated Biphenyls or PCBs)
6. Alpha, Gross (including Radium-226 and excluding Radon and Uranium)
7. Antimony
8. Arsenic
9. Atrazine
10. Barium
11. Benzene
12. Benzo(a)pyrene
13. Beryllium
14. Beta, Gross
15. bromate
16. Cadmium
17. Carbofuran
18. Carbon tetrachloride
19. Cesium-134
20. Chlordane
21. Chlorine
22. Chloramines

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23. Chlorine dioxide
24. Chlorite
25. Chlorobenzene (Monochlorobenzene)
26. Chromium
27. Coliforms, Total
28. Conductivity
29. Cyanide as (free Cyanide)
30. 2,4-D (2,4-Dichlorophenoxyacetic acid)
31. Dalapon (2,2-Dichloropropionic acid)
32. Dibromochloropropane (DBCP)
33. 1,2-Dibromoethane (EDB, Ethylene Dibromide)
34. 1,2-Dichlorobenzene (o-Dichlorobenzene)
35. 1,4-Dichlorobenzene (p-dichlorobenzene or para-Dichlorobenzene)
36. 1,2-Dichloroethane (Ethylene dichloride)
37. 1,1 Dichloroethene(Vinylidene chloride)
38. cis-1,2- Dichloroethylene (1,2-Dichlorethylene)
39. trans-1,2-Dichloroethylene (1,2-Dichloroethylene)
40. Dichloromethane (Methylene chloride)
41. 1,2-Dichloropropane
42. Di(2-ethylhexyl) adipate (Bis(2-ethylhexyl) adipate)
43. Di(2-ethylhexyl) phthalate (Bis(2-ethylhexyl) phthalate)
44. Dinoseb
45. Diquat
46. *E. coli*
47. Endothall
48. Endrin
49. Ethylbenzene
50. Ethylene dibromide (EDB)
51. Fluoride
52. Glyphosate (Roundup)
53. Haloacetic Acids (Five) (HAA5)
54. Heptachlor
55. Heptachlor epoxide
56. Hexachlorobenzene (HCB)
57. Hexachlorocyclopentadiene
58. Iodine-131
59. Lead
60. Lindane (gamma-Hexachlorocyclohexane)
61. Mercury
62. Methoxychlor
63. Monochlorobenzene
64. Nickel
65. Nitrate (as N)
66. Nitrite (as N)
67. Total Nitrate + Nitrite (as N)
68. Oxamyl (vydate)
69. Pentachlorophenol
70. Picloram
71. Polychlorinated biphenyls (PCBs)
72. Radionuclides, Other
73. Radium-226

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74. Radium-228
75. Radium-226 and Radium-228, Combined
76. Selenium
77. Silver
78. Silvex (2,4,5-TP)
79. Simazine
80. Sodium
81. Strontium-89
82. Strontium-90
83. Styrene (Vinyl Benzene)
84. Tetrachloroethylene (Perchloroethene)
85. Tetrachloromethane (Carbon Tetrachloride)
86. Thallium
87. Toluene
88. Toxaphene
89. 1,2,4-Trichlorobenzene
90. 1,1,1-Trichloroethane
91. 1,1,2-Trichloroethane
92. Trichloroethylene (TCE)
93. Trihalomethanes, Total (TTHM)
94. Tritium
95. Uranium
96. Vinyl Chloride (Chloroethylene)
97. Xylenes (total)

Secondary Drinking Water Standards – Listed below:

98. Aluminum
99. Chloride
100. Color
101. Copper
102. Fluoride
103. Foaming Agents (MBAS)
104. Iron
105. Manganese
106. Odor
107. pH
108. Silver
109. Sulfate
110. Total Dissolved Solids (TDS)
111. Zinc

Municipal Wastewater Indicator Parameters for Groundwater Monitoring

112. Ammonia
113. Nitrogen (organic)
114. Total Kjeldahl Nitrogen
115. Total Phosphorus (phosphate)

PART 1 - DOWNHOLE CONSTRUCTION

116. Chloroethane
117. Chloroform
118. Para-Dichlorobenzene (1,4 Dichlorobenzene)
119. 1,2-Dichloroethylene (cis-1,2-Dichloroethylene or trans-1,2-Dichloroethylene
120. Anthracene
121. Butylbenzylphthallate
122. Dimethylphthallate
123. Naphthalene
124. Phenanthrene
125. Aldrin
126. Dieldrin
127. 2-chlorophenol
128. Phenol
129. 2,4,6-trichlorophenol
130. Conductivity
131. Biochemical Oxygen Demand
132. Chemical Oxygen Demand
133. Temperature

Inorganic Compounds:

1. Asbestos

[1] Parameters measured in the field during well construction and testing.

END OF SECTION

PART 1 - DOWNHOLE CONSTRUCTION

SECTION 40 05 05.11 - PIPING, GENERAL

PART 1 -- GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide piping systems indicated, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section shall apply to piping in **Division 40**, and on the Drawings and as indicated in the Piping Schedule.

C. The Drawings define the general layout, configuration, routing, method of support, pipe size, and pipe type. The Drawings are not pipe construction or fabrication drawings. The CONTRACTOR shall prepare pipe spooling and fabrication drawings and shall submit them to the ENGINEER for review.

D. Where pipe layout details are not indicated on the Drawings, it is the CONTRACTOR'S responsibility to develop the details necessary to design and construct piping systems to accommodate the specific equipment provided, and to provide spacers, adapters, and connectors for a complete and functional system.

1.2 DEFINITIONS

A. Pipe, piping, pipe work, pipe system, piping system, or similar words, singular or plural shall mean and include, any type of pipes, tubes, fittings, valves, piping specialties, appurtenances, supports, restraints, anchors, coatings and linings and items related to piping.

B. Submerged piping, underwater piping or similar words, shall include any piping located two feet above water surface in basins or tanks

C. Potable water or similar words, shall mean and include any type of potable water or process water that be deemed potable after treatment processes.

D. Corrosive service shall mean and include in locations listed below:

a. Buried locations

b. Submerged locations or submerged piping.

c. Inside buried vaults, manholes, and structures that do not drain through a gravity sewer or to a sump with a pump.

d. Chemical handling areas

e. Inside trenches, containment walls, and curbed areas

f. Locations indicated or designated in the contract documents.

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with **Section 01 33 00 – Submittals**.

B. Shop Drawings: Shop Drawings shall contain the following information:

1. Drawings: Layout drawings including necessary dimensions, details, pipe joints, fittings, specials, bolts and nuts, gaskets, valves, appurtenances, anchors, guides, and material lists. Pipe spooling and fabrication drawings shall indicate spacers, adapters, connectors, fittings, and pipe supports to accommodate the equipment and valves in a complete and functional system.

2. Welding Qualifications and Procedures

3. Gasket Material: Submit gasket manufacturer's catalog indicating that the recommended product is suitable for each fluid service application.

4. Seals and Seating Materials: Submit elastomer material and manufacturer's catalog indicating that the recommended product is suitable for each fluid service application.

C. Samples

1. Performing and paying for sampling and testing as necessary for certifications are the CONTRACTOR'S responsibility.

D. Certifications

1. Necessary certificates, test reports, and affidavits of compliance shall be obtained by the CONTRACTOR.

2. A certification from the pipe fabricator that each pipe will be manufactured subject to the fabricator’s or a recognized Quality Control Program. An outline of the program shall be submitted to the ENGINEER for review prior to the manufacture of any pipe.

1.4 MATERIAL DELIVERY, STORAGE, AND PROTECTION

A. Piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground for protection against oxidation caused by ground contact.

B. Defective or damaged materials shall be replaced with new materials.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Extent of Work

1. Pipes, fittings, and appurtenances shall be provided in accordance with the requirements of the applicable **Divisions 31** and **40** and as indicated.

2. Materials in contact with potable water or process water that be deemed potable after treatment processes shall be listed as compliant with NSF Standard 61.

B. Pressure Rating

1. Piping systems shall be designed for the pressure as defined in respective pipe sections, or as indicated on the Piping Schedule, whichever is greater.

C. Inspection

1. Pipe shall be subject to inspection at the place of manufacture.

2. During the manufacture, the ENGINEER shall be given access to areas where manufacturing is in progress and shall be permitted to make inspections necessary to confirm compliance with requirements.

D. Tests

1. Except where otherwise indicated, materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards.

2. Welds shall be tested as indicated.

3. The CONTRACTOR shall be responsible for performing material tests.

E. Welding Requirements

1. Qualification of welding procedures used to fabricate pipe shall be in accordance with the provisions of AWS D1.1 - Structural Welding Code or the ASME Boiler and Pressure Vessel Code, Section 9, whichever is applicable.

F. Welder Qualifications

1. Welding shall be performed by skilled welders and welding operators who have adequate experience in the methods and materials to be used.

2. Welders shall be qualified under the provisions of AWS D1.1 or the ASME Boiler and Pressure Vessel Code, Section 9, whichever is applicable.

3. Machines and electrodes similar to those used in the WORK shall be used in qualification tests.

4. Qualification testing of welders and materials used during testing is part of the WORK.

2.2 PIPE FLANGES

A. General

1. Flanges shall be provided with flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise indicated.

2. Flange faces shall be perpendicular to the axis of the adjoining pipe.

3. Flanges for miscellaneous small diameter pipes shall be in accordance with the standards indicated for those pipes.

B. Pressure Ratings

1. 150 psig or less: Flanges shall conform to either AWWA C207 - Steel Pipe Flanges for Waterworks Service--Sizes 4 In. Through 144 In., Class D, or ASME B16.5 - Pipe Flanges and Flanged Fittings, Class 150.

2. 150 psig to 275 psig: Flanges shall conform to either AWWA C207 Class E or Class F, or ASME B16.5, Class 150.

3. Selection Based on Test Pressure

    a. Do not expose AWWA flanges to test pressures greater than 125 percent of rated capacity.

    b. For higher test pressures, the next higher rated AWWA flange or an ANSI-rated flange shall be selected.

C. Blind Flanges

1. Provide blind flanges in accordance with AWWA C207, or as indicated for miscellaneous small pipes.

2. Blind flanges for pipe diameters 12 inches and greater shall be provided with lifting eyes in the form of welded or threaded eye bolts.

D. Flange Coating

1. Machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

E. Flange Fasteners

1. Unless otherwise shown on the drawings, or indicated in the applicable Sections of **Division 40**, Bolts and nuts shall conform to the following requirements;

    a. Threads shall be in accordance with ANSI/ASME B1.1, Class 2, UNC for bolt diameters 1” and smaller and UN8 for bolt diameters greater than 1”.

    b. Bolts shall have heavy hexagon heads and heavy hexagon nuts. Length of studs shall provide a projection of not less than 0.25 inch and no more than 0.5 inch through the nut when it is drawn tight.

    c. Thread studs on flange connections are not permitted except where space restrictions preclude the use of standard bolts and where approved by the ENGINEER.

    d. Through bolt holes shall be drilled in accordance with the applicable flange standard.

    e. All bolts fastening metallic flanges shall be provided with plain washers installed under the nut. Washer materials shall be of the same material as the bolt. If the through bolt holes are drilled larger than the applicable standard by 1/8 inch in diameter or more, bolts shall be also installed with a plain washer under the bolt head as well.

    f. All bolts fastening non-metallic flanges shall be provided with plain washers installed under both the bolt head and nut.

    g. Washer materials shall be of the same material as the bolt.

    h. Anti-seize compound shall be used on carbon steel fasteners, and shall be Husk-ITT, Husky 2000; or equal.

i. Anti-galling compound used for stainless steel fasteners in LOX, nitrogen injection, oxygen, ozone process/off-gas/vent and ozone contactor maintenance air service shall be DuPont “Krytox”; or equal.

j. Anti-galling compound used for stainless steel fasteners for other services shall be certified for potable water use and shall be Husk-ITT, Lube O’seal; Hercules, Real-Tuff; La Co, Slic-Tite; or equal.

2. Fastener Material Group Numbering System

a. Flange fasteners shall conform to the following material standards and shall be categorized within the Fastener Material Schedule Groups as indicated:

1) Material Group C1 (Carbon steel): ASTM A307 Grade B bolts, ASTM A563 Grade B nuts with ASTM F436 washers

2) Material Group C2 (Carbon steel): ASTM A193 Grade B7 bolts, ASTM A194 Grade 2H nuts with ASTM F436 washers

3) Material Group S1 (316 SS): ASTM A193, Grade B8M bolts, ASTM A194 Grade 8M nuts with Type 316 SS plain washers.

4) Material Group S2 (304 SS): ASTM A193, Grade B8 bolts, ASTM A194 Grade 8F nuts with Type 304 SS plain washers.

5) Material Group S3 (Hastelloy C-276): ASTM F468 N10276 bolts ASTM F467 N10276 nuts with type Hastelloy plain washers.

3. Fastener Material Group Numbers used in Non-Corrosive Service Applications

a. AWWA C115 ductile iron flanges - Material Group C1

b. AWWA C207 steel flanges - Material Group C2

c. ASME B31 group piping flanges – Material Group C2

d. Non-metallic pipe flanges - Material Group S1

e. Stainless steel pipe flanges and all others not listed above - Material Group S1

f. Where mating flanges are of different flange material standards and the specified Fastener Material Groups are in conflict, then fasteners of the higher grade shall be utilized unless otherwise indicated. For the purpose of this requirement, the Material Groups in order of decreasing grade shall be S1, C2, C1. Provide insulating flange sets for dissimilar metal flanged piping to electrically isolate the dissimilar piping.

g. Where gaskets of Teflon or Viton-A are required, fasteners of Material Group C2 shall be utilized for all C1 flange standards.

4. Fastener Material Group Numbers used in Corrosive Service Applications

a. All Flange fasteners shall be of Material Group S1 unless S2 and S3 are otherwise indicated on the drawings.

F. Insulating Flanges

1. Insulated flanges shall be provided with bolt holes 1/4-inch diameter greater than the bolt diameter.

G. Insulating Flange Sets

1. In order to prevent corrosion, insulating flange sets shall be furnished on all piping connections where two dissimilar metals are to be connected. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers, and a steel washer.

2. For bolt diameters 1-1/2 inches or smaller, insulating sleeves and washers shall be one piece and shall be made of acetyl resin.

3. For bolt diameters larger than 1-1/2 inches, insulating sleeves and washers shall be 2-piece and shall be made of polyethylene or phenolic material.

4. Insulating flange sets materials used for fluids other than general water and wastewater shall be made of materials compatible with the fluid services.

5. Insulating gaskets shall be full-face.

H. Insulating Flange Manufacturer, or Equal

1. **JM Red Devil, Type E**

2. **Fluid Sealing Products, Inc.**

3. **Enpro Industries, Inc. (GPT)**

I. Flange Gaskets

1. Gaskets for flanged joints used in general water and wastewater service shall be full faced type in accordance with AWWA C207, suitable for temperatures to 700 degrees F, a pH of one to 11, and pressures to 1000 psig.

2. Blind flanges shall be provided with gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange.

3. Ring gaskets will not be accepted unless otherwise indicated.

4. Unless otherwise indicated, flange gaskets up to 150 psi shall be EPDM sheet material, NSF 61 approved, **Garlock, Style 98206-U (unbranded), or similar products from John Crane, or equal**.

5. Unless otherwise indicated, flange gaskets up to 500 psi shall be aramid fiber with rubber binder material, NSF 61 approved, **Garlock, Style 3760-U (unbranded), or similar products from John Crane, or equal**.

6. Gaskets for flanged joints used in water with chloramines shall be Teflon material, NSF 61 approved, **Garlock, Gylon Style 3505, or similar products from John Crane, or equal**.

7. Gaskets for flanged joints used in water with ozone shall be Teflon material, NSF 61 approved, **Garlock, Gylon, Style 3504, or similar products from John Crane, or equal**.

8. Gaskets for flanged joints used in cryogenic oxygen (LOX and GOX) service shall be Teflon material, **Garlock Gylon, Style 3502 and 3503 or similar products from John Crane, or equal**.

9. Gaskets for flanged joints in PVC and CPVC piping used in general water and wastewater service shall be NSF 61 approved, full-faced, 1/8-inch thick, and made of fluoroelastomer having a durometer hardness of 50 to 70. Gaskets for pipe sizes up to 24-inch and 150 psi shall be Garlock Style XP or similar products from John Crane, or equal.

10. When the mating flange has a raised face, provide stainless steel flat ring gasket filler between the PVC flange and gasket and the adjacent flange.

11. Gaskets for flanged joints used in chemicals, hot air, ozone gas, solvents, hydrocarbons, steam, chlorine and other fluids shall be made of materials compatible with the service, pressure, and temperature. Consult gasket Manufacturer for recommended gasket material.

2.3 PIPE THREADS

A. Pipe threads shall be in conformance with ASME B1.20.1 - Pipe Threads, General Purpose (inch), and be made up with Teflon tape unless otherwise indicated.

B. Unless otherwise indicated, use metal FNPT and plastic MNPT for threaded pipe connections between metal and plastic pipes.

2.4 THREADED INSULATING CONNECTIONS

A. General

1. Threaded insulating bushings, unions, or couplings, as appropriate, shall be furnished for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.

B. Materials

1. Threaded insulating connections shall be constructed of nylon, Teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties to suit the service and loading conditions.

PART 3 -- EXECUTION

3.1 GENERAL

A. This section specifies the general installation requirements for piping, valves, and related items and shall be installed in accordance with the manufacturer's technical data and printed instructions. Specific piping materials, systems, appurtenances, and related installation and testing requirements are specified in related sections of **Division 40** and as noted on the Drawings.

B. Piping shall be installed in a neat and workmanlike manner, properly aligned and cut from measurements taken at the Site to avoid interferences with structural members, architectural features, openings, and equipment. Exposed pipe shall afford maximum headroom and access to equipment, and where necessary piping shall be installed with sufficient slopes for venting or drainage of liquids and condensate to low points.

C. CONTRACTOR shall obtain the assistance of the pipe manufacturer to instruct the pipe fitters in the correct installation and support of the piping system. Valves and flanges attached to the pipe shall be provided with adequate supports.

D. Lined Piping Systems

1. The lining manufacturer shall take full responsibility for the complete, final product and its application.

2. Pipe ends and joints of lined pipes at threaded flanges shall be epoxy-coated in order to assure continuous protection.

3.2 INSTALLATION

A. Installation shall be free from defects. Prior to installation, each pipe length shall be carefully inspected, be flushed clean of any debris or dust, and be straightened if not true straight. Ends of threaded pipes shall be reamed and filed smooth. Groove ends shall be clean and free from indentations, projections, and roll marks in the area from the pipe end to the groove. Fittings shall be equally cleaned before assembly.

B. Supports and Anchors: Piping supports, thrust, and seismic restraints shall be provided where determined to be required and where necessary to avoid stress on equipment or structural members, the pipe shall be anchored or harnessed.

C. Piping Joints: Pipe joints requirements shall conform to the applicable piping sections of **Division 40**.

1. Threaded Joints: Pipe threads shall be full and cleanly cut with sharp dies. Not more than 3 threads shall remain exposed after installation.

2. Welded Joints: Welded joints shall conform to the specifications and recommendations of ASME B 31.1 - Power Piping. Welding shall be done by skilled and qualified welders. Pipe surface residues, oxides, and heat stains are to be removed from a field weld and the affected areas adjacent by the use of stainless steel wire brushes. For alloy and stainless steel pipe, the post welding surfaces shall be cleaned with a pickle agent such as nitric/hydrofluoric acid solutions or pickle paste or equal, then complete removal of the agent by wash the surface thoroughly with clean water.

3. Flange Joints: Flanged joints shall be made with gaskets with bolts and nuts as specified. Care shall be taken not to over-torque the bolts, in accordance with the manufacturer's written recommendations.

4. Fusion-Welded Joints: Fusion-welded joints shall be made with the manufacturer's recommended equipment on clean, dry pipe ends. The joints shall be made up at the recommended ambient temperatures, to the pipe manufacturer's written recommendations. The pipe supplier shall be consulted to obtain machinery and expertise for the joining by fusion welded of pipe and fittings. No pipe or fittings shall be joined by fusion by any of the Contractor's personnel unless they are adequately

trained and qualified in the techniques involved. Butt fusion joining shall yield a joint strength equal to or greater than the tensile strength of the pipe. Socket fusion, extrusion welding and hot gas welding shall not be used for field connections.

5. Brazed and Soldered Joints: Brazed and soldered joints shall conform to the manufacturer's recommendations and to the specifications and recommendations of ASME B 31.1 - Power Piping. Brazing shall be done by skilled and qualified welders. Prior to the application of flux, the ends of tubes shall be thoroughly dried and cleaned

6. Solvent-Welded Joints: Solvent-welded joints shall be made with fresh primer and solvent cement on clean, dry pipe ends. The primer and cement cans shall be kept closed at all times and the joints shall be made up at the recommended ambient temperatures, to the pipe or cement manufacturer's written recommendations. PVC socket connections shall be joined with PVC cement conforming to ASTM D2564 Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC). CPVC socket connections shall be joined with CPVC solvent cement conforming to ASTM F493. For chemical service applications, solvent cement shall be formulated and labeled for use on that chemical.

7. Adhesive Joints: Adhesive joints shall be made with freshly-mixed 2-part epoxy on clean, dry pipe ends per pipe manufacturer recommendations. The joints shall be made up at the recommended ambient temperatures, to the pipe or adhesive manufacturer's written recommendations. Pipe ends shall be inserted to the full depth of the socket.

D. Valves and Unions: Unless otherwise indicated, connections to fixtures, groups of fixtures and equipment shall be provided with a shutoff valve and union, unless the valve has flanged ends. Unions shall be provided at threaded valves, equipment, and other devices requiring occasional removal or disconnection.

E. Branch Connections: Branch connections in horizontal runs of air and gas piping shall be made from the top of the pipe, to avoid drainage of condensate into the equipment. Unless otherwise indicated for threaded pipe connections between metal and plastic pipes, use metal FNPT and plastic MNPT.

1. Pipe ends and joints of lined pipes at threaded flanges shall be epoxy-coated in order to assure continuous protection.

F. Isolation Joints / Dielectric Protection: Provide electrically isolate connections between dissimilar metal piping connections. Electrical checks shall be made to assure no contact is made between dissimilar metal piping elements.

1. Use dielectric couplings specially designed for the prevention of galvanic reaction between dissimilar metals.

2. For flanged connections, use stainless steel bolts with isolation bushings, washers, and full-face flange gaskets.

G. Care shall be taken to insure that piping flanges, mechanical-type couplings, sleeve-type couplings, flexible connectors, and expansion joints are properly installed as follows:

1. Gasket surfaces shall be carefully cleaned and inspected prior to making up the connection. Gasket shall be centered properly on the contact surfaces.

2. Connections shall be installed to prevent inducing stress to the piping system or the equipment to which the piping is connected.

3. Contact surfaces for flanges, couplings, and piping ends shall be aligned parallel, concentric, and square to each axis at the piping connections.

4. Flange Bolts

   a. Flange bolts shall be initially hand-tightened with the piping connections properly aligned.

   b. Bolts shall be tightened with a torque wrench in a staggered sequence to the recommended torque for the applicable piping material per AWWA or manufacturer's recommendation. Care shall be taken to avoid over-torquing the bolts especially on plastic flanged joints.

   c. Harness, thrust restraint, and tie rod bolts used for sleeve couplings, flange coupling adapters, or flexible joints shall be tightened gradually and equally at diametrically opposite sides until snug, in order to prevent misalignment and to insure that all studs carry equal loads.

   d. In order to prevent induced stress or misalignment, do not over-torque connections to adjoining pump or equipment. Flanges shall not be deformed nor cracked.

3.3 INSPECTION

A. After completion of the WORK, cuttings, joining and wrapping materials, and other scattered debris shall be removed from the Site. The entire piping system shall be in a clean and functional condition.

B. Inspection: Finished installations shall be carefully inspected for proper joints and supports, interferences, and damage to pipe, fittings, and coating. Temporary plugs and covers shall be removed from openings and floor drains. Defective WORK shall be repaired to the satisfaction of the field engineer or plumbing inspector.

3.4 FIELD TESTING FOR PRESSURE PIPING

A. Prior to enclosure or burying, piping systems shall be pressure tested as required in the Piping Schedule for a period of not less than two hours without exceeding the tolerances listed in the Piping Schedule. Where no pressures are indicated, the pipes shall be subject to 1-1/2 times the maximum working pressure. The CONTRACTOR shall furnish test equipment, labor, materials, and devices as part of the WORK.

B. Leakage may be determined by loss of pressure, soap solution, chemical indicator, or other positive and accurate method. Fixtures, devices, or other accessories which are to be connected to the lines and which would be damaged if subjected to the test pressure shall be disconnected and ends of the branch lines plugged or capped as required during the testing procedures.

C. Leaks shall be repaired, and the system shall be re-tested until no leaks are found.

END OF SECTION

SECTION 40 05 23

STAINLESS STEEL PIPE AND FITTINGS

PART 1 -- GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide stainless steel pipe and appurtenances, complete and in place, in accordance with the Contract Documents.

B. The requirements of **Section 40 05 05.11 - Piping, General** apply to the Work of this Section.

1.2 CONTRACTOR SUBMITTALS

A. In addition to the submittals required by **Section 01 33 00 – Submittals** and **Section 40 05 05.11 – Piping, General**, provide proposed post welding cleaning method (including precleaning, descaling, chemicals to be used) or mechanical descaling method and final cleaning/passivation.

B. Provide written certification that the pipe as supplied are in accordance with ASTM A 409 or ASTM 778, if the pipes are provided, supplemental testing is not required.

PART 2 -- PRODUCTS

2.1 PIPE MATERIAL

A. Unless otherwise indicated, stainless steel pipe shall be in accordance with ASTM A 312 - Seamless and Welded Austenitic Stainless Steel Pipe, Type 316L seamless, of the schedules indicated. Stainless steel pipe 12 inches in diameter and larger shall be in accordance with ASTM A 409 - Welded Large Diameter Austenitic Steel Pipe for Corrosive or High-Temperature Service or ASTM A 778 - Welded, Unannealed Austenitic Stainless Steel Tubular Products, Type 316L, of the schedules indicated, with welded or flanged joints. Piping less than 3 inches in nominal diameter shall have a minimum wall thickness not less than the Schedule 40S.

2.2 PIPE JOINTS

A. Stainless steel pipe for sizes 2-1/2 inches and smaller shall have threaded ends with NPT threads made up with Teflon tape. Where indicated, stainless steel pipe shall have plain ends for sleeve-type couplings.

B. Threaded joints (all sizes) are not allowed for the following fluid services: sodium hydroxide, sulfuric acid, oxygen and other fluid services indicated in pipe schedule.

2.3 FITTINGS

A. Threaded Fittings: Forged stainless steel fittings conforming to ASME B 16.11 - Forged Fittings, Socket-Welding and Threaded, Type 316.

B. Socket-Welding Fittings: Forged stainless steel fittings conforming to ASME B 16.11, Type 316.

C. Butt-Welding Fittings: Wrought stainless steel butt-welding fittings conforming to ASTM A 403 - Wrought Austenitic Stainless Steel Piping Fittings, and ASME B 16.9 - Factory-Made Wrought Steel Butt-Welding Fittings, Type 316.

D. Grooved Fittings: Wrought stainless steel grooved fittings conforming to ASTM A 403 and ASME B 16.9, with grooving conforming to AWWA C606 - Grooved and Shouldered Joints, Type 316.

E. Flanged Fittings: Type 316 stainless steel flanged fittings and flanges conforming to ASME B 16.5 - Pipe Flanges and Flanged Fittings.

F. Pressure Class: Unless otherwise indicated, fittings shall be in accordance with the pressure classes called for in the Piping Schedule. Where not indicated, the fittings shall have the same pressure rating as the pipe.

2.4 CLEANING

A. Stainless steel pipe and fittings shall be pickled at the point of manufacture, scrubbed and washed until all discoloration is removed in accordance with ASTM A 380 – Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems or A 967 - Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts.

PART 3 -- EXECUTION

3.1 GENERAL

A. Installation, inspection and field testing of the pipes shall in accordance with the requirements of **Section 40 05 05.11 - Piping, General.**

END OF SECTION

SECTION 40 05 51.16 - GATE VALVES

PART 1 -- GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide gate valves and appurtenances, complete and operable, in accordance with the Contract Documents.

B. The requirements of **Section 40 05 56 - Valves, General** apply to this Section.

C. The requirements of **Section 40 05 57 - Valve and Gate Actuators** apply to this Section.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with **Section 40 05 56 – Valves, General**.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Buried valves shall be of the inside screw, non-rising stem type. The valve actuators shall be as indicated, with counter-clockwise opening stems, in accordance with **Section 40 05 57 – Valve and Gate Actuators.**

2.2 RESILIENT-SEATED GATE VALVES

A. General: Resilient-seated gate valves may be provided in lieu of metal-seated double-disc or solid-disc gate valves, at the discretion of the ENGINEER.

B. Construction: Resilient-seated gate valves shall conform to AWWA C509 - Resilient-Seated Gate Valves for Water and Sewerage Systems. The valves shall be suitable for a minimum design working water pressure of 150 psig, with flanged, bell and spigot, or mechanical joint ends. The valve body, bonnet, and disc shall be of cast iron or ductile iron and the disc or body shall be rubber-coated. Body and bonnet wall thickness shall be equal to or greater than the minimum wall thickness as listed in Table 1 of AWWA C509. The stem, stem nuts, glands, and bushings shall be bronze, with the stem seal per AWWA C509.

C. Pressure Ratings:

1. AWWA C509 valves that are 3, 4, 6, 8, and 12 inches in size shall be rated for 200 psig minimum design working water pressure, and 16-, 20-, 24-, and 30-inch valves shall be rated for 150 psig minimum design working water pressure.

D. Protective Coating: Valves shall be factory coated in accordance with Section 09 96 00 - Protective Coating. The CONTRACTOR shall submit a test report from a coating inspector that the coating is holiday-free. The CONTRACTOR shall be aware that it may retain the services of a third-party coating applicator to achieve the holiday-free requirement.

E. Actuators: Unless otherwise indicated, resilient-seated gate valves shall have manual actuators in accordance with **Section 40 05 57 - Valve and Gate Actuators**.

F. Manufacturers, or Equal

1. **Mueller Company**

2. **M & H**

3. **Clow**

PART 3 -- EXECUTION

3.1 GENERAL

A. Gate valves shall be installed in accordance with the provisions of **Section 40 05 56 - Valves, General**. Care shall be taken that valves in plastic lines are well supported at each end of the valve.

END OF SECTION

SECTION 40 05 56

VALVES, GENERAL

PART 1 -- GENERAL

1.1 THE SUMMARY

A. Provide valves, actuators, and appurtenances, complete and operable, as indicated in accordance with the Contract Documents.

B. The provisions of this Section shall apply to all valves and valve actuators except where otherwise indicated.

C. Valves and actuators in particular locations may require a combination of units, sensors, limit switches, and controls, as indicated.

D. Unit Responsibility

1. The CONTRACTOR shall assign a single manufacturer to be responsible for the supply, coordination of design, assembly, testing, and furnishing of each valve; however, the CONTRACTOR shall be responsible to the OWNER for compliance with the requirements of each valve Section.

E. Single Manufacturer

1. Where 2 or more valves of the same type and size are required, the valves shall be furnished by the same manufacturer.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with the requirements of **Section 01 33 00 – Submittals**.

B. Furnish the following information on Shop Drawings:

1. valve name, size, Cv factor, pressure rating, identification number (if any), and specification section number;

C. Furnish a technical manual containing the required information for each valve, as indicated.

D. Furnish a spare parts list, containing the required information for each valve assembly, as indicated.

E. Factory Test Data

1. Where indicated, submit signed, dated, and certified factory test data for each valve requiring certification, before shipping the valve.

2. Furnish a certification of quality and test results for factory-applied coatings.

F. Field Test Data

1. Submit signed, dated, and certified field test data for each valve.

PART 2 -- PRODUCTS

2.1 PRODUCTS

A. General

1. Provide valves and gates of new and current manufacture.

B. Valve Labeling

1. Except when such requirement is waived by the ENGINEER in writing, provide a label on shut-off valves and control valves except for hose bibbs and chlorine cylinder valves.

2. Furnish a label composed of 1/16-inch plastic or stainless steel, a minimum of 2 inches by 4 inches in size, and permanently attached to the valve or on the wall adjacent to the valve as directed by the ENGINEER.

C. Valve Testing

1. As a minimum, unless otherwise indicated or recommended by the reference standards, test valves 3 inches in diameter and smaller in accordance with the manufacturer's standard procedure.

2. Factory-test valves 4 inches in diameter and larger as follows:

a. Hydrostatic Testing

1) Subject valve bodies to an internal hydrostatic pressure equivalent to twice the water-rated pressure of the valve.

2) Metallic valves rating pressures shall be based at 100 degrees F.

3) Plastic valves rating pressures shall be based at 73 degrees F, or at a higher temperature according to material type.

4) During the hydrostatic test, there shall be no visible leakage through the valve body, end joints, or shaft seals, nor shall parts of the valve be permanently deformed.

5) Allow test duration of at least 10 minutes, in order to allow visual examination for leakage.

b. Seat Testing

1) Test the valves for leaks in the closed position, with the pressure differential across the seat equal to the water rated pressure of the valve.

2) Provide test duration of at least 10 minutes, in order to allow visual examination for leakage.

3) The leakage rate shall be the more stringent of the following:

a) As recommended by the reference standard for that type of valve; or

b) Leakage past the closed valve not to exceed one fluid ounce per hour per inch diameter for metal seated valves, and drop-tight for resilient seated valves.

c. Performance Testing

1) Shop-operate the valves from the fully-closed to the fully-open position, and reverse under no-flow conditions in order to demonstrate that the valve assembly operates properly.

D. Valve Markings

1. Permanently mark valve bodies in accordance with MSS SP25 - Standard Marking Systems for Valves, Fittings, Flanges, and Unions.

2.2 MATERIALS

A. General

1. Provide materials suitable for the intended application.

2. Ensure that materials not indicated are of high-grade standard commercial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended.

3. Unless otherwise indicated, provide valve and actuator bodies conforming to the following requirements:

a. Stainless Steel: Stainless steel valve and operator bodies and trim shall conform to ASTM A 351 - Steel Castings, Austenitic, for High-Temperature Service, Grade CF8M, or shall be Type 316 stainless steel

b. Elastomeric materials used for seat, seals and O-rings shall be compatible with temperature, pressures and fluid or gas service.

1) Elastomeric materials for water with chloramines shall be Teflon or Viton-A.

2.3 VALVE CONSTRUCTION

A. Bodies

1. Provide valve bodies that are cast, molded (in the case of plastic valves), forged, or welded, of the materials indicated, and with smooth interior passages.

2. Provide wall thicknesses uniform and in agreement with the applicable standards for each type of valve, without casting defects, pinholes, and other defects that could weaken the body.

3. Perform welds on welded bodies by certified welders and ground welds smooth.

4. Provide valve ends as indicated, and rated for the maximum temperature and pressure to which the valve will be subjected.

B. Valve End Connections

1. Unless otherwise indicated, valves 2-1/2 inches in diameter and smaller may be provided with threaded end connections.

C. Bonnets

1. Connect valve bonnets to the body by clamping, screwing, or flanging.

2. Provide bonnets of the same material, temperature, and pressure rating as the body.

3. Make provisions for the stem seal with the necessary glands, packing nuts, and yokes.

CI. Stems

1. Provide valve stems of the materials indicated, or, if not indicated, of the best commercially-available material for the specific service, with adjustable stem packing, O-rings, chevron V-type packing, or other suitable seal. Bronze materials in contact with potable water shall be NSF 61 approved and free of lead. Elastomeric materials shall be compatible with fluid service.

2. Where dezincification is not a problem, bronze conforming to ASTM B 584 may be used, except that the zinc content shall not exceed 16 percent.

CII. Internal Parts

1. Provide internal parts and valve trim as indicated for each individual valve.

2. Where not indicated, construct valve trim from Type 316 stainless steel or other material best-suited for the intended service.

CIII. Nuts and Bolts

1. Unless otherwise indicated, provide nuts and bolts on valve flanges and supports in accordance with the requirements of **Section 05500 – Metal Fabrications, Miscellaneous**.

2.4 VALVE ACCESSORIES

A. Provide valves complete with the accessories required to provide a functional system.

2.5 SPARE PARTS

A. Furnish the required spare parts, suitably packaged and labeled with the valve name, location, and identification number.

B. Furnish the name, address, and telephone number of the nearest distributor for the spare parts of each valve.

C. Spare parts are intended for use by the OWNER, after expiration of the correction of defects period.

2.6 MANUFACTURERS

A. Valve manufacturers shall have a successful record of not less than 5 years in the manufacture of the indicated valves.

PART 3 -- EXECUTION

3.1 VALVE INSTALLATION AND TRIAL OPERATION

A. General

1. Install valves, actuating units, stem extensions, valve boxes, and accessories in accordance with the manufacturer's written instructions and as indicated.

2. Firmly support valves in order to avoid undue stresses on the pipe.

B. Access

1. Install valves in a manner to provide easy access for actuation, removal, and maintenance, and to avoid interference between valve actuators and structural members, handrails, and other equipment.

C. Valve Accessories

1. Where combinations of valves, sensors, switches, and controls are indicated, properly assemble and install such items such that systems are compatible and operating properly.

2. Clearly note the relationship between interrelated items on Shop Drawing submittals.

D. Trial Operation

1. After installation, schedule trial operation witnessed by the ENGINEER and the OWNER representative.

2. All valves shall be cleaned thoroughly of all foreign materials and final adjustments made. The valves shall then be operated through one complete cycle from a fully closed position to a fully open position and back to a fully closed position to verify that the assembly is functional.

3. A field leakage test meeting the maximum allowable specified requirement shall be conducted.

4. Test certificate shall be signed by the valve manufacturer and the CONTRACTOR and shall be submitted to the ENGINEER.

END OF SECTION

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SECTION 40 05 57 - VALVE AND GATE ACTUATORS

PART 1 -- GENERAL

1.1 THE SUMMARY

A. Provide valve and gate actuators and appurtenances, complete and operable, as indicated in accordance with the Contract Documents.

B. The provisions of this Section apply to valves and gates except where otherwise indicated in the Contract Documents.

C. Unit Responsibility

1. Make the valve or gate manufacturer responsible for the coordination of design, assembly, testing, and installation of actuators on the valves and gates; however, the CONTRACTOR shall be responsible to the OWNER for compliance of the valves, gates, and actuators with the Contract Documents.

D. Where 2 or more valve or gate actuators of the same type or size are required, the actuators shall be produced by the same manufacturer.

E. The requirements of **Section 26 05 15 – Local Control Stations and Miscellaneous Electrical Devices** apply to the WORK of this Section.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with the requirements of **Section 01 33 00 – Submittals** and **Section 40 05 56 – Valves, General**.

B. Submit Shop Drawing information for actuators with the valve and gate submittals as a complete package.

C. Submit calculations showing dynamic seating and unseating torques versus the output torque of the actuator.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Unless otherwise indicated, provide shut-off and throttling valves and externally actuated valves and gates with manual or power actuators.

B. Provide actuators complete and operable with mounting hardware, motors, gears, controls, wiring, solenoids, hand wheels, levers, chains, and extensions, as applicable.

C. Provide actuators with torque ratings equal to or greater than required for valve seating and dynamic torques, whichever is greater, and capable of holding the valve in any intermediate position between fully-open and fully-closed without creeping or fluttering.

D. Actuator torque ratings for butterfly valves shall be determined in accordance with AWWA C504 - Rubber-Seated Butterfly Valves.

E. Identify wires of motor-driven actuators by unique numbers.

F. Manufacturers

1. Where indicated, certain valves and gates may be provided with actuators manufactured by the valve or gate manufacturer.

2. Where actuators are furnished by different manufacturers, coordinate the selection to result in the fewest number of manufacturers possible.

G. Materials

1. Provide actuators of current models, of the best commercial quality materials, and liberally sized for the required torque.

2. Provide materials suitable for the environment in which the valve or gate is to be installed.

H. Actuator Mounting and Position Indicators

1. Securely mount actuators by means of brackets or hardware specially designed and sized for this purpose and of ample strength.

2. Cast the word "OPEN" on each valve or actuator, with an arrow indicating the direction to open in the counter-clockwise direction.

3. Equip gear and power actuators with position indicators.

4. Where possible, locate manual actuators between 48 and 60 inches above the floor or the permanent working platform.

I. Provide fasteners in accordance with the requirements of **Section 05500 –Metal Fabrications, Miscellaneous**.

2.2 MANUAL ACTUATORS

A. General

1. Unless otherwise indicated, provide valves and gates with manual actuators.

2. Provide valves in sizes up to and including 4 inches with direct-acting lever or hand wheel actuators of the manufacturer's best standard design.

3. Provide valves and gates larger than 4-inch with gear-assisted manual actuators, with an operating pull of maximum 60 pounds on the rim of the hand wheel.

4. Provide buried and submerged gear-assisted valves, gates, gear-assisted valves for pressures higher than 250 psig, valves 30 inches in diameter and larger, and where indicated, with worm gear actuators, hermetically-sealed water-tight and grease-packed.

5. Valves 6-inch to 24-inch diameter may be provided with traveling-nut actuators, worm gear actuators, spur or bevel gear actuators, as appropriate for each valve.

B. Manual Worm Gear Actuator

1. Provide an actuator consisting of a single- or double-reduction gear unit contained in a weatherproof cast iron or steel body with cover, and a minimum 12-inch diameter handwheel.

2. Provide the actuator to be capable of a 90-degree rotation, and equip the actuator with travel stops capable of limiting the valve opening and closing.

3. Provide the actuator with spur or helical gears and worm gearing.

4. Provide a self-locking gear ratio in order to prevent "back-driving."

5. Construct the spur or helical gears of hardened alloy steel, and the worm gear of alloy bronze.

6. Construct the worm gear shaft and the hand wheel shaft from 17-4 PH or similar stainless steel.

7. Accurately cut gearing with hobbing machines.

8. Use ball or roller bearings throughout.

9. Provide the output shaft end with a spline in order to allow adjustable alignment.

10. Actuator output gear changes shall be mechanically possible by simply changing the exposed or helical gearset ratio without further disassembly of the actuator.

11. Design gearing for a 100 percent overload.

12. The entire gear assembly shall be sealed weatherproof.

C. Design and rate buried gear actuators for buried service, provide with a stainless steel input shaft, and double-seal on shaft and top cap.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install valve and gate actuators and accessories in accordance with the requirements of **Section 40 05 56 – Valves, General**.

B. Locate the actuators to be readily accessible for operation and maintenance without obstructing walkways.

C. Do not mount actuators where shock or vibrations will impair their operation, and do not attach the support systems to handrails, process piping, or mechanical equipment.

END OF SECTION

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THREE OAKS WATER RECLAMATION FACILITY DEEP INJECTION WELL IW-2

PART 2 - ABOVE SURFACE FACILITIES

PART 2 - ABOVE SURFACE FACILITIES

SECTION 00 01 15

INDEX OF DRAWINGS

PART 1 GENERAL

1.01 CONTRACT PLANS/DRAWINGS

A. Contract plans, also referred to as Drawings, are listed below, dated May 2024 and any subsequent revision thereto introduced by Addenda prior to negotiations, showing the work of the Contract are hereby made a part of the Contract Documents and are listed as follows:

THREE OAKS WATER RECLAMATIN FACILITY
DEEP INJECTION WELL IW-2

Sheet No.	Title
G-001	COVER SHEET AND GENERAL LOCATION MAP
G-002	DRAWING LIST, NOTES, SYMBOLS AND LEGENDS
G-601	PROCESS FLOW DIAGRAM
C-001	LEGNENDS, CIVIL AND PROCESS MECHANICAL ABBREVIATIONS
C-101	AERIAL SITE PLAN
C-102	GRADING AND DRAINAGE PLAN
C-103	YARD PIPING PLAN
C-501	DETAILS 1
C-502	DETAILS 2
C-503	DETAILS 3
C-504	DETAILS 4
S-001	STANDARD NOTES AND LOADING CRITERIA
S-101	WELL PAD PLAN AND SECTION
S-102	SUCTION PIPING PAD PLAN AND SECTION
S-501	CONCRETE DETAILS
S-502	PIPE SUPPORT DETAILS
M-001	LEGEND AND NOTES
M-101	EXISTING EFFLUENT PUMP STATION DEMOLITION PLAN
M-102	OVERALL PIPING CONNECTION PLAN
M-103	WELL PAD PLAN AND SECTION
M-502	INJECTION WELL AND PAD MONIROTING WELL DETAILS
M-503	INJECTION WELL WELLHEAD DETAILS
E-001	LEGENDS
E-002	ABBREVIATIONS AND NOTES
E-101	ELECTRICAL SITE PLAN
E-102	PARTIAL SITE PLAN – DEMOLITION
E-103	PARTIAL SITE PLAN
E-601	EXISTING SINGLE LINE DIAGRAM, DETAILS AND PANEL SCHEDULE
I-001	P&ID – LEGENDS & ABBREVIATIONS

PART 2 - ABOVE SURFACE FACILITIES

I-501 P&ID – INSTRUMENTATION INSTALLATION DETAILS
I-601 P&ID – EFFLUENT PUMPS

B. Due to the possibility of typing errors or omissions, the above list shall not be considered as necessarily complete, nor shall the Standard Details which may be included elsewhere herein be considered as forming a complete listing of all Standard Details which may apply to this Project. Perform all work shown on all sheets of the Plans, as specified herein or necessary for a complete functional installation and no extra compensation will be made due to the omission or incorrect listing of a Drawing in this Section. All County Standard Details are incorporated in these Contract Documents by reference and all work shall be performed in accordance with all applicable County Standard Details.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01 11 00

SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of Work

B. Constraints

C. Work by Others

D. CONTRACTOR's Use of Site

E. Work Sequence

F. Owner Occupancy

1.2 DESCRIPTION OF WORK

A. General: The Work to be done under this Contract consists of the construction of surface facilities for the new Deep Injection Well IW-2 including one injection well pad, expansion of existing effluent pump station pad, all piping and connections to new IW-2, miscellaneous yard piping, and all associated electrical and instrumentation as shown and specified in Contract Documents entitled Three Oaks Water Reclamation Facility Deep Injection Well IW-2.

B. The Work includes:

1. Furnishing of all labor, material, superintendence, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies, services and other means of construction necessary or proper for performing and completing the Work.

2. Sole responsibility for adequacy of plant and equipment.

3. Maintaining the Work area and site in a clean and acceptable manner.

4. Maintaining existing facilities in service at all times except where specifically provided for otherwise herein.

5. Protection of finished and unfinished Work.

6. Repair and restoration of Work damaged during construction.

PART 2 - ABOVE SURFACE FACILITIES

7. Furnishing as necessary proper equipment and machinery, of a sufficient capacity, to facilitate the Work and to handle all emergencies normally encountered in Work of this character.

8. Furnishing, installing, and protecting all necessary guides, track rails, bearing plates, anchor and attachment bolts, and all other appurtenances needed for the installation of the devices included in the equipment specified. Make anchor bolts of appropriate size, strength and material for the purpose intended. Furnish substantial templates and shop drawings for installation.

C. Implied and Normally Required Work: It is the intent of these Specifications to provide the OWNER with complete operable systems, subsystems and other items of Work. Any part or item of Work which is reasonably implied or normally required to make each installation satisfactorily and completely operable is deemed to be included in the Work and the Contract Amount. All miscellaneous appurtenances and other items of Work incidental to meeting the intent of these Specifications are included in the Work and the Contract Amount even though these appurtenances may not be specifically called for in these Specifications.

D. Quality of Work: Regard the apparent silence of the Contract Documents as to any detail, or the apparent omission from them of a detailed description concerning any Work to be done and materials to be furnished as meaning that only the best general practice is to prevail and that only materials and workmanship of the best quality are to be used. Interpretation of these specifications will be made upon this basis.

1.3 CONSTRAINTS

Not Used

1.4 WORK BY OTHERS

A. Work on the Project, which may take place concurrently with this CONTRACT and which is excluded from this CONTRACT, is as follows:

1. Deep Injection Well IW-2. Drilling and construction of IW-2 is included in separate contract documents.
2. Three Oaks Water Reclamation Facility Expansion.

1.5 CONTRACTOR'S USE OF SITE

A. In addition to the requirements of the General Conditions, limit use of site and premises for work and storage to allow for the following:

1. Coordination of the Work under this CONTRACT with the work of the other contractors where Work under this CONTRACT encroaches on the Work of other contractors.

PART 2 - ABOVE SURFACE FACILITIES

2. OWNER occupancy and access to operate existing facilities.

3. Coordination of site use with ENGINEER.

4. Responsibility for protection and safekeeping of products under this CONTRACT.

5. Providing additional off site storage at no additional cost to OWNER as needed.

1.6 WORK SEQUENCE

A. Construct Work in stages to accommodate OWNER's use of premises during construction period and in accordance with the limitations on the sequence of construction specified. Coordinate construction schedules and operations with ENGINEER.

B. Coordinate Work of all subcontractors.

1.7 OWNER OCCUPANCY

A. OWNER will occupy premises during entire period of construction in order to maintain normal operations. Cooperate with OWNER's representative in all construction operations to minimize conflict, and to facilitate OWNER usage.

B. Conduct operations so as to inconvenience the general public in the least.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

A. Starting Work: Start Work within 10 days following the date stated in the Notice to Proceed and execute with such progress as may be required to prevent delay to other contractors or to the general completion of the project. Execute Work at such items and in or on such parts of the project, and with such forces, material and equipment, as to complete the Work in the time established by the Contract. At all times, schedule and direct the Work so that it provides an orderly progression to completion within the specified time for completion.

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

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SECTION 01 22 13

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Explanation and Definitions

B. Measurement

C. Payment

D. Schedule of Values

1.2 EXPLANATION AND DEFINITIONS

A. The following explanation of the Measurement and Payment for the bid form items is made for information and guidance. The omission of reference to any item in this description shall not, however, alter the intent of the bid form or relieve the CONTRACTOR of the necessity of furnishing such as a part of the Contract.

1.3 MEASUREMENT

A. The quantities set forth in the bid form are approximate and are given to establish a uniform basis for the comparison of bids. The OWNER reserves the right to increase or decrease the quantity of any class or portion of the work during the progress of construction in accord with the terms of the Contract.

1.4 PAYMENT

A. Payment shall be made for the items listed on the Bid Form on the basis of the work actually performed and completed, such work including but not limited to, the furnishing of all necessary labor, materials, equipment, transportation, clean up, restoration of disturbed areas, and all other appurtenances to complete the construction and installation of the work as shown on the drawings and described in the specifications.

B. Unit prices are used as a means of computing the final figures for bid and Contract purposes, for periodic payments for work performed, for determining value of additions or deletions and wherever else reasonable.

PART 2 - ABOVE SURFACE FACILITIES

1.5 SCHEDULE OF VALUES

A. Approval of Schedule: Submit for approval a preliminary schedule of values, in duplicate, for all of the Work. Prepare preliminary schedule in accordance with the General Conditions. Submit preliminary schedule of values within 10 calendar days after the Effective Date of the Agreement. Submit final schedule of values in accordance with the General Conditions.

B. Format: Utilize a format similar to the Table of Contents of the Project Specifications. Identify each line item with number and title of the major specification. Identify site mobilization, bonds and insurance. Include within each line item, a direct proportional amount of CONTRACTOR's overhead profit.

C. Revisions: With each Application for Payment, revise schedule to list approved Change Orders.

1.6 APPLICATION FOR PAYMENT

A. Required Copies: Submit three copies of each application on EJCDC Form No. 1910-8-E (1990) or approved equal. Present required information in typewritten form or on electronic media printout.

B. Execute certification by signature of authorized officer.

C. Use data from approved Schedule of Values.

D. Stored Materials: When payment for materials stored is permitted, submit a separate schedule for Materials Stored showing line item, description, previous value received, value incorporated into the Work and present value.

E. Change Orders: List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original item of work.

F. Final Payment: Prepare Application for Final Payment as required in the General Conditions.

G. Submit an updated construction schedule for each Application for Payment.

PART 2 EXECUTION

2.1 MEASUREMENT AND PAYMENT

A. Payment shall be made on the basis of work actually performed completing each item in the Bid, such work including, but not limited to, the furnishing of all necessary labor, materials, equipment, transportation, cleanup, and all other appurtenances to

PART 2 - ABOVE SURFACE FACILITIES

complete the construction and installation of the work to the configuration and extent as shown on the drawings and described in the specifications.

1. Item No. III-1. Mobilization: Payment for mobilization will be made at the Contract lump sum price for the contractor's cost for mobilization, demolition, survey, insurance, audio-video tape of existing conditions, preparing a field office, identifying and securing a staging area and other applicable administrative charges as outlined in the Contract Documents and specified herein. Payment for mobilization will be twenty-five percent (25%) of the lump sum amount to be included with the final payment request.

2. Item No. III-2. Furnish and Install New Concrete Well Pad for IW-2: Payment for furnishing and installing the new concrete well pad for IW-2 will be made at the Contract lump sum price for all concrete installed and shall include all formwork, rebar, and labor, equipment, and materials necessary for installation.

3. Item No. III-3. Furnish and Install Aboveground Ductile Iron IW-2 Piping: Payment for furnishing and installing aboveground ductile iron IW-2 piping will be made at the Contract unit price per lineal foot for the pipe in place. This item includes all necessary fittings, connections to the existing piping, labor, equipment and materials for the furnishing and laying of the pipe, signs, restrained joint piping, plugs and caps, adapters, clean-up, sterilization, and tests. Measurement of the pipe shall be to the nearest foot along the centerline including the lengths of valves and fittings. Lineal footage measurement shall be horizontal.

4. Item No. III-4. Furnish and Install Aboveground Stainless Steel IW-2 Piping: Payment for furnishing and installing aboveground stainless steel IW-2 piping will be made at the Contract unit price per lineal foot for the pipe in place. This item includes all necessary fittings, connections to the existing piping, labor, equipment and materials for the furnishing and laying of the pipe, signs, restrained joint piping, plugs and caps, adapters, clean-up, sterilization, and tests. Measurement of the pipe shall be to the nearest foot along the centerline including the lengths of valves and fittings. Lineal footage measurement shall be horizontal.

5. Item No. III-5. Furnish and Install Gate Valves: Payment for furnishing and installing gate valves will be made at the appropriate Contract unit price per valve acceptably installed. This item includes the valve, actuators and all necessary labor, materials and equipment for installation.

6. Item No. III-6. Furnish and Install Air Valves: Payment for furnishing and installing air valves will be made at the appropriate Contract unit price per valve acceptably installed. This item includes the valve, actuators and all necessary labor, materials and equipment for installation.

7. Item No. III-7. Furnish and Install Flow Meters: Payment for furnishing and installing flow meters will be made at the appropriate Contract unit price per meter acceptably installed.

PART 2 - ABOVE SURFACE FACILITIES

8. Item No. III-8. Furnish and Install Concrete Pipe Supports: Payment for furnishing and installing the concrete pipe supports will be made at the appropriate Contract unit price per support for all concrete installed and shall include all formwork, rebar, and labor, equipment, and materials necessary for installation.

9. Item No. III-9. Furnish and Install Buried PVC Drain Line: Payment for furnishing and installing the buried PVC drain line will be made at the appropriate Contract unit price per linear foot for PVC acceptably installed. This item includes all labor, equipment and materials for furnishing and installing all necessary pipe, fittings, connections, solids sleeves and adapters, protection of existing utilities and facilities, excavation, pipe bedding, sheeting, shoring, dewatering, compaction, cleanouts, service markers, plugs, detectable tape, removal and replacement of grass, sod, shrubs, pavement, driveways, culverts and storm sewers, mailboxes, sidewalks and other surface materials not specifically designated in the Bid, cleanup, testing, and all other work for a complete installation.

10. Item No. III-10. Furnish and Install Associated Electrical and Instrumentation Improvements: Payment for furnishing and installing all associated electrical and instrumentation improvements will be made at the Contract lump sum price and shall include light poles, light fixtures, GFCI receptacles, underground concrete encased electrical duct bank, MOV for existing valve 80-FCV-7, and all labor, equipment, and materials necessary for installation.

11. Item No. III-11. Finish Grading and Site Restoration: Payment for final grading and site restoration will be made at the Contract lump sum price and shall include all grading, pavement restoration, lawn restoration, bollard installation, site cleanup, and all labor, equipment, and materials necessary for installation.

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

SECTION 01 26 00

CHANGE ORDER AND FIELD DIRECTIVE CHANGE PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Definitions

B. Change Orders

C. Field Directive Change

1.2 DEFINITIONS

A. Change Order: Refer to the Change Order definition in Article 2 of the General Conditions.

B. Field Directive Change: Field Directive Change is a written directive to the CONTRACTOR issued on or after the effective date of the agreement; signed by the OWNER, recommended by the ENGINEER ordering an addition, deletion, or revision in the Work. A Field Directive Change will subsequently be followed by the issuance of a Change Order.

C. Overhead: Overhead is defined as the cost of administration, field office and home office costs, general superintendence, office engineering and estimating costs, other required insurance, materials used in temporary structures (not including form work), additional premiums on the performance bond of the CONTRACTOR, the use of small tools, scheduling costs, and all other costs incidental to the performance of the change or the cost of doing business.

1.3 CHANGE ORDERS

A. Initiation of Proposals:

1. From time to time, the OWNER or the ENGINEER may issue a Request for a Change Order Proposal. The Request will contain a description of the intended change with supplementary or revised Drawings and Specifications as applicable, and the projected time for accomplishing the change.

2. The CONTRACTOR may propose a change in the Work by submittal of a Change Order Request to the ENGINEER describing the proposed change with a statement of the reason for the change and the effect on the Contract time and price, along with supporting documentation.

PART 2 - ABOVE SURFACE FACILITIES

B. Execution of Change Order Proposal:

1. When a Proposal is requested for changed work, submit proposal within 15 days following receipt of the Request from OWNER or ENGINEER. State the increase or decrease, if any, in Contract Completion time and Contract Price.

2. Explain proposal in sufficient detail to permit review by OWNER.

3. For Omitted Work the decrease in the Contract Price will be determined by the ENGINEER and will include appropriate amounts for profit and overhead.

4. The OWNER and ENGINEER will review the Proposal and may request additional information and documentation. Provide these items upon request.

5. If the OWNER decides to proceed with the change, the OWNER will issue a Change Order for signature first by the CONTRACTOR and then by the OWNER.

6. The CONTRACTOR will promptly complete the approved change in the Work on receipt of the executed Change Order.

   a. Failure to sign the Change Order does not relieve the CONTRACTOR from performing the Work if the Change Order is signed by the OWNER.

C. Compute the cost of both additive and deductive changes in the Work in accordance with Article 11 of the General Conditions and as follows:

1. Include, the costs of labor, crew foreman and general foreman performing or directly supervising the changed Work on the site. Include travel and subsistence, but only to the extent incurred.

2. To the labor cost add all net premium for Workman's Compensation, taxes pursuant to the Federal Social Security Act, and payments required under State and Federal unemployment laws.

3. Add necessary extra materials, delivered at the site.

4. Include Subcontractor's costs, determined by items 1 through 4 in the preceding subparagraphs, including a maximum of 10 percent overhead and 10 percent profit for the first $20,000; 7-1/2 percent overhead and 7-1/2 percent profit on the next $30,000; and 5 percent overhead and 5 percent profit on balance over $50,000.

PART 2 - ABOVE SURFACE FACILITIES

5. For all subcontract work add 5 percent overhead and 5 percent profit to the subcontractor's costs as determined in paragraph 5. For work performed by the CONTRACTOR's own forces add a maximum of 10 percent overhead and 10 percent profit for the first $20,000; 7-1/2 percent overhead and 7-1/2 percent profit on the next $30,000; and 5 percent overhead and 5 percent profit on balance over $50,000.

1.4 FIELD DIRECTIVE CHANGE

A. Initiation by OWNER: OWNER may issue a Field Directive Change with a Notice to Proceed without a prior Request for a Change Order Proposal or the CONTRACTOR's signature.

B. Payment Determination: The OWNER will designate the method of determining the amount of compensation or credit, if any, based on one of the methods contained in Article 11 of the General Conditions.

C. Timing: Proceed with the change in the Work immediately upon receipt of the Field Directive Change.

D. Addition to Contract: The Field Directive Change will be incorporated into the Contract Documents via a Change Order at a later date.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

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SECTION 01 31 13

PROJECT COORDINATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Work Progress

B. Private Land

C. Work Locations

D. Open Excavations

E. Test Pits

F. Maintenance of Traffic

G. Maintenance of Flow

1.2 WORK PROGRESS

A. Furnish personnel and equipment which will be efficient, appropriate and large enough to secure a satisfactory quality of work and a rate of progress which will allow the completion of the work within the time stipulated in the Bid of these Specifications. If at any time such personnel appears to the ENGINEER to be inefficient, inappropriate or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may order the CONTRACTOR to increase the efficiency, change the character or increase the personnel and equipment, and the CONTRACTOR shall conform to such order. Failure of the ENGINEER to give such order shall in no way relieve the CONTRACTOR of his obligations to secure the quality of the work and rate of progress.

1.3 WORK LOCATIONS

A. Structures and pipelines shall be located substantially as indicated on the Drawings, but the ENGINEER reserves the right to make such modifications in locations as may

PART 2 - ABOVE SURFACE FACILITIES

be found desirable to avoid interference noted on the Drawings, such notation is for the CONTRACTOR's convenience and does not relieve him from laying and jointing different or additional items where required.

1.4 OPEN EXCAVATIONS

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The CONTRACTOR shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by the public and workmen.

1.5 TEST PITS

A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the CONTRACTOR. Test pits shall be backfilled immediately after their purpose has been satisfied and maintained in a manner satisfactory to the ENGINEER. The costs for such test pits shall be borne by the CONTRACTOR.

1.6 MAINTENANCE OF FLOW

A. Provide for the flow of sewers, drains, courses interrupted during the progress of the work, and shall immediately cart away and remove all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the OWNER and ENGINEER well in advance of the interruption of any flow.

PART 2 PRODUCTS

2.1 PROTECTION OF CONSTRUCTION AND EQUIPMENT

A. All newly constructed work shall be carefully protected from damage in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions damaged shall be reconstructed by the CONTRACTOR at his own expense.

B. All structures shall be protected in a manner approved by the ENGINEER. Should any of the floors or other parts of the structures become heaved, cracked or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the CONTRACTOR at his own expense and to the satisfaction of the ENGINEER. Special attention is directed to substructure bracing requirements, described in Section 31 40 00. If, in the final inspection of the work, any defects, faults or omissions are found, the CONTRACTOR shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. The CONTRACTOR shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the guarantee period described in the contract.

PART 2 - ABOVE SURFACE FACILITIES

C. Take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the OWNER.

PART 3 EXECUTION

3.1 PROTECTION OF CONSTRUCTION AND EQUIPMENT

A. Sequence and schedule work in a manner to preclude delays and conflicts between the work of various trades and contractors. Each trade shall keep informed as to the work of other trades on the project and shall execute their work in a manner that will not interfere with the work of other trades.

3.2 DIAGRAMMATIC NATURE OF DRAWINGS

A. Where layout is diagrammatic, such as pipelines, conduits, ductwork, etc., it shall be followed as closely as other work will permit. Changes from diagrams shall be made as required to conform to the construction requirements.

B. Before running lines, carefully verify locations, depths and sizes and confirm that lines can be run as contemplated without interfering with other construction. Any deviation shall be referred to the ENGINEER for approval before lines are run. Minor changes in location of the equipment, fixtures, piping, etc., from those shown on the Drawings, shall be made without extra charge if so directed by the ENGINEER before installation.

C. Determine the locations and sizes of equipment, fixtures, conduit, ducts, openings, etc., in order that there will be no interference in the installation of the work or delay in the progress of other work. In the event that interferences develop, the ENGINEER's decision regarding relocation of work will be final.

D. Any changes made necessary through failure to make proper arrangements to avoid interference shall not be considered as extras. Cooperate with those performing other work in preparation of interference drawings, to the extent that the location of piping, ductwork, etc., with respect to the installations of other trades shall be mutually agreed upon by those performing the work.

3.3 PROVISIONS FOR LATER INSTALLATION

A. Where any work cannot be installed as the construction is progressing, provide for boxes, sleeves, inserts, fixtures or devices as necessary to permit installation of the omitted work during later phases of construction. Arrange for chases, holes, and other openings in the masonry, concrete or other work and provide for subsequent closure after placing equipment. Arrangement for and closure of openings shall be subject to the approval of the ENGINEER and all costs therefor shall be included in the contract price for the work.

3.4 COORDINATION

A. The CONTRACTOR shall be fully responsible for the coordination of his work and the wok of his employees, subcontractors, and suppliers with the OWNER, and regulatory agencies, and assure compliance with schedules.

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

SECTION 01 31 19

PROJECT MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination

B. Preconstruction Conference

C. Progress Meetings

1.2 COORDINATION

A. General: Coordinate scheduling, submittals, and Contract work to assure efficient and orderly sequence of installation of interdependent construction elements.

1.3 PRECONSTRUCTION CONFERENCE

A. General: Prior to commencement of the Work, in accordance with the General Conditions, the OWNER will conduct a preconstruction conference to be held at a predetermined time and place.

B. Delineation of Responsibilities: The purpose of the conference is to designate responsible personnel, to establish a working relationship among the parties and to identify the responsibilities of the OWNER, plant personnel and the CONTRACTOR. Matters requiring coordination will be discussed and procedures for handling such matters, established. The agenda will include:

1. Submittal procedures
2. Partial Payment procedures
3. Maintenance of Records
4. Schedules, sequences and maintenance of facility operations
5. Safety and First Aid responsibilities
6. Change Orders and Field Directive Changes
7. Use of site
8. Housekeeping
9. Equipment delivery

C. Attendees: The preconstruction conference is to be attended by the representatives of the CONTRACTOR, the OWNER and plant personnel that will be associated with the project. Representatives of regulatory agencies, subcontractors, and principal suppliers may also attend when appropriate.

PART 2 - ABOVE SURFACE FACILITIES

D. Chair and Minutes: The preconstruction conference will be chaired by the Owner who will also arrange for the keeping and distribution of minutes to all attendees.

1.4 PROGRESS MEETINGS

A. Meeting Frequency and Format: Schedule progress meetings on at least a basis or more frequently as warranted by the complexity of the Project, to review the Work, discuss changes in schedules, maintain coordination and resolve potential problems. Invite OWNER, ENGINEER and all subCONTRACTORs. Suppliers may be invited as appropriate. Minutes of the meeting will be maintained by CONTRACTOR and reviewed by ENGINEER prior to distribution by the CONTRACTOR. Distribute reviewed minutes to attendees within calendar days after each meeting.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

SECTION 01 32 16

PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Form of Schedules

B. Content of Schedules: Submit for approval, a preliminary progress schedule in accordance with the General Conditions.

C. Schedule Revisions

D. Submittal Requirements

1.2 FORM OF SCHEDULES

A. Prepare schedules in form of a horizontal bar chart.

1. Provide separate horizontal bar for each trade or operation.

2. Utilize a horizontal time scale and identify first work day of each week.

3. Utilize scale and spacings to allow space for notations and future revisions.

B. Utilize a listing format which chronologically indicates the order of start of each item of work.

C. Identify each listing by major specification section numbers.

1.3 CONTENT OF SCHEDULES

A. Completion Dates: Show the beginning and ending contract dates stated in documents. Schedules showing completion prior to the contract completion date will be accepted but in no event will they be considered basis for a claim for delay against the OWNER by the CONTRACTOR for the period between the early completion date and the completion date provided in the Contract Documents.

PART 2 - ABOVE SURFACE FACILITIES

B. Show complete sequence of construction by activity.

C. Show dates for beginning and completion of each major element of construction and installation dates for major items of equipment. Elements shall include, but not be limited to, the following:

1. Shop drawing receipt from supplier/manufacturer submitted to ENGINEER, review and return to supplier/manufacturer

2. Material and equipment order, manufacturer, delivery, installation, and checkouts

3. Performance tests and supervisory services activity

4. Construction of various facilities

5. Demolition

6. Excavation, sheeting, shoring, dewatering

7. Concrete placement sequence

8. Structural steel erection

9. Wall and roof construction

10. Piping and equipment installation

11. Electrical work activity

12. Heating, ventilating, and air conditioning work activity

13. Plumbing work activity

14. Sewer installation

15. Connection to existing sewers

16. Water main installation

17. Miscellaneous concrete placement

18. Subcontractor's items of work

19. Backfilling, grading, seeding, sodding, landscaping, fence construction, and paving

20. Final cleanup

PART 2 - ABOVE SURFACE FACILITIES

21. Allowance for inclement weather

22. Coordination with concurrent Work on site

D. Show projected percentage of completion for each item as of first day of each month.

1.4 SCHEDULE REVISIONS

A. As a minimum, revise construction schedule every 30 calendar days to reflect changes in progress of Work for duration of Contract.

B. Indicate progress of each activity at date of submittal.

C. Show changes occurring since previous submittal of schedule.

1. Major change in scope
2. Activities modified since previous submittal
3. Revised projections of progress and completion
4. Other identifiable changes

D. Provide a written report as needed to define:

1. Problem areas, anticipated delays, and impact on schedule
2. Corrective action recommended and its effect
3. Effect of changes on schedules of other Contractors

1.5 SUBMITTAL REQUIREMENTS

A. Schedule: Submit final progress schedule in accordance with the General Conditions.

B. For preliminary and final submittal of construction progress schedule and subsequent revisions thereof furnish three copies to ENGINEER.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

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SECTION 01 33 00

SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of Requirements

B. Submittal Procedures

C. Specific Submittal Requirements

D. Action on Submittals

E. Repetitive Review

1.2 DESCRIPTION OF REQUIREMENTS

A. This section specifies procedural requirements for Shop Drawings, product data, samples, and other miscellaneous Work-related submittals.

B. Procedures concerning items such as listing of manufacturers, suppliers, subcontractors, construction progress schedule, schedule of Shop Drawing submissions, bonds, payment applications, insurance certificates, and schedule of values are specified elsewhere.

C. Work-Related Submittals:

1. Substitution or "Or Equal" Items:

a. Includes material or equipment CONTRACTOR requests ENGINEER to accept, after Bids are received, as substitute for items specified or described in Specifications by using name of a proprietary item or name of particular supplier.

2. Shop Drawings:

a. Includes technical data and drawings specially prepared for this Project, including fabrication and installation drawings, diagrams, actual performance curves, data sheets, schedules, templates, patterns, reports, instructions, design mix formulas, measurements, and similar information not in standard printed form.

PART 2 - ABOVE SURFACE FACILITIES

b. Standard information prepared without specific reference to the Project is not considered a Shop Drawing.

3. Product Data:

a. Includes standard printed information on manufactured products, and systems that has not been specially prepared for this Project, including manufacturer's product specifications and installation instructions, catalog cuts, standard wiring diagrams, printed performance curves, mill reports, and standard color charts.

4. Samples:

a. Includes both fabricated and manufactured physical examples of materials, products, and units of work, partial cuts of manufactured or fabricated work, swatches showing color, texture, and pattern, and units of work to be used for independent inspection and testing.

b. Mock-ups are special forms of samples which are too large or otherwise inconvenient for handling in manner specified for transmittal of sample submittals.

5. Working Drawings:

a. When used in the Contract Documents, the term “working drawings” shall be considered to mean the CONTRACTOR’S plans for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities control systems, forming and falsework for underpinning; temporary by-pass pumping and for such other work as may be required for construction but does not become an integral part of the project.

b. Copies of working drawings shall be submitted to the ENGINEER at least fourteen (14) calendar days (unless otherwise specified by the ENGINEER) in advance of the required work.

c. Working drawings shall be signed by a registered Professional Engineer currently licensed to practice in the State of Florida and shall convey, or be accompanied by, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use.

6. Miscellaneous Submittals:

a. Work-related submittals that do not fit in the previous categories, such as guarantees, warranties, certifications, experience records, maintenance agreements, Operating and Maintenance Manuals, workmanship bonds,

PART 2 - ABOVE SURFACE FACILITIES

survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, and similar information, devices, and materials applicable to the Work.

1.3 SUBMITTAL PROCEDURES

A. Scheduling:

1. Submit for approval, a preliminary schedule of shop drawings and samples submittals, in duplicate, and in accordance with the General Conditions.

2. Prepare and transmit each submittal to ENGINEER sufficiently in advance of scheduled performance of related work and other applicable activities.

B. Coordination:

1. Coordinate preparation and processing of submittals with performance of work. Coordinate each submittal with other submittals and related activities such as substitution requests, testing, purchasing, fabrication, delivery, and similar activities that require sequential activity.

2. Coordinate submission of different units of interrelated work so that one submittal will not be delayed by ENGINEER's need to review a related submittal. ENGINEER may withhold action on any submittal requiring coordination with other submittals until related submittals are forthcoming.

C. Submittal Preparation:

1. Stamp and sign each submittal certifying to review of submittal, verification of products, field measurement, field construction criteria, coordination of information within submittal with requirements of the Work and the Contract Documents, coordination with all trades, and verification that product will fit in space provided.

2. Transmittal Form: In the transmittal form forwarding each specific submittal to the ENGINEER include the following information as a minimum.

a. Date of submittal and dates of previous submittals containing the same material.

b. Project title and number.

c. Submittal and transmittal number.

d. Contract identification.

PART 2 - ABOVE SURFACE FACILITIES

e. Names of:

(1) Contractor
(2) Supplier
(3) Manufacturer

f. Identification of equipment and material with equipment identification numbers, model numbers, and Specification section number.

g. Variations from Contract Documents and any limitations which may impact the Work.

h. Drawing sheet and detail number as appropriate.

D. Resubmittal Preparation:

1. Comply with the requirements described in Submittal Preparation. In addition:

a. Identify on transmittal form that submittal is a resubmission.

b. Make any corrections or changes in submittals required by ENGINEER's notations on returned submittal.

c. Respond to ENGINEER's notations:

(1) On the transmittal or on a separate page attached to CONTRACTOR's resubmission transmittal, answer or acknowledge in writing all notations or questions indicated by ENGINEER on ENGINEER's transmittal form returning review submission to CONTRACTOR.

(2) Identify each response by question or notation number established by ENGINEER.

(3) If CONTRACTOR does not respond to each notation or question, resubmission will be returned without action by ENGINEER until CONTRACTOR provides a written response to all ENGINEER's notations or questions.

d. CONTRACTOR initiated revisions or variations:

(1) On transmittal form identify variations or revisions from previously reviewed submittal, other than those called for by ENGINEER.

(2) ENGINEER's responsibility for variations or revisions is established in the General Conditions.

PART 2 - ABOVE SURFACE FACILITIES

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

A. Specific submittals required for individual elements of work are specified in the individual Specification sections. Except as otherwise indicated in Specification sections, comply with requirements specified herein for each indicated type of submittal.

B. Requests for Substitution or "Or Equal"

1. Collect data for items to be submitted for review as substitution into one submittal for each item of material or equipment in accordance with the General Conditions.

2. Submit with other scheduled submittals for the material or equipment allowing time for ENGINEER to evaluate the additional information required to be submitted.

3. If CONTRACTOR requests to substitute for material or equipment specified but not identified in Specifications as requiring submittals, schedule substitution submittal request in Submittal schedule and submit as scheduled.

C. Shop Drawings:

1. Check all drawings, data and samples before submitting to the ENGINEER for review. Each and every copy of the drawings and data shall bear CONTRACTOR's stamp showing that they have been so checked. Shop drawings submitted to the ENGINEER without the CONTRACTOR's stamp will be returned to the CONTRACTOR for conformance with this requirement. All shop drawings shall be submitted through the CONTRACTOR, including those from any subcontractors.

2. Submit newly prepared information, with graphic information at accurate scale. Indicate name of manufacturer or supplier (firm name). Show dimensions and clearly note which are based on field measurement; identify materials and products which are included in the Work; identify revisions. Indicate compliance with standards and notation of coordination requirements with other work. Highlight, encircle or otherwise indicate variations from Contract Documents or previous submittals.

3. Include on each drawing or page:

a. Submittal date and revision dates.

b. Project name, division number and descriptions.

c. Detailed specifications section number and page number.

PART 2 - ABOVE SURFACE FACILITIES

d. Identification of equipment, product or material.

e. Name of CONTRACTOR and Subcontractor.

f. Name of Supplier and Manufacturer.

g. Relation to adjacent structure or material.

h. Field dimensions, clearly identified.

i. Standards or Industry Specification references.

j. Identification of deviations from the Contract Documents.

k. CONTRACTOR's stamp, initialed or signed, dated and certifying to review of submittal, certification of field measurements and compliance with Contract.

l. Physical location and location relative to other connected or attached material at which the equipment or materials are to be installed.

4. Provide 8-inch by 3-inch blank space for CONTRACTOR and ENGINEER stamps.

5. Submittals:

a. Submit 3 hard copies plus 1 PDF.

6. Distribution:

a. Do not proceed with installation of materials, products or systems until copy of applicable product data showing only approved information is in possession of installer.

b. Maintain one set of product data (for each submittal) at Project site.

c. Mark 5 additional copies with the date of approval and forward to the ENGINEER for use in field and for OWNER's records.

D. Product Data:

1. Preparation:

a. Collect required data into single submittal for each element of work or system. Where product data has been printed to include information on several similar products, some of which are not required for use on

PART 2 - ABOVE SURFACE FACILITIES

Project or are not included in submittal, mark copies to clearly show such information is not applicable.

b. Where product data must be specially prepared for required products, materials or systems, because standard printed data are not suitable for use, submit data as a Shop Drawing and not as product data.

2. Submittals:

a. Submittal is for information and record, and to determine that products, materials, and systems comply with Contract Documents. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".

b. Submit 3 copies.

3. Distribution:

a. Do not proceed with installation of materials, products or systems until copy of applicable product data showing only approval information is in possession of installer.

b. Maintain one set of product data (for each submittal) at Project site, available for reference by ENGINEER and others.

c. Mark 5 additional copies with the date of approval and forward to the ENGINEER for use in field and for OWNER records.

E. Samples:

1. Preparation:

a. Where possible, provide samples that are physically identical with proposed materials or products to be incorporated into the Work. Where variations in color, pattern or texture are inherent in material or product represented by sample, submit multiple units (not less than 3 units) showing approximate limits of variations.

b. Provide full set of optional samples where ENGINEER's selection required. Prepare samples to match ENGINEER's selection where so indicated.

c. Include information with each sample to show generic description, source or product name and manufacturer, limitations, and compliance with standards.

PART 2 - ABOVE SURFACE FACILITIES

d. Submit samples for ENGINEER's visual review of general generic kind, color, pattern, texture, and for final check of coordination of these characteristics with other related elements of work.

2. Submittals:

a. At CONTRACTOR's option, and depending upon nature of anticipated response from ENGINEER, initial submittal of samples may be either preliminary or final submittal.

b. A preliminary submittal, consisting of a single set of samples, is required where specifications indicate ENGINEER's selection of color, pattern, texture or similar characteristics from manufacturer's range of standard choices is necessary. Preliminary submittals will be reviewed and returned with ENGINEER's "Action" marking.

c. Final Submittals: Submit 3 sets of samples in final submittal, 1 set will be returned.

3. Distribution:

a. Maintain returned final set of samples at Project site, in suitable condition and available for quality control comparisons throughout course of performing work.

b. Returned samples intended or permitted to be incorporated in the Work are indicated in Specification sections, and shall be in undamaged condition at time of use.

F. Mock-Ups:

1. Mock-ups and similar samples specified in Specification sections are recognized as special type of samples. Comply with samples submittal requirements to greatest extent possible. Process transmittal forms to provide record of activity.

G. Miscellaneous Submittals:

1. Inspection and Test Reports:

a. Classify each inspection and test report as being either "Shop Drawings" or "product data", depending on whether report is specially prepared for Project or standard publication of workmanship control testing at point of production. Process inspection and test reports accordingly.

2. Guarantees, Warranties, Maintenance Agreements, and Workmanship Bonds:

PART 2 - ABOVE SURFACE FACILITIES

a. Refer to Specification sections for specific requirements. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".

b. In addition to copies desired for CONTRACTOR's use, furnish 2 executed copies. Provide 2 additional copies where required for maintenance data.

3. Survey Data:

a. Refer to Specification sections for specific requirements on property surveys, building or structure condition surveys, field measurements, quantitative records of actual Work, damage surveys, photographs, and similar data required by Specification sections. Copies will not be returned.

(1) Survey Copies: Furnish 2 copies. Provide 10 copies of final property survey (if any).

(2) Condition Surveys: Furnish 2 copies.

4. Certifications:

a. Refer to Specification sections for specific requirement on submittal of certifications. Submit 7 copies. Certifications are submitted for review of conformance with specified requirements and information. Submittal is final when returned by ENGINEER marked "Approved".

5. Closeout Submittals:

a. Refer to Specification Section 01 77 00 for specific requirements on submittal of closeout information, materials, tools, and similar items.

(1) Record Documents: Section 01 77 00.

(2) Materials and Tools: Spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.

(3) Operating and maintenance data.

H. Operation and Maintenance Manuals:

1. Submit Operation and Maintenance Manuals in accordance with Section 01 78 23.

I. General Distribution:

PART 2 - ABOVE SURFACE FACILITIES

1. Unless required elsewhere, provide distribution of submittals to subcontractors, suppliers, governing authorities, and others as necessary for proper performance of work.

1.5 ACTION ON SUBMITTALS

A. ENGINEER's Action:

1. General:

a. Except for submittals for record and similar purposes, where action and return on submittals are required or requested, ENGINEER will review each submittal, mark with appropriate action, and return. Where submittal must be held for coordination, ENGINEER will also advise CONTRACTOR without delay.

b. ENGINEER will stamp each submittal with uniform, self-explanatory action stamp, appropriately marked with submittal action.

B. Action Stamp:

1. Approved:

a. Final Unrestricted Release: Where submittals are marked "Approved", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH CONTRACT DOCUMENTS. Acceptance of Work will depend upon that compliance.

2. Approved As Noted:

a. When submittals are marked "Approved as Noted", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH BOTH ENGINEER'S NOTATIONS OR CORRECTIONS ON SUBMITTAL AND WITH Contract Documents. Acceptance of Work will depend on that compliance. Re-submittal is not required.

3. Comments Attached - Confirm or Resubmit:

a. When submittals are marked "Examined and Returned for Correction", do not proceed with Work covered by submittal. Do not permit Work covered by submittal to be used at Project site or elsewhere where Work is in progress.

b. Revise submittal or prepare new submittal in accordance with ENGINEER's notations in accordance with Paragraph 1.3D of this section. Resubmit submittal without delay. Repeat if necessary to obtain different action marking.

PART 2 - ABOVE SURFACE FACILITIES

1.6 RE-SUBMITTAL REVIEW

A. Cost of Subsequent Reviews: Shop Drawings and Operation and Maintenance Manuals submitted for each item will be reviewed no more than twice at the OWNER's expense. All subsequent reviews will be performed at times convenient to the ENGINEER and at the CONTRACTOR's expense based on the ENGINEER's then prevailing rates including all direct and indirect costs and fees. Reimburse the OWNER for all such fees invoiced to the OWNER by the ENGINEER.

B. Time Extension: Any need for more than one resubmission, or any other delay in ENGINEER's review of submittals, will not entitle CONTRACTOR to extension of the Contract Time.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

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SECTION 01 42 00

REFERENCE STANDARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Abbreviations and Symbols

B. Reference Standards

C. Definitions

1.2 RELATED SECTIONS

A. Information provided in this section is used where applicable in individual Specification Sections, Divisions 2 through 16.

1.3 REFERENCE ABBREVIATIONS

A. Reference to a technical society, trade association or standards setting organization, may be made in the Specifications by abbreviations in accordance with the following list:

AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
ADC	Air Diffusion Council
AFBMA	Anti-friction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHA	Association of Home Appliance Manufacturers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association, Inc.
ANSI	American National Standards Institute
APA	American Plywood Association
ARI	American Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers

PART 2 - ABOVE SURFACE FACILITIES

ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders' Hardware Manufacturers Association
BIA	Brick Institute of American
CABO	Council of American Building Officials
CAGI	Compressed Air and Gas Institute
CISPI	Cast Iron Soil Pipe Institute
CMAA	Crane Manufacturers Association of America
CRD	U.S. Corps of Engineers Specifications
CRSI	Concrete Reinforcing Steel Institute
CTI	Cooling Tower Institute
DHI	Door and Hardware Institute
DOH	Department of Health
DOT	Department of Transportation
Fed. Spec.	Federal Specifications
FGMA	Flat Glass Marketing Association
FM	Factory Mutual
HMI	Hoist Manufacturing Institute
HPMA	See HPVA
HPVA	Hardwood Plywood Veneer Association
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IFI	Industrial Fasteners Institute
MIL	Military Specifications
MSS	Manufacturer's Standardization Society
NAAMM	National Association of Architectural Metal Manufacturers
NACM	National Association of Chain Manufacturers
NBS	National Bureau of Standards, See NIST
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NETA	National Electrical Testing Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NFPA	National Fluid Power Association
NIST	National Institute of Standards and Technology
NLMA	National Lumber Manufacturers Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Act
PCI	Prestressed Concrete Institute
PDI	Plumbing and Drainage Institute
SAE	Society of Automotive Engineers
SCPRF	Structural Clay Products Research Foundation
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPI	Society of the Plastics Industry

PART 2 - ABOVE SURFACE FACILITIES

SSPC	Steel Structures Painting Council
STI	Steel Tank Institute
TCA	Tile Council of American
TIMA	Thermal Insulation Manufacturers' Association
UL	Underwriters' Laboratories, Inc.
USBR	U. S. Bureau of Reclamation
USBS	U. S. Bureau of Standards, See NIST

1.4 REFERENCE STANDARDS

A. Latest Edition: Construe references to furnishing materials or testing, which conform to the standards of a particular technical society, organization, or body, to mean the latest standard, code, or specification of that body, adopted and published as of the date of bidding this Contract. Standards referred to herein are made a part of these Specifications to the extent which is indicated or intended.

B. Precedence: The duties and responsibilities of the OWNER, CONTRACTOR or ENGINEER, or any of their consultants, agents or employees are set forth in the Contract Documents and are not changed or altered by any provision of any referenced standard specifications, manuals or code, whether such standard manual or code is or is not specifically incorporated by reference in the Contract Documents. Any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority, to undertake responsibility contrary to the powers of the ENGINEER as set forth in the Contract Documents cannot be assigned to the ENGINEER or any of the ENGINEER's consultants, agents or employees.

1.5 DEFINITIONS

A. In these Contract Documents the words furnish, install and provide are defined as follows:

1. Furnish (Materials): to supply and deliver to the project ready for installation and in operable condition.

2. Install (services or labor): to place in final position, complete, anchored, connected in operable condition.

3. Provide: to furnish and install complete. Includes the supply of specified services. When neither furnish, install or provide is stated, provided is implied.

1.6 LCU APPROVED MATERIALS LIST

A. The CONTRACTOR shall refer to the most resent Approved Materials List, as of the date of the advertisement for these contract documents.

B. The Approved Materials List located on LCU website constitutes a part of these contract documents.

PART 2 - ABOVE SURFACE FACILITIES

1.7 LCU STANDARD DETAILS

A. The CONSTRACTOR shall refer to the most resent LCU Standard Details, as of the date of the advertisement for these contract documents.

B. The Standard Details located on LCU website constitutes a part of these contract documents.

1.8 LCU DESIGN MANUAL

A. The CONSTRACTOR shall refer to the most resent LCU Design Manual, as of the date of the advertisement for these contract documents.

B. The Design Manual located on LCU website constitutes a part of these contract documents.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

SECTION 01 42 13

ABBREVIATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Abbreviations

B. Standards for Abbreviations

1.2 RELATED SECTIONS

A. Abbreviations provided in this section are used where applicable in individual Specification Sections, Divisions 2 through 16.

1.3 ABBREVIATIONS

A. Abbreviations which may be used in Divisions 1 through 16 for units of measure are as follows:

alternating current..... ac
American wire gauge .....AWG
ampere(s) .....amp
ampere-hour(s) ..... AH
annual..... ann
Ampere Interrupting Capacity.....AIC
atmosphere(s) .....atm
average ..... avg

biochemical oxygen demand .....BOD
Board Foot..... FBM
brake horsepower.....bhp
Brinell Hardness ..... BH
British thermal unit(s).....Btu

calorie (s).....cal
carbonaceous biochemical oxygen demand ..... CBOD
Celsius (centigrade)..... C
Center to Center ..... C to C
centimeter(s)..... cm
chemical oxygen demand ..... COD
coefficient, valve flow..... C_v

cubic ..... cu
cubic centimeter(s)..... cc
cubic feet per day..... cfd
cubic feet per hour .....cfh
cubic feet per minute..... cfm
cubic feet per minute, standard conditions ..... scfm
cubic feet per second .....cfs
cubic foot (feet) .....cu ft
cubic inch(es)..... cu in
cubic yard(s) ..... cu yd

decibels..... dB
decibels (A scale)..... dBa
degree(s).....deg
dewpoint temperature .....dpt
diameter.....dia
direct current .....dc
dissolved oxygen..... DO
dissolved solids .....DS
dry-bulb temperature.....dbt

efficiency .....eff
elevation..... el

PART 2 - ABOVE SURFACE FACILITIES

entering water temperature.....ewt
entering air temperature .....eat
equivalent direct radiation.....edr

face area .....fa
face to face.....f to f
Fahrenheit ..... F
feet per day.....fpd
feet per hour .....fph
feet per minute.....fpm
feet per second.....fps
foot (feet) .....ft
foot-candle..... fc
foot-pound .....ft-lb
foot-pounds per minute..... ft-lb/min
foot-pounds per second .....ft-lb/sec
formazin turbidity unit(s) .....FTU
frequency..... freq

gallon(s)..... gal
gallons per day .....gpd
gallons per day per
cubic foot ..... gpd/cu ft
gallons per day per
square foot..... gpd/sq ft
gallons per hour ..... gph
gallons per minute .....gpm
gallons per second ..... gps
gas chromatography and
mass spectrometry .....GC-MS
gauge .....ga
grain(s) .....gr
gram(s) .....g
grams per cubic centimeter .....gm/cc

Heat Transfer Coefficient.....U
height..... hgt
Hertz..... Hz
horsepower..... hp
horsepower-hour .....hp-hr
hour(s) ..... hr
humidity, relative..... rh
hydrogen ion concentration .....pH

inch(es)..... in
inches per second .....ips
inside diameter .....ID

Jackson turbidity unit(s) .....JTU

kelvin..... K
kiloamperes..... kA
kilogram(s) .....kg
kilometer(s) .....km
kilovar (kilovolt-amperes
reactive) .....kvar
kilovolt(s)..... kV
kilovolt-ampere(s).....kVA
kilowatt(s).....kW
kilowatt-hour(s) .....kWh

linear foot (feet).....lin ft
liter(s) L

megavolt-ampere(s).....MVA
meter(s).....m
micrograms per liter ..... ug/L
miles per hour .....mph
milliampere(s) ..... mA
milligram(s) ..... mg
milligrams per liter ..... mg/L
milliliter(s)..... mL
millimeter(s) ..... mm
million gallons ..... MG
million gallons per day..... mgd
millisecond(s) ..... ms
millivolt(s) ..... mV
minute(s) ..... min

mixed liquor suspended
solids.....MLSS

nephelometric turbidity
unit .....NTU
net positive suction head.....NPSH
noise criteria.....nc
noise reduction coefficient.....NRC
number.....no

ounce(s).....oz
outside air .....oa
outside diameter ..... OD

parts per billion..... ppb
parts per million..... ppm
percent ..... pct

PART 2 - ABOVE SURFACE FACILITIES

phase (electrical) .... ph
pound(s) ..... lb
pounds per cubic foot ..... pcf
pounds per cubic foot
per hour ..... pcf/hr
pounds per day..... lbs/day
pounds per day per
cubic foot .....lbs/day/cu ft
pounds per day per
square foot..... lbs/day/sq ft
pounds per square foot..... psf
pounds per square foot
per hour ..... psf/hr
pounds per square inch ..... psi
pounds per square inch
absolute .....psia
pounds per square inch
gauge .....psig
power factor.....PF
pressure drop or
difference..... dp
pressure, dynamic
(velocity) .....vp
pressure, vapor..... vap pr

quart(s) .....qt

Rankine ..... R
relative humidity.....rh
resistance ..... res
return air .....ra
revolution(s)..... rev
revolutions per minute .....rpm
revolutions per second..... rps
root mean squared..... rms

safety factor ..... sf
second(s)..... sec
shading coefficient ..... SC
sludge density index ..... SDI

Sound Transmission
Coefficient..... STC
specific gravity ..... sp gr
specific volume ..... Sp Vol
sp ht at constant pressure ..... Cp
square ..... sq
square centimeter(s).....sq cm
square foot (feet)..... sq ft
square inch (es) ..... sq in
square meter(s)..... sq m
square yard(s)..... sq yd
standard ..... std
static pressure.....st pr
supply air..... . . sa
suspended solids ..... SS

temperature..... temp
temperature difference ..... TD
temperature entering..... TE
temperature leaving ..... TL
thousand Btu per hour..... Mbh
thousand circular mils ..... kcmil
thousand cubic feet ..... Mcf
threshold limit value ..... TLV
tons of refrigeration .....tons
torque..... TRQ
total dissolved solids .....TDS
total dynamic head ..... TDH
total kjeldahl nitrogen .....TKN
total oxygen demand..... TOD
total pressure ..... TP
total solids ..... TS
total suspended solids..... TSS
total volatile solids .....TVS

vacuum ..... vac
viscosity .....visc
volatile organic chemical ..... VOC
volatile solids.....VS
volatile suspended solids ..... VSS
volt(s) V
volts-ampere(s) ..... VA
volume ..... vol

watt(s) ..... W
watthour(s) ..... Wh
watt-hour demand .....WHD
watt-hour demand meter..... WHDM
week(s) ..... wk
weight ..... wt
wet-bulb ..... WB
wet bulb temperature ..... WBT

yard(s)..... yd
year(s).....yr

PART 2 - ABOVE SURFACE FACILITIES

1.4 STANDARD FOR ABBREVIATIONS

A. Use ASME Y1.1-1989, "Abbreviations for use on Drawings and in Text" for abbreviations for units of measure not included in Paragraph 1.3.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

SECTION 01 43 00

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittals

B. Inspection Services

C. Inspection of Materials

D. Quality Control

E. Costs of Inspection

F. Acceptance Tests

G. Failure to Comply with Contract

1.2 RELATED SECTIONS

A. Section 01 33 00 - Submittals: Specific Submittal Requirements

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Certificate Submittals: Furnish the ENGINEER authoritative evidence in the form of Certificates of Manufacture that the materials and equipment to be used in the Work have been manufactured and tested in conformity with the Contract Documents. Include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

1.4 INSPECTION SERVICES

A. OWNER's Access: At all times during the progress of the Work and until the date of final completion, afford the OWNER and ENGINEER every reasonable, safe, and proper facility for inspecting the Work at the site. The observation and inspection of any work will not relieve the CONTRACTOR of any obligations to perform proper and satisfactory work as specified. Replace work rejected due to faulty design, inferior, or defective materials, poor workmanship, improper installation, excessive wear, or nonconformity with the requirements of the Contract Documents, with satisfactory

PART 2 - ABOVE SURFACE FACILITIES

work at no additional cost to the OWNER. Replace as directed, finished or unfinished work found not to be in strict accordance with the Contract, even though such work may have been previously approved and payment made therefor.

B. Rejection: The OWNER and the OWNER's Authorized Representatives have the right to reject materials and workmanship which are defective or require correction. Promptly remove rejected work and materials from the site.

C. Inferior Work Discoveries: Failure or neglect on the part of the OWNER or the OWNER's Authorized Representatives to condemn or reject bad or inferior work or materials does not imply an acceptance of such work or materials. Neither is it to be construed as barring the OWNER or the OWNER's Authorized Representatives at any subsequent time from recovering damages or a sum of money needed to build anew all portions of the Work in which inferior work or improper materials were used.

D. Removal for Examination: Should it be considered necessary or advisable by the OWNER or the OWNER's Authorized Representatives, at any time before final acceptance of the Work, to make examinations of portions of the Work already completed, by removing or tearing out such portions, promptly furnish all necessary facilities, labor, and material, to make such an examination. If such Work is found to be defective in any respect, defray all expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the cost of examination and restoration of the Work will be considered a change in the Work to be paid for in accordance with applicable provisions of the Contract.

E. Operation Responsibility: Assume full responsibility for the proper operation of equipment during tests and instruction periods. Make no claim for damage which may occur to equipment prior to the time when the OWNER accepts the Work.

F. Rejection Prior to Warranty Expiration: If at anytime prior to the expiration of any applicable warranties or guarantees, equipment is rejected by the OWNER, repay to the OWNER all sums of money received for the rejected equipment on progress certificates or otherwise on account of the Contract lump sum prices, and upon the receipt of the sum of money, OWNER will execute and deliver a bill of sale of all its rights, title, and interest in and to the rejected equipment. Do not remove the equipment from the premises of the OWNER until the OWNER obtains from other sources, equipment to take the place of that rejected. The OWNER hereby agrees to obtain other equipment within a reasonable time and the CONTRACTOR agrees that the OWNER may use the equipment furnished by the CONTRACTOR without rental or other charge until the other new equipment is obtained.

1.5 INSPECTION OF MATERIALS

A. Premanufacture Notification: Give notice in writing to the ENGINEER sufficiently in advance of the commencement of manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. When required, notice to include a request for inspection, the date of commencement, and

PART 2 - ABOVE SURFACE FACILITIES

the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, ENGINEER will arrange to have a representative present at such times during the manufacture or testing as may be necessary to inspect the materials, or will notify CONTRACTOR that the inspection will be made at a point other than the point of manufacture or testing, or that the inspection will be waived. Comply with these provisions before shipping any materials. Such inspection will not constitute a release from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

B. Testing Standards: Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized, applicable test codes except as may otherwise be stated herein.

1.6 QUALITY CONTROL

A. Testing

1. Field and Laboratory

a. Provide personnel to assist the ENGINEER in performing the following periodic observation and associated services.

(1) Soils: Observe and test excavations, placement and compaction of soils. Determine suitability of excavated material. Observe subgrade soils and foundations.

(2) Concrete: Observe forms and reinforcement; observe concrete placement; witness air entrainment tests, facilitate concrete cylinder preparation and assist with other tests performed by ENGINEER.

(3) Masonry: Sample and test mortar, bricks, blocks and grout; inspect brick and block samples and sample panels; inspect placement of reinforcement and grouting.

b. When specified in Divisions 2 through 16 of the Contract Documents, provide an independent laboratory testing facility to perform required testing. Qualify the laboratory as having performed previous satisfactory work. Prior to use, submit to the ENGINEER for approval.

c. Cooperate with the ENGINEER and laboratory testing representatives. Provide at least 24 hours notice prior to when specified testing is required. Provide labor and materials, and necessary facilities at the site as required by the ENGINEER and the testing laboratory.

d. Provide an independent testing agency, a member of the National Electrical Testing Association, to perform inspections and tests specified in Division 16 of these Specifications.

PART 2 - ABOVE SURFACE FACILITIES

2. Equipment: Coordinate and demonstrate test procedures as specified in the Contract Documents or as otherwise required during the formal tests.

3. Pipeline and Other Testing: Conform to test procedures and requirements specified in the appropriate Specification Section.

B. Reports

1. Certified Test Reports: Where transcripts or certified test reports are required by the Contract Documents, meet the following requirements:

a. Before delivery of materials or equipment submit and obtain approval of the ENGINEER for all required transcripts, certified test reports, certified copies of the reports of all tests required in referenced specifications or specified in the Contract Documents. Perform all testing in an approved independent laboratory or the manufacturer's laboratory. Submit for approval reports of shop equipment tests within thirty days of testing. Transcripts or test reports are to be accompanied by a notarized certificate in the form of a letter from the manufacturer or supplier certifying that tested material or equipment meets the specified requirements and the same type, quality, manufacture and make as specified. The certificate shall be signed by an officer of the manufacturer or the manufacturer's plant manager.

2. Certificate of Compliance: At the option of the ENGINEER, or where not otherwise specified, submit for approval a notarized Certificate of Compliance. The Certificates may be in the form of a letter stating the following:

a. Manufacturer has performed all required tests

b. Materials to be supplied meet all test requirements

c. Tests were performed not more than one year prior to submittal of the certificate

d. Materials and equipment subjected to the tests are of the same quality, manufacture and make as those specified

e. Identification of the materials

1.7 COSTS OF INSPECTION

A. OWNER's Obligation: Initial inspection and testing of materials furnished under this Contract will be performed by the OWNER or his authorized Representatives or inspection bureaus without cost to the CONTRACTOR, unless otherwise expressly specified. If subsequent testing is necessary due to failure of the initial tests or

PART 2 - ABOVE SURFACE FACILITIES

because of rejection for noncompliance, reimburse the OWNER for expenditures incurred in making such tests.

B. CONTRACTOR's Obligation: Include in the Contract Price, the cost of all shop and field tests of equipment and other tests specifically called for in the Contract Documents.

C. Reimbursements to OWNER:

1. Materials and equipment submitted by the CONTRACTOR as the equivalent to those specifically named in the Contract may be tested by the OWNER for compliance. Reimburse the OWNER for expenditures incurred in making such tests on materials and equipment which are rejected for noncompliance.

2. Reimburse OWNER for the costs of any jobsite inspection between the hours of 7:00 p.m. and 6:00 a.m.

3. Reimburse OWNER for all costs associated with Witness Tests which exceed 5 Calendar Days per kind of equipment.

1.8 ACCEPTANCE TESTS

A. Preliminary Field Tests: As soon as conditions permit, furnish all labor and materials and services to perform preliminary field tests of all equipment provided under this Contract. If the preliminary field tests disclose that any equipment furnished and installed under this Contract does not meet the requirements of the Contract Documents, make all changes, adjustments and replacements required prior to the acceptance tests.

B. Final Field Tests: Upon completion of the Work and prior to final payment, subject all equipment, piping and appliances installed under this Contract to specified acceptance tests to demonstrate compliance with the Contract Documents.

1. Furnish all labor, fuel, energy, water and other materials, equipment, instruments and services necessary for all acceptance tests.

2. Conduct field tests in the presence of the ENGINEER. Perform the field tests to demonstrate that under all conditions of operation each equipment item:

a. Has not been damaged by transportation or installation
b. Has been properly installed
c. Has been properly lubricated
d. Has no electrical or mechanical defects
e. Is in proper alignment
f. Has been properly connected
g. Is free of overheating of any parts
h. Is free of all objectionable vibration

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i. Is free of overloading of any parts
j. Operates as intended

3. Operate work or portions of work for a minimum of 100 hours or 14 days continuous service, whichever comes first. For those items of equipment which would normally operate on wastewater or sludge, plant effluent may be used if available when authorized by ENGINEER. If water can not properly exercise equipment, conduct 100-hour test after plant startup. Conduct test on those systems which require load produced by weather (heating or cooling) exercise only when weather will produce proper load.

C. Failure of Tests: If the acceptance tests reveal defects in material or equipment, or if the material or equipment in any way fails to comply with the requirements of the Contract Documents, then promptly correct such deficiencies. Failure or refusal to correct the deficiencies, or if the improved materials or equipment, when tested again, fail to meet the guarantees or specified requirements, the OWNER, notwithstanding its partial payment for work and materials or equipment, may reject said materials or equipment and may order the CONTRACTOR to remove the defective work from the site at no addition to the Contract Price, and replace it with material or equipment which meets the Contract Documents.

1.9 FAILURE TO COMPLY WITH CONTRACT

A. Unacceptable Materials: If it is ascertained by testing or inspection that the material or equipment does not comply with the Contract, do not deliver said material or equipment, or if delivered remove it promptly from the site or from the Work and replace it with acceptable material without additional cost to the OWNER. Fulfill all obligations under the terms and conditions of the Contract even though the OWNER or the OWNER's Authorized Representatives fail to ascertain noncompliance or notify the CONTRACTOR of noncompliance.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

SECTION 01 57 00

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General Requirements

B. Temporary Utilities

C. Temporary Construction

D. Barricades and Enclosures

E. Fences

F. Security

G. Temporary Controls

H. Traffic Regulation

I. Field Offices and Sheds

1.2 GENERAL REQUIREMENTS

A. Plant and Facilities: Furnish, install, maintain and remove all false work, scaffolding, ladders, hoistways, braces, pumping plants, shields, trestles, roadways, sheeting, centering forms, barricades, drains, flumes, and the like, any of which may be needed in the construction of any part of the Work and which are not herein described or specified in detail. The CONTRACTOR shall accept responsibility for the safety and efficiency of such works and for any damage that may result from their failure or from their improper construction, maintenance or operation.

B. First Aid: Maintain a readily accessible, completely equipped first aid kit at each location where work is in progress.

C. Safety Responsibility: Accept sole responsibility for safety and security at the site. Indemnify and hold harmless the OWNER and the OWNER's Authorized Representatives, including the ENGINEER, for any safety violation, or noncompliance with governing bodies and their regulations, and for accidents, deaths, injuries, or damage at the site during occupancy or partial occupancy of the site by CONTRACTOR's forces while performing any part of the Work.

PART 2 - ABOVE SURFACE FACILITIES

D. Hazard Communication: Furnish two copies of the CONTRACTOR's Hazard Communication Program required under OSHA regulations before beginning on site activities. Furnish two copies of amendments to Hazard Communications Program as they are prepared.

1.3 TEMPORARY UTILITIES

A. Water: Provide all necessary and required water without additional cost, unless otherwise specified. If necessary, provide and lay water lines to the place of use; secure all necessary permits; pay for all taps to water mains and hydrants and for all water used at the established rates.

B. Light and Power: Provide without additional cost to the OWNER temporary lighting and power facilities required for the proper construction and inspection of the Work. If, in the ENGINEER's opinion, these facilities are inadequate, do NOT proceed with any portion of the Work affected thereby. Maintain temporary lighting and power until the Work is accepted.

C. Heat: Provide temporary heat, whenever required, for work being performed during cold weather to prevent freezing of concrete, water pipes, and other damage to the Work or existing facilities.

D. Sanitary Facilities: Provide sufficient sanitary facilities for construction personnel. Prohibit and prevent nuisances on the site of the Work or on adjoining property. Discharge any employee who violates this rule. Abide by all environmental regulations or laws applicable to the Work.

E. Connections to Existing Utilities:

1. Unless otherwise specified or indicated, make all necessary connections to existing facilities including structures, drain lines, and utilities such as water, sewer, gas, telephone, and electricity. In each case, obtain permission from the OWNER or the owning utility prior to undertaking connections. Protect facilities against deleterious substances and damage.

2. Thoroughly plan in advance all connections to existing facilities. Have on hand at the time of undertaking the connections, all material, labor and required equipment. Proceed continuously to complete connections in minimum time. Arrange for the operation of valves or other appurtenances on existing utilities, under the direct supervision of the owning utility.

1.4 TEMPORARY CONSTRUCTION

A. Bridges: Design and place suitable temporary bridges where necessary for the maintenance of vehicular and pedestrian traffic. Assume responsibility for the sufficiency and safety of all such temporary work or bridges and for any damage which may result from their failure or their improper construction, maintenance, or

PART 2 - ABOVE SURFACE FACILITIES

operation. Indemnify and save harmless the OWNER and the OWNER's representatives from all claims, suits or actions, and damages or costs of every description arising by reason of failure to comply with the above provisions.

1.5 BARRICADES AND ENCLOSURES

A. Protection of Workmen and Public: Effect and maintain at all times during the prosecution of the Work, barriers and lights necessary for the protection of Workmen and the Public. Provide suitable barricades, lights, "danger" or "caution" or "street closed" signs and watchmen at all places where the Work causes obstructions to normal traffic, excavation sites, or constitutes in any way a hazard to the public.

B. Barricades and Lights:

1. Protect all streets, roads, highways, excavations and other public thoroughfares which are closed to traffic; use effective barricades which display acceptable warning signs. Locate barricades at the nearest public highway or street on each side of the blocked section.

2. Statutory Requirements: Install and maintain all barricades, signs, lights, and other protective devices within highway rights-of-way in strict conformity with applicable statutory requirements by the authority having jurisdiction.

1.6 FENCES

A. Existing Fences: Obtain written permission from the OWNER prior to relocating or dismantling fences which interfere with construction operations. Reach agreements with the fence owner as to the period the fence may be left relocated or dismantled. Install adequate gates where fencing must be maintained. Keep gates closed and locked at all times when not in use.

B. Restoration: Restore all fences to their original or better condition and to their original location on completion of the Work.

1.7 SECURITY

A. Preservation of Property:

1. Preserve from damage, all property along the line of the Work, in the vicinity of or in any way affected by the Work, the removal or destruction of which is not called for by the Drawings. Preserve from damage, public utilities, trees, lawn areas, building monuments, fences, pipe and underground structures, and public streets. Note: Normal wear and tear of streets resulting from legitimate use by the CONTRACTOR are not considered as damage. Whenever damages occur to such property, immediately restore to its original condition. Costs for such repairs are incidental to the Contract.

PART 2 - ABOVE SURFACE FACILITIES

2. In case of failure on the part of the CONTRACTOR to restore property or make good on damage or injury, the OWNER may, upon 24 hours written notice, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary, and the cost thereof will be deducted from any moneys due or which may become due the CONTRACTOR under this Contract. If removal, repair or replacement of public or private property is made necessary by alteration of grade or alignment authorized by the OWNER and not contemplated by the Contract Documents, the CONTRACTOR will be compensated, in accordance with the General Conditions, provided that such property has not been damaged through fault of the CONTRACTOR or the CONTRACTOR's employees.

B. Public Utility Installations and Structures:

1. Public utility installations and structures include all poles, tracks, pipes, wires, conduits, vaults, manholes, and other appurtenances and facilities, whether owned or controlled by public bodies or privately-owned individuals, firms or corporations, used to serve the public with transportation, gas, electricity, telephone, storm and sanitary sewers, water, or other public or private utility services. Facilities appurtenant to public or private property which may be affected by the Work are deemed included hereunder.

2. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. Existing public utility installations and structures are indicated on the Drawings only to the extent such information was made available to, or found by, the ENGINEER in preparing the Drawings. These data are not guaranteed for completeness or accuracy, and the CONTRACTOR is responsible for making necessary investigations to become fully informed as to the character, condition, and extent of all public utility installations and structures that may be encountered and that may affect the construction operations.

3. Contact utility locating service sufficiently in advance of the start of construction to avoid damage to the utilities and delays to the completion date.

4. Remove, replace, relocate, repair, rebuild, and secure any public utility installations and structures damaged as a direct or indirect result of the Work under this Contract. Costs for such work are incidental to the Contract. Be responsible and liable for any consequential damages done to or suffered by any public utility installations or structures. Assume and accept responsibility for any injury, damage, or loss which may result from or be consequent to interference with, or interruption or discontinuance of, any public utility service.

5. Repair or replace any water, electric, sewer, gas, irrigation, or other service connection damaged during the Work with no addition to the Contract price.

PART 2 - ABOVE SURFACE FACILITIES

6. At all times in performance of the Work, employ proven methods and exercise reasonable care and skill to avoid unnecessary delay, injury, damage, or destruction to public utility installations and structures. Avoid unnecessary interference with, or interruption of, public utility services. Cooperate fully with the owners thereof to that end.

7. Give written notice to the owners of all public utility installations and structures affected by proposed construction operations, sufficiently in advance of breaking ground in any area or on any unit of the Work, to obtain their permission before disrupting the lines and to allow them to take measures necessary to protect their interests. Advise the Chiefs of Police, Fire and Rescue Services of any excavation in public streets or the temporary shut-off of any water main. Provide at least 24 hours notice to all affected property owners whenever service connections are taken out of service.

C. Miscellaneous Structures: Assume and accept responsibility for all injuries or damage to culverts, building foundations and walls, retaining walls, or other structures of any kind met with during the prosecution of the Work. Assume and accept liability for damages to public or private property resulting therefrom. Adequately protect against freezing all pipes carrying liquid.

D. Protection of Trees and Lawn Areas:

1. Protect with boxes, trees and shrubs, except those ordered to be removed. Do not place excavated material so as to cause injury to such trees or shrubs. Replace trees or shrubs destroyed by accident or negligence of the CONTRACTOR or CONTRACTOR's employees with new stock of similar size and age, at the proper season, at no additional cost to the OWNER.

2. Leave lawn areas in as good condition as before the start of the Work. Restore areas where sod has been removed by seeding or sodding.

1.8 TEMPORARY CONTROLS

A. During Construction:

1. Keep the site of the Work and adjacent premises free from construction materials, debris, and rubbish. Remove this material from any portion of the site if such material, debris, or rubbish constitutes a nuisance or is objectionable.

2. Remove from the site all surplus materials and temporary structures when they are no longer needed.

3. Neatly stack construction materials such as concrete forms and scaffolding when not in use. Promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or

PART 2 - ABOVE SURFACE FACILITIES

other damage.

4. Properly store volatile wastes in covered metal containers and remove from the site daily.

5. Do not bury or burn on the site or dispose of into storm drains, sanitary sewers, streams, or waterways, any waste material. Remove all wastes from the site and dispose of in a manner complying with applicable ordinances and laws.

B. Smoke Prevention:

1. Strictly observe all air pollution control regulations.
2. Open fires will be allowed only if permitted under current ordinances.

C. Noises:

1. Maintain acceptable noise levels in the vicinity of the Work. Limit noise production to acceptable levels by using special mufflers, barriers, enclosures, equipment positioning, and other approved methods.

2. Supply written notification to the OWNER sufficiently in advance of the start of any work which violates this provision. Proceed only when all applicable authorizations and variances have been obtained in writing.

D. Hours of Operation:

1. Refer to the supplemental conditions section for hours of operation.

2. Do not carry out nonemergency work, including equipment moves, on Sundays without prior written authorization by the OWNER. No work shall be performed on holidays or weekends unless otherwise specified or approved.

E. Dust Control:

1. Take measures to prevent unnecessary dust. Keep earth surfaces exposed to dusting moist with water or a chemical dust suppressant. Cover materials in piles or while in transit to prevent blowing or spreading dust.

2. Adequately protect buildings or operating facilities which may be affected adversely by dust. Protect machinery, motors, instrument panels, or similar equipment by suitable dust screens. Include proper ventilation with dust screens.

F. Temporary Drainage Provisions:

1. Provide for the drainage of stormwater and any water applied or discharged on the site in performance of the Work. Provide adequate drainage facilities to

PART 2 - ABOVE SURFACE FACILITIES

prevent damage to the Work, the site, and adjacent property.

2. Supplement existing drainage channels and conduits as necessary to carry all increased runoff from construction operations. Construct dikes as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect the OWNER's facilities and the Work, and to direct water to drainage channels or conduits. Provide ponding as necessary to prevent downstream flooding.

3. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

G. Pollution: Prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities. Do not permit sanitary wastes to enter any drain or watercourse other than sanitary sewers. Do not permit sediment, debris, or other substances to enter sanitary sewers. Take reasonable measures to prevent such materials from entering any drain or watercourse.

1.9 TRAFFIC REGULATION

A. Parking: Provide and maintain suitable parking areas for the use of all construction workers and others performing work or furnishing services in connection with the Contract, to avoid any need for parking personal vehicles where they may interfere with public traffic, construction activities, or plant personnel/operations.

B. Access: Conduct Work to interfere as little as possible with plant personnel/operations and public travel, whether vehicular or pedestrian. Provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when the CONTRACTOR has obtained permission from the owner or tenant of private property, or from the authority having jurisdiction over the public property involved, to obstruct traffic at the designated point.

1.10 FIELD OFFICES AND SHEDS

A. CONTRACTOR's Office: Erect, furnish, and maintain a field office with a telephone. Have an authorized agent present at this office at all times while the Work is in progress. Keep readily accessible copies of the Contract Documents, required record documents, and the latest approved shop drawings at this field office.

B. Material Sheds and Temporary Structures: Provide material sheds and other temporary structures of sturdy construction and neat appearance.

C. Location: Coordinate location of field offices, material sheds and temporary structures with ENGINEER and OWNER.

PART 2 - ABOVE SURFACE FACILITIES

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

SECTION 01 61 00

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description

B. Substitutions

C. Manufacturer's Written Instructions

D. Transportation and Handling

E. Storage, Protection and Maintenance

F. Manufacturer's Field Quality Control Services

G. Post Startup Services

H. Special Tools and Lubricating Equipment

I. Lubrication

1.2 DESCRIPTION

A. Proposed Manufacturers List: Within 15 calendar days of the date of the Notice to Proceed, submit to the ENGINEER a list of the names of proposed manufacturers, materialmen, suppliers and subcontractors, obtain approval of this list by OWNER prior to submission of any working drawings. Upon request submit evidence to ENGINEER that each proposed manufacturer has manufactured a similar product to the one specified and that it has previously been used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.

B. Furnish and install Material and Equipment which meets the following:

1. Conforms to applicable specifications and standards.

2. Complies with size, make, type, and quality specified or as specifically approved, in writing, by ENGINEER.

PART 2 - ABOVE SURFACE FACILITIES

3. Will fit into the space provided with sufficient room for operation and maintenance access and for properly connecting piping, ducts and services, as applicable. Make the clear spaces that will be available for operation and maintenance access and connections equal to or greater than those shown and meeting all the manufacturers' requirements. Make all provisions for installing equipment furnished at no increase in Contract Price.

4. Manufactured and fabricated in accordance with the following:

   a. Design, fabricate, and assemble in accordance with best engineering and shop practices.

   b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.

   c. Provide two or more items of same kind identical, by same manufacturer.

   d. Provide materials and equipment suitable for service conditions.

   e. Adhere to equipment capabilities, sizes, and dimensions shown or specified unless variations are specifically approved, in writing, in accordance with the Contract Documents.

   f. Adapt equipment to best economy in power consumption and maintenance. Proportion parts and components for stresses that may occur during continuous or intermittent operation, and for any additional stresses that may occur during fabrication or installation.

   g. Working parts are readily accessible for inspection and repair, easily duplicated and replaced.

5. Use material or equipment only for the purpose for which it is designed or specified.

1.3 SUBSTITUTIONS

A. Substitutions:

1. CONTRACTOR's requests for changes in equipment and materials from those required by the Contract Documents are considered requests for substitutions and are subject to CONTRACTOR's representations and review provisions of the Contract Documents when one of following conditions are satisfied:

   a. Where request is directly related to an "or equal" clause or other language of same effect in Specifications.

PART 2 - ABOVE SURFACE FACILITIES

b. Where required equipment or material cannot be provided within Contract Time, but not as result of CONTRACTOR's failure to pursue Work promptly or to coordinate various activities properly.

c. Where required equipment or material cannot be provided in manner compatible with other materials of Work, or cannot be properly coordinated therewith.

2. CONTRACTOR'S Options:

a. Where more than one choice is available as options for CONTRACTOR's selection of equipment or material, select option compatible with other equipment and materials already selected (which may have been from among options for other equipment and materials).

b. Where compliance with specified standard, code or regulation is required, select from among products which comply with requirements of those standards, codes, and regulations.

c. "Or Equal": For equipment or materials specified by naming one or more equipment manufacturer and "or equal", submit request for substitution for any equipment or manufacturer not specifically named.

B. Conditions Which are Not Substitution:

1. Requirements for substitutions do not apply to CONTRACTOR options on materials and equipment provided for in the Specifications.

2. Revisions to Contract Documents, where requested by OWNER or ENGINEER, are "changes" not "substitutions".

3. CONTRACTOR's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute substitutions and do not constitute basis for a Change Order, except as provided for in Contract Documents.

1.4 MANUFACTURER'S WRITTEN INSTRUCTIONS

A. Instruction Distribution: When the Contract Documents require that installation, storage, maintenance and handling of equipment and materials comply with manufacturer's written instruction's, obtain and distribute printed copies of such instructions to parties involved in installation, including six copies to ENGINEER.

1. Maintain one set of complete instructions at jobsite during storage and installation, and until completion of work.

PART 2 - ABOVE SURFACE FACILITIES

B. Manufacturer's Requirements: Store, maintain, handle, install, connect, clean, condition, and adjust products in accordance with manufacturer's written instructions and in conformity with Specifications.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult ENGINEER for further instructions.

2. Do not proceed with work without written instructions.

C. Performance Procedures: Perform work in accordance with manufacturer's written instructions. Do not omit preparatory steps or installation procedures, unless specifically modified or exempted by Contract Documents.

1.5 TRANSPORTATION AND HANDLING

A. Coordination with Schedule: Arrange deliveries of materials and equipment in accordance with Construction Progress Schedules. Coordinate to avoid conflict with work and conditions at site.

1. Deliver materials and equipment in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

2. Protect bright machined surfaces, such as shafts and valve faces, with a heavy coat of grease prior to shipment.

3. Immediately upon delivery, inspect shipments to determine compliance with requirements of Contract Documents and approved submittals and that material and equipment are protected and undamaged.

B. Handling: Provide equipment and personnel to handle material and equipment by methods recommended by manufacturer to prevent soiling or damage to materials and equipment or packaging.

1.6 STORAGE, PROTECTION, AND MAINTENANCE

A. On-site storage areas and buildings:

1. Conform storage buildings to requirements of Section 01 57 00.

2. Coordinate location of storage areas with ENGINEER and OWNER.

3. Arrange on site storage areas for proper protection and segregation of stored materials and equipment with proper drainage. Provide for safe travel around storage areas and safe access to stored materials and equipment.

4. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.

5. Store materials such as pipe, reinforcing and structural steel, and equipment on

PART 2 - ABOVE SURFACE FACILITIES

pallets, blocks or racks, off ground.

6. PVC Pipe may be damaged by prolonged exposure to direct sunlight and the CONTRACTOR shall take necessary precautions during storage and installation to avoid this damage. Pipe shall be stored under cover and installed with sufficient backfill to shield it from the sun.

7. Store fabricated materials and equipment above ground, on blocking or skids, to prevent soiling or staining. Cover materials and equipment which are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.

B. Interior Storage:

1. Store materials and equipment in accordance with manufacturer's instructions, with seals and labels intact and legible.

2. Store materials and equipment, subject to damage by elements, in weathertight enclosures.

3. Maintain temperature and humidity within ranges required by manufacturer's instructions.

C. Accessible Storage: Arrange storage in a manner to provide easy access for inspection and inventory. Make periodic inspections of stored materials or equipment to assure that materials or equipment are maintained under specified conditions and free from damage or deterioration.

1. Perform maintenance on stored materials of equipment in accordance with manufacturer's instructions, in presence of OWNER or ENGINEER.

2. Submit a report of completed maintenance to ENGINEER with each Application for Payment.

3. Failure to perform maintenance, to notify ENGINEER of intent to perform maintenance or to submit maintenance report may result in rejection of material or equipment.

D. OWNER's Responsibility: OWNER assumes no responsibility for materials or equipment stored in buildings or on-site. CONTRACTOR assumes full responsibility for damage due to storage of materials or equipment.

E. CONTRACTOR's Responsibility: CONTRACTOR assumes full responsibility for protection of completed construction. Repair and restore damage to completed Work equal to its original condition.

F. Special Equipment: Use only rubber-tired wheelbarrows, buggies, trucks, or dollies to wheel loads over finished floors, regardless if the floor has been protected or not.

PART 2 - ABOVE SURFACE FACILITIES

This applies to finished floors and to exposed concrete floors as well as those covered with composition tile or other applied surfacing.

G. Surface Damage: Where structural concrete is also the finished surface, take care to avoid marking or damaging surface.

1.7 MANUFACTURER'S FIELD QUALITY CONTROL SERVICES

A. General:

1. Provide manufacturer's field services in accordance with this subsection for those tasks specified in other sections.

2. Provide training as specified in Section 01 79 00.

3. Include and pay all costs for suppliers' and manufacturers' services, including, but not limited to, those specified.

B. Installation Instruction: Provide instruction by competent and experienced technical representatives of equipment manufacturers or system suppliers as necessary to resolve assembly or installation procedures which are attributable to, or associated with, the equipment furnished.

C. Installation Inspection, Adjustments and Startup Participation:

1. Provide competent and experienced technical representatives of equipment manufacturers or system suppliers to inspect the completed installation as follows.

a. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or for other conditions which may cause damage.

b. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

c. Verify that wiring and support components for equipment are complete.

d. Verify that equipment or system is installed in accordance with the manufacturer's recommendations, approved shop drawings and the Contract Documents.

e. Verify that nothing in the installation voids any warranty.

2. Provide manufacturer's representatives to perform initial equipment and system adjustment and calibration conforming to the manufacturer's recommendations and instructions, approved shop drawings and the Contract Documents.

3. Obtain ENGINEER's approval before start-up of equipment. Execute start-up

PART 2 - ABOVE SURFACE FACILITIES

under supervision of applicable manufacturer's representative in accordance with manufacturers' instructions.

4. Furnish ENGINEER with three copies of the following. When training is specified, furnish the copies at least 24 hours prior to training.

   a. "Certificate of Installation, Inspection and Start-up Services" by manufacturers' representatives for each piece of equipment and each system specified, certifying:

      (1) That equipment is installed in accordance with the manufacturers' recommendations, approved shop drawings and the Contract Documents.

      (2) That nothing in the installation voids any warranty.

      (3) That equipment has been operated in the presence of the manufacturer's representative.

      (4) That equipment, as installed, is ready to be operated by others.

   b. Detailed report by manufacturers' representatives, for review by ENGINEER of the installation, inspection and start-up services performed, including:

      (1) Description of calibration and adjustments if made; if not in Operation and Maintenance Manuals, attach copy.

      (2) Description of any parts replaced and why replaced.

      (3) Type, brand name, and quantity of lubrication used, if any.

      (4) General condition of equipment.

      (5) Description of problems encountered, and corrective action taken.

      (6) Any special instructions left with CONTRACTOR or ENGINEER.

D. Field Test Participation: Provide competent and experienced technical representatives of all equipment manufacturers and system suppliers as necessary to participate in field testing of the equipment specified in Section 01 43 00.

E. Trouble-Free Operation: Provide competent and experienced technical representatives of all equipment manufacturers and system suppliers as necessary to place the equipment in trouble-free operation after completion of start-up and field tests.

1.8 POST START-UP SERVICES

PART 2 - ABOVE SURFACE FACILITIES

A. General: Provide Post Start-up Services in accordance with this subsection for equipment specified in other sections.

B. Site Visit: Provide the services of an authorized service representative for each equipment manufacturer or system supplier to make a final site visit after the equipment or system has been in operation for at least 6 months, but no longer than 11 months. Furnish assistance to OWNER's operating personnel in making adjustments and calibrations required to determine that the equipment and system is operating in conformance with design, manufacturer's, and specification requirements. Instruct the personnel in a review of proper operation and maintenance procedures.

C. Certificate: Furnish "Certificate of Post Start-up Services" cosigned by ENGINEER and the manufacturer's representative, certifying that this service has been performed. Use form provided in this section, and furnish OWNER with three copies.

1.9 SPECIAL TOOLS AND LUBRICATING EQUIPMENT

A. General: Furnish, per manufacturer's recommendations, special tools required for checking, testing, parts replacement, and maintenance. (Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics.)

B. Time of Delivery: Deliver special tools and lubricating equipment to OWNER when unit is placed into operation and after operating personnel have been properly instructed in operation, repair, and maintenance of equipment.

C. Quality: Provide tools and lubricating equipment of a quality meeting equipment manufacturer's requirements.

1.10 LUBRICATION

A. General: Where lubrication is required for proper operation of equipment, incorporate in the equipment the necessary and proper provisions in accordance with manufacturer's requirements. Where possible, make lubrication automated and positive.

B. Oil Reservoirs: Where oil is used, supply reservoir of sufficient capacity to lubricate unit for a 24-hour period.

PART 2 PRODUCTS

Not Used

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PART 3 EXECUTION

Not Used

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

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Section 01 67 00

METEOROLOGICAL AND SEISMIC DESIGN CRITERIA

1. SCOPE. Buildings, non-structural components and non-building structures shall be designed in accordance with this section. In the event of conflict with requirements in other sections, the more stringent criteria shall be followed.

2. DESIGN CRITERIA. Non-structural components and non-building structures including anchorage of such items, shall be designed in accordance with the following criteria.

General Design Data:

Building code and references	IBC 2018, ASCE 7-16 "Minimum Design Loads and Associated Criteria for Buildings and Other Structures", AISC 360 "Specification for Structural Steel Buildings", AISC 341 "Seismic Provisions for Structural Steel Buildings"
Site elevation, above mean sea level (ft)	18.00
Design flood elevation, DFE (ft)	Not located in a FEMA Flood Zone

Wind Design Data:

Basic (Ultimate) Design wind speed, V (mph)	169
Allowable Stress (Nominal) Design wind speed, V_{asd} (mph)	131
Exposure category	C
Ground elevation factor, K_e	1.00
Risk Category	III

Snow Design Data:

Ground snow load, P_g (psf)	0

Seismic Design Data

PART 2 - ABOVE SURFACE FACILITIES

Mapped MCE one second period spectral response acceleration, S_1	0.023g
Design short period spectral response acceleration, S_{DS}	0.050g
Design one second period spectral response acceleration, S_{D1}	0.037g
Risk Category	III
Building Importance factor, I	1.25
Building Seismic Design Category	A
Non-Structural Components Importance factors, I_P	Not Applicable
Non-Structural Components Seismic Design Category	Not Applicable
Non-Builidng Structures Importance factors, I	Not Applicable

3. WIND ANCHORAGE. Equipment that is to be located outdoors shall have anchor bolts designed for the effects of wind forces, as determined in accordance with ASCE 7, Chapters 26-31. Design of anchorage shall be in accordance with the Anchorage in Concrete and Masonry section.

4. SEISMIC DESIGN.

4-1. General. Structural systems shall provide continuous load paths, with adequate strength and stiffness to transfer all seismic forces from the point of application to the point of final resistance.

4-2. Pre-Engineered Buildings. Not used.

4-3. Non-Structural Components. Non-structural components are architectural, mechanical, and electrical items that are permanently attached to and supported by a structure but are not part of the structural system, as indicated in Chapter 13 of ASCE 7. Seismic design of non-structural components is not required because the site is in Seismic Design Category A.

4-4. Non-Building Structures. Non-building structures are the items described as such in Chapter 15 of ASCE 7. Seismic design of non-building structures is not required because the site is located in Seismic Design Category A.

End of Section

PART 2 - ABOVE SURFACE FACILITIES

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General Requirements

B. Scheduling of Shutdown

1.2 RELATED SECTIONS

A. Section 32 10 01 – Pavement Repair and Restoration

1.3 GENERAL REQUIREMENTS

A. CONTRACTOR shall be responsible for all cutting, fitting and patching, including attendant excavation and backfill, required to complete the work or to:

1. Make its several parts fit together properly.
2. Uncover portions of the work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace work not conforming to requirements of Contract Documents.
5. Remove samples of installed work as specified for testing.
6. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.

B. Coordination: Perform all cutting, fitting or patching of the Work that may be required to make the several parts thereof join in accordance with the Contract Documents. Perform restoration with competent workmen skilled in the trade.

C. Improperly Timed Work: Perform all cutting and patching required to install improperly timed work, to remove samples of installed materials for testing, and to provide for alteration of existing facilities or for the installation of new Work in the existing construction.

D. Limitations: Except when the cutting or removal of existing construction is specified or indicated, do not undertake any cutting or demolition which may affect the structural stability of the Work or existing facilities without the ENGINEER's concurrence.

PART 2 - ABOVE SURFACE FACILITIES

1.4 SUBMITTALS

A. Submit a written request to the ENGINEER well in advance of executing any cutting or alteration which affects:
   1. Work of the OWNER or any separate contractor.
   2. Structural value or integrity of any element of the project or work.
   3. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
   4. Efficiency, operational life, maintenance or safety of operational elements.
   5. Visual qualities of sight-exposed elements.

B. Request shall include:
   1. Identification of the work.
   2. Description of affected work.
   3. The necessity for cutting, alteration or excavation.
   4. Effect on work of OWNER or any separate contract, or on structural or weatherproof integrity of work.
   5. Description of proposed work:
      a. Scope of cutting, patching, alteration, or excavation.
      b. Trades who will execute the work.
      c. Products proposed to be used.
      d. Extent of refinishing to be done.
   6. Alternatives to cutting and patching.
   7. Cost proposal, when applicable.
   8. Written permission of any separate contractor whose work will be affected.

C. SUBMIT WRITTEN NOTICE TO THE ENGINEER DESIGNATING THE DATE AND THE TIME THE WORK WILL BE UNCOVERED.

1.5 SCHEDULING OF SHUTDOWN

A. Connections to Existing Facilities: If any connections, replacement, or other work requiring the shutdown of an existing facility is necessary, schedule such work at times when the impact on the OWNER's normal operation is minimal. Overtime, night and weekend work without additional compensation from the OWNER, may be required to make these connections, especially if the connections are made at times other than those specified.

B. Request for Shutdowns: Submit a written request for each shutdown to the OWNER and the ENGINEER sufficiently in advance of any required shutdown.

PART 2 PRODUCTS

2.1 MATERIALS

A. Comply with specifications and standards for each specific product involved.

PART 2 - ABOVE SURFACE FACILITIES

PART 3 EXECUTION

3.1 INSPECTION

A. Inspect existing conditions of projects, including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, inspect conditions affecting installation of products, or performance of the work.

C. Report unsatisfactory or questionable conditions to the ENGINEER in writing; do not proceed with work until the ENGINEER has provided further instructions.

3.2 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value or integrity or affected portion of work.

B. Provide devices and methods to protect other portions of project from damage.

C. Provide protection from elements for that portion of the project which may be exposed by cutting and patching work, and maintain excavations free from water.

D. Material Removal: Cut and remove all materials to the extent shown or as required to complete the Work. Remove materials in a careful manner with no damage to adjacent facilities. Remove materials which are not salvageable from the site.

3.3 PERFORMANCE

A. Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs.

B. Execute excavating and backfilling by methods which will prevent settlement or damage to other work.

C. Employ original installer or fabricator to perform cutting and patching for:
   1. Weather-exposed or moisture-resistant elements.
   2. Sight-exposed finished surfaces.

D. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.

E. Restore work which has been cut or removed; install new products to provide completed work in accord with requirements of contract documents.

F. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

PART 2 - ABOVE SURFACE FACILITIES

G. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:
   1. For continuous surfaces, refinish to nearest intersection.
   2. For an assembly, refinish entire unit.

3.4 PAVEMENT RESTORATION

A. Restore all pavement or roadway surfaces in accordance with Section 32 10 01 – Pavement Repair and Restoration.

B. The restoration of existing street paving, including underdrains, if any are encountered, where damaged, shall be restored by the CONTRACTOR and shall be replaced or rebuilt using the same type of construction as was in the original. The CONTRACTOR shall be responsible for restoring all such work, including subgrade, base courses, curb and gutter or other appurtenances where present. The CONTRACTOR shall obtain and pay for at his own expense such local or other governmental permits as may be necessary for the opening of streets and shall satisfy himself as to any requirements other than those herein set forth which may affect the type, quality and manner of carrying on the restoration of surfaces by reason of jurisdiction of such governmental bodies.

C. This section does not describe the construction of new road surfaces or the complete resurfacing of existing pavements.

D. In all cases, the CONTRACTOR will be required to maintain, without additional compensation, all permanent replacement of street paving, done by him under this Contract for a period of 12 months after the acceptance of the Contract, including the removal and replacement of such work wherever surface depressions or underlying cavities result from settlement of trench backfill.

E. The CONTRACTOR shall do all the final resurfacing or repaving of streets or roads, over the excavations that he has made and he shall be responsible for relaying paving surfaces of roads that have failed or been damaged, at any time before the termination of the maintenance period on account of work done by him and he shall resurface or repave over any tunnel jacking, or boring excavation that shall settle or break the surface, shall be repaved to the satisfaction of the OWNER and at the CONTRACTOR's sole expense. Backfilling of trenches and the preparation of subgrades shall conform to the requirements of excavation and backfilling of pipeline trenches.

F. Where pipeline construction crosses paved streets, the CONTRACTOR may elect, at no additional cost to the OWNER, to place the pipe by the jacking or boring or tunneling method in lieu of cutting and patching of the paved surfaces.

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

SECTION 01 74 00

CLEANING

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. General Requirements

B. Disposal Requirements

1.2 GENERAL REQUIREMENTS

A. Execute cleaning during progress of the work and at completion of the work.

1.3 DISPOSAL REQUIREMENTS

A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 DURING CONSTRUCTION

A. Execute daily cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris, resulting from construction operations.

B. Provide onsite containers for the collection of waste materials, debris and rubbish. All waste materials including containers, food debris and other miscellaneous materials must be disposed of daily in onsite containers.

C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

PART 2 - ABOVE SURFACE FACILITIES

3.2 FINAL CLEANING

A. Requirements: At the completion of work and immediately prior to final inspection, clean the entire project as follows:

1. Thoroughly clean, sweep, wash, and polish all work and equipment provided under the Contract, including finishes. Leave the structures and site in a complete and finished condition to the satisfaction of the ENGINEER.

2. Direct all subcontractors to similarly perform, at the same time, an equivalent thorough cleaning of all work and equipment provided under their contracts.

3. Remove all temporary structures and all debris, including dirt, sand, gravel, rubbish and waste material.

4. Should the CONTRACTOR not remove rubbish or debris or not clean the buildings and site as specified above, the OWNER reserves the right to have the cleaning done at the expense of the CONTRACTOR.

B. Employ experienced workers, or professional cleaners, for final cleaning.

C. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

D. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.

E. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces. Polish surfaces so designated to shine finish.

F. Repair, patch, and touch up marred surfaces to specified finish, to match adjacent surfaces.

G. Replace air-handling filters if units were operated during construction.

H. Clean ducts, blowers, and coils, if air-handling units were operated without filters during construction.

I. Vacuum clean all interior spaces, including inside cabinets.

J. Handle materials in a controlled manner with as few handlings as possible. Do not drop or throw materials from heights.

PART 2 - ABOVE SURFACE FACILITIES

K. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly-painted surfaces.

L. Clean interior of all panel cabinets, pull boxes, and other equipment enclosures.

M. Wash and wipe clean all lighting fixtures, lamps, and other electrical equipment which may have become soiled during installation.

N. Perform touch-up painting.

O. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

P. Remove erection plant, tools, temporary structures and other materials.

Q. Remove and dispose of all water, dirt, rubbish or any other foreign substances.

3.3 FINAL INSPECTION

A. After cleaning is complete the final inspection may be scheduled. The inspection will be done with the OWNER and ENGINEER.

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

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SECTION 01 77 00

CONTRACT CLOSE OUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Warranties and Bonds

B. Record Drawings

C. Special Tools

1.2 WARRANTIES AND BONDS

Prior to final payment deliver to the OWNER the original and one copy of all bonds, warranties, guarantees and similar documents, including those customarily provided by manufacturers and suppliers which cover a period greater than the one year correction period. Show OWNER as beneficiary of these documents.

1.3 RECORD DRAWINGS

Contractor shall provide record drawing updates on a monthly basis. Contractor shall maintain an onsite log book containing testing activities and other construction documentation.

At the site keep and maintain one record copy of all Contract Documents, reference documents and all technical documents submitted in good order. As the work progresses the Engineer or his designated representative shall record on one set of reproducible drawings all changes and deviations from the original Plans. He shall record the exact location of all changes in vertical and horizontal alignment by offsets and ties at each; sewer, water, electric, gas, communication and other services by off-set distance to permanent improvements such as building and curbs.

Prior to acceptance of the project and before final payment is made, the Engineer shall submit one (1) set of reproducible drawings, two (2) sets of blueline or blackline prints, all marked "Drawings of Record". These Record Drawings must be certified by the Florida Registered Professional Engineer, who prepared the plans and signs and seals these plan, and submits AutoCAD compatible diskette copy of the drawings, and other applicable related records to the Department of Lee County Utilities.

These Record Drawings must be certified by the Florida Registered Professional Engineer, who prepared the plans and signs and seals these plans. The Record Drawings shall include vertical and horizontal alignment of all water, sewer, and effluent reuse lines, valves, tees, bends, reducers, hydrants, pump stations, service

PART 2 - ABOVE SURFACE FACILITIES

connections, meter boxes and/or pads, and other pertinent structures. Pipeline runs in excess of 152.4m, (500'), without fittings shall include vertical alignment information at 152.4m, (500') intervals. Said alignment shall be tied to permanent improvements, such as roadway and/or railroad centerlines and rights-of-way, building and property corners, and shall be certified by a Professional Land Surveyor, licensed in the State of Florida. The Professional Land Surveyor can coordinate with the Contractor to install the necessary appurtenances on buried utilities to facilitate the survey after construction is completed. In addition, property strap numbers and street names shall be shown on the plan.

On a case by case basis, Lee County Utilities may waive the requirement for certification by a Professional Land Surveyor, licensed in the State of Florida. However, prior consent must first be obtained from Lee County Utilities. The County shall withhold final acceptance of the project until the requirement for record drawings and related records has been met. Record Drawings without detailed field verified horizontal and vertical locations of all facilities shown will be rejected.

1.4 SPECIAL TOOLS

Special tools are considered to be those tools which, because of their limited use, are not normally available but which are necessary for maintenance of particular equipment.

For each type of equipment provided under this CONTRACT, furnish a complete set of all special tools including grease guns and other lubricating devices, which may be needed for the adjustment, operation, maintenance, and disassembly of such equipment. Furnish only tools of high grade, smooth forged alloy tool steel. Manufacture grease guns of the lever type.

Furnish and erect one or more neat and substantial steel wall cases or cabinets with flat key locks and clips or hooks to hold each special tool in a convenient arrangement.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

SECTION 01 78 23

OPERATION AND MAINTENANCE MANUALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description

B. Quality Assurance

C. Submittals

D. Format and Contents

1.2 DESCRIPTION

A. Scope: Furnish to the ENGINEER 10 copies and a PDF of an Operation and Maintenance Manual for all equipment and associated control systems furnished and installed.

1.3 QUALITY ASSURANCE

A. Reference Codes and Specifications: No current government or commercial specifications or documents apply.

1.4 SUBMITTALS

A. Prior to the Work Reaching 50 Percent Completion, submit to the ENGINEER for approval two copies of the manual with all specified material. Submit the approval copies with the partial payment request for the specified completion. Within 30 days after the ENGINEER's approval of the two-copy submittal, furnish to the ENGINEER the remaining 8 copies of the manual. Provide space in the manual for additional material. Submit any missing material for the manual prior to requesting certification of substantial completion.

1.5 FORMAT AND CONTENTS

A. Prepare and arrange each copy of the manual as follows:

1. One copy of an equipment data summary (see sample form) for each item of equipment.

2. One copy of an equipment preventive maintenance data summary (see sample form) for each item of equipment.

PART 2 - ABOVE SURFACE FACILITIES

3. One copy of the manufacturer's operating and maintenance instructions. Operating instructions include equipment start-up, normal operation, shutdown, emergency operation and troubleshooting. Maintenance instructions include equipment installation, calibration and adjustment, preventive and repair maintenance, lubrication, troubleshooting, parts list and recommended spare parts.

4. List of electrical relay settings and control and alarm contact settings.

5. Electrical interconnection wiring diagram for equipment furnished including all control and lighting systems.

6. One valve schedule giving valve number, location, fluid, and fluid destination for each valve installed. Group all valves in same piping systems together in the schedule. Obtain a sample of the valve numbering system from the ENGINEER.

7. Furnish all O&M Manual material on 8-1/2 by 11 commercially printed or typed forms or an acceptable alternative format.

8. Provide a digital copy of all O&M Manual material.

B. Organize each manual into sections paralleling the equipment specifications. Identify each section using heavy section dividers with reinforced holes and numbered plastic index tabs. Use 3-ring, hard-back binders Type No. VS11 as manufactured by K&M Company, Torrence, CA, or equal. Punch all loose data for binding. Arrange composition and printing so that punching does not obliterate any data. Print on the cover and binding edge of each manual the project title, and manual title, as furnished and approved by the ENGINEER.

C. Leave all operating and maintenance material that comes bound by the equipment manufacturer in its original bound state. Cross-reference the appropriate sections of the CONTRACTOR's O&M manual to the manufacturers' bound manuals.

D. Label binders Volume 1, 2, and so on, where more than one binder is required. Include the table of contents for the entire set, identified by volume number, in each binder.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

PART 2 - ABOVE SURFACE FACILITIES

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

Lee County Utilities
Three Oaks Water Reclamation Facility
Deep Injection Well IW-2

Equipment Data Summary

Equipment Name: Specification Reference:

Manufacturer:

Name:

Address:

Telephone:

Number Supplied: Location/Service:

Model No: Serial No:

Type:

Size/Speed/Capacity/Range (as applicable):

Power Requirement (Phase/Volts/Hertz):

Local Representative:

Name:

Address:

Telephone:

NOTES:

PART 2 - ABOVE SURFACE FACILITIES

Lee County Utilities
Three Oaks Water Reclamation Facility
Deep Injection Well IW-2

Preventive Maintenance Summary

Equipment Name: Location:

Manufacturer:

Name:

Address:

Telephone:

Model No: Serial No:

Maintenance Task	Lubricant/Part	D W M Q SA A	O&M Manual Reference

NOTES:

*D-Daily W-Weekly M-Monthly Q-Quarterly SA-Semi-Annual A-Annual

PART 2 - ABOVE SURFACE FACILITIES

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SECTION 01 78 36

WARRANTIES AND BONDS

PART 1 GENERAL

1.1 REQUIREMENTS INCLUDED

A. Compile specified warranties and bonds, as in Articles 6 and 13 of the General Conditions.

B. Co-execute submittals when so specified.

C. Review submittals to verify compliance with Contract Documents.

D. Submit to the ENGINEER for review and transmittal to OWNER.

1.2 SUBMITTAL REQUIREMENTS

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.

B. Two original signed copies are required.

C. Table of Contents. Neatly typed in orderly sequence. Provide complete information for each items.

1. Product or work item.
2. Firm, with name of principal, address and telephone number.
3. Scope.
4. Date of beginning warranty, bond or service and maintenance contract.
5. Duration of warranty, bond or service maintenance contract.
6. Provide information for OWNER's personnel:
    a. Proper procedure in case of failure.
    b. Instances which might affect the validity of warranty or bond.
7. CONTRACTOR, name of responsible principal, address and telephone number.

1.3 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2" x 11", punch sheets for standard 3-post binder.
    a. Fold larger sheets to fit into binders.

PART 2 - ABOVE SURFACE FACILITIES

2. Cover: Identify each packet with typed or printed title “WARRANTIES AND BONDS” list:
   a. Title of Project
   b. Name of CONTRACTOR

C. Binders: Commercial quality, three-post binder, with durable and cleanable plastic covers and maximum post width of 2 inches.

1.4 WARRANTY SUBMITTAL REQUIREMENTS

A. For all major pieces of equipment, submit a warranty from the equipment manufacturer. The manufacturer’s warranty period shall be concurrent with the CONTRACTOR’s for one (1) year, unless otherwise specified, commencing at the time of substantial completion.

B. The CONTRACTOR shall be responsible for obtaining certificates for equipment warranty for all major equipment specified under Division 11, 13, 14, 15, and 16 and which has a 1 HP motor or which lists for more than $1,000. The ENGINEER reserves the right to request warranties for equipment not classified as major. The CONTRACTOR shall still warrant equipment not considered to be “major” in the CONTRACTOR’s one-year warranty period even though certificates of warranty may not be required.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

SECTION 02 21 13

LINES AND GRADES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General

B. Surveys

C. Datum Plane

D. Protection of Survey Data

1.2 GENERAL

A. Construct all work in accordance with the lines and grades shown on the Drawings. Assume full responsibility for keeping all alignment and grade.

1.3 SURVEYS

A. Reference Points: The OWNER will provide reference points for the work as described in the General Conditions. Base horizontal and vertical control points will be designated by the ENGINEER and used as datum for the Work. Perform all additional survey, layout, and measurement work.

1. Keep ENGINEER informed, sufficiently in advance, of the times and places at which work is to be performed so that base horizontal and vertical control points may be established, and any checking deemed necessary by ENGINEER may be done, with minimum inconvenience to the ENGINEER and at no delay to CONTRACTOR. It is the intention not to impede the Work for the establishment of control points and the checking of lines and grades set by the CONTRACTOR. However, when necessary, suspend working operations for such reasonable time as the ENGINEER may require for this purpose. Costs associated with such suspension are deemed to be included in the Contract Price, and no time extension or additional costs will be allowed.

2. Provide an experienced survey crew including an instrument operator, competent assistants, and any instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement of work performed by the CONTRACTOR.

PART 2 - ABOVE SURFACE FACILITIES

1.4 DATUM PLANE

A. All elevations indicated or specified refer to the Mean Sea Level Datum Plane, 1988 General Adjustment, of the United States Coast and Geodetic Survey and are expressed in feet and decimal parts thereof, or in feet and inches.

1.5 PROTECTION OF SURVEY DATA

A. General: Safeguard all points, stakes, grade marks, known property corners, monuments, and bench marks made or established for the Work. Reestablish them if disturbed and bear the entire expense of checking reestablished marks and rectifying work improperly installed.

B. Records: Keep neat and legible notes of measurements and calculations made in connection with the layout of the Work. Furnish copies of such data to the ENGINEER for use in checking the CONTRACTOR's layout. Data considered of value to the OWNER will be transmitted to the OWNER by the ENGINEER with other records on completion of the Work.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

SECTION 02 40 00

DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: All work necessary for the removal and disposal of buildings, structures, foundations, piping, equipment and roadways, or any part thereof including masonry, steel, reinforced concrete, plain concrete, electrical facilities, and any other material or equipment shown or specified to be removed.

B. Basic Procedures and Schedule: Carry out demolition so that adjacent structures, which are to remain, are not endangered. Schedule the work so as not to interfere with the day to day operation of the existing facilities. Do not block doorways or passageways in existing facilities.

C. Additional Requirements: Provide dust control and make provisions for safety.

1.2 SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 1.

B. Site Inspection: Visit the site and inspect all existing structures. Observe and record any defects which may exist in buildings or structures adjacent to but not directly affected by the demolition work. Provide the OWNER with a copy of this inspection record and obtain the OWNER's approval prior to commencing the demolition.

1.3 QUALITY ASSURANCE

A. Limits: Exercise care to break concrete sufficiently for removal in reasonably small masses. Where only parts of a structure are to be removed, cut the concrete along limiting lines with a suitable saw so that damage to the remaining structure is held to a minimum.

PART 2 PRODUCTS

Not Used

PART 2 - ABOVE SURFACE FACILITIES

PART 3 EXECUTION

3.1 EXAMINATION OF EXISTING DRAWINGS

A. Drawings of existing structures and equipment will be available for inspection at the office of the OWNER.

3.2 PROTECTION

A. General Safety: Provide warning signs, protective barriers, and warning lights as necessary adjacent to the work as approved or required. Maintain these items during the demolition period.

B. Existing Services: Undertake no demolition work until all mechanical and electrical services affected by the work have been properly disconnected. Cap, reroute or reconnect interconnecting piping or electrical services that are to remain in service either permanently or temporarily in a manner that will not interfere with the operation of the remaining facilities.

C. Hazards: Perform testing and air purging where the presence of hazardous chemicals, gases, flammable materials or other dangerous substances is apparent or suspected, and eliminate the hazard before demolition is started.

3.3 DEMOLITION REQUIREMENTS

A. Explosives: The use of explosives will not be permitted.

B. Protection: Carefully protect all mechanical and electrical equipment against dust and debris.

C. Removal: Remove all debris from the structures during demolition and do not allow debris to accumulate in piles.

D. Access: Provide safe access to and egress from all working areas at all times with adequate protection from falling material.

E. Protection: Provide adequate scaffolding, shoring, bracing railings, toe boards and protective covering during demolition to protect personnel and equipment against injury or damage. Cover floor openings not used for material drops with material substantial enough to support any loads placed on it. Properly secure the covers to prevent accidental movement.

F. Lighting: Provide adequate lighting at all times during demolition.

G. Closed Areas: Close areas below demolition work to anyone while removal is in progress.

PART 2 - ABOVE SURFACE FACILITIES

H. Material Drops: Do not drop any material to any point lying outside the exterior walls of the structure unless the area is effectively protected.

3.4 DISPOSAL OF MATERIALS

A. Final Removal: Remove all debris, rubbish, scrap pieces, equipment, and materials resulting from the demolition unless otherwise indicated. Take title to all demolished materials and remove such items from the site.

B. OWNER's Property: In addition to any items which may be shown, the following items remain the property of the OWNER. Remove carefully, without damage, all items listed or shown, and stockpile as directed.

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

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Section 03 30 53

MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1-1. SCOPE. This section covers all cast-in-place concrete, including reinforcing steel, forms, finishing, curing, and appurtenant work.

1-2. GENERAL. All cast-in-place concrete shall be accurately formed and properly placed and finished as indicated on the drawings and as specified herein.

1-3. SUBMITTALS. All submittals shall be made in accordance with the Submittal Procedures section.

The following items shall be submitted, as a minimum.

Manufacturer's information for all products and concrete ingredients supplied under this section, in the form of technical data sheets, certificates of compliance, test data, or reports.

Items required to verify the concrete mixture:

Aggregate reports (ASTM C33 and ASTM C1778)

Source and type

Gradation

Deleterious materials

Alkali-aggregate reactivity

Cement mill report

Fly ash or slag cement test report

Admixture data sheets

Proposed mixture proportions

Concrete compressive strength at 28 days

PART 2 - ABOVE SURFACE FACILITIES

NSF/ANSI 61 and NSF/ANSI 600 compliance evaluations

Drawings or figures indicating the location of all construction joints, expansion joints, and contraction joints.

Drawings or figures indicating the location of all waterstops including prefabricated or specialty pieces at turns, intersections, and changes of waterstop types.

Bar lists and drawings for the fabrication and placing of reinforcement, with sufficient plans, elevations, and sections to adequately detail and label all reinforcement. Bar drawings shall also include a reference to the structure where the reinforcement is to be installed and the relevant contract drawings showing the reinforcement.

Proposed repair materials and procedures for defects in concrete that are more than 3 inches deep, submitted only after such repairs are found to be necessary.

A curing plan, indicating the planned method and duration of curing for each individual structure on the project.

1-4. STORAGE AND HANDLING. Cement shall be stored in suitable moistureproof enclosures. Cement which has become caked or lumpy shall not be used.

Aggregates shall be stored so that segregation and the inclusion of foreign materials are prevented. The bottom 6 inches of aggregate piles in contact with the ground shall not be used.

Reinforcing steel shall be carefully handled and shall be stored on supports that will prevent the steel from touching the ground.

PART 2 - PRODUCTS

2-1. LIMITING REQUIREMENTS. Unless otherwise specified, concrete shall be controlled within the following limiting requirements.

2-1.01. Cement Content. The cementitious material content shall be suitable for meeting the performance requirements of this specification.

2-1.02. Maximum Water-Cementitious Ratio. The maximum water-cementitious ratio shall be 0.42 on a weight basis. If fly ash or slag cement are used, the combined mass of cement plus fly ash or slag cement shall be used to determine the water-cementitious materials ratio.

2-1.03. Fly Ash and Slag Cement Content. At the option of Contractor, fly ash or slag cement may be substituted for cement, on the basis of 1.0 lb added for each 1.0 lb of cement reduction. Fly ash replacement shall be within a range of 15 to 25 percent. Slag cement replacement shall be within a range of 25 to 50 percent.

2-1.04. Coarse Aggregate. The maximum nominal coarse aggregate size shall be 1 inch. Recycled aggregates, or aggregates created from crushed concrete, will not be acceptable.

2-1.05. Slump. Concrete slump shall be kept as low as possible consistent with proper handling and thorough compaction. Unless otherwise authorized by Engineer, slump of concrete without a superplasticizer shall not exceed 4 inches. Slump of concrete with a high-range water reducer (superplasticizer), or a midrange water reducer, shall not exceed 8 inches.

2-1.06. Total Air Content. The total volumetric air content of concrete after placement shall be 6 percent ±1.5 percent. Air-entraining admixture shall be omitted from concrete for interior slabs which are to be trowel finished.

2-1.07. Admixtures. The admixture content, batching method, and time of introduction to the mix shall be in accordance with the manufacturer's recommendations and acceptable to Engineer. A water-reducing admixture and an air-entraining admixture shall be included in all concrete. A midrange water reducer or a high-range water reducer (superplasticizer) may be used at Contractor’s option. No calcium chloride or admixture containing chloride from sources other than impurities in admixture ingredients will be acceptable.

2-1.08. Strength. The minimum acceptable compressive strengths, as determined by ASTM C39, shall be:

Age	Minimum Compressive Strength
7 days	3,375 psi
28 days	4,500 psi

Cylinders shall be 6 inches diameter by 12 inches high for concrete mixes using a maximum nominal aggregate size of 1 inch or larger. Cylinders may be either 6 inches diameter by 12 inches high, or 4 inches diameter by 8 inches high for concrete mixes using a maximum nominal aggregate size of less than 1 inch. The average compressive strength shall be determined from the results of at least three cylinders when using 4 inch diameter cylinders, and at least two cylinders when using 6 inch diameter cylinders. All tests shall be performed using the same sized cylinders for the duration of the work.

PART 2 - ABOVE SURFACE FACILITIES

2-1.09. Concrete for Ductbank, Pipe Blocking, and Pipe Encasement. Concrete for ductbank, buried blocking, and encasement of pipe shall conform to the limiting requirements specified herein, except that the cement factor and total water content may be adjusted to provide a minimum compressive strength of 3,000 psi at 28 days. Concrete shall have a slump of not less than 2 inches nor more than 5 inches when placed.

2-2. MATERIALS.

Cement	ASTM C150 Type I, II, or I/II, or ASTM C595 Type IL. ASTM C595 cements that incorporate ASTM C1157 cements will not be acceptable.
Fly Ash	ASTM C618, Class F, except loss on ignition shall not exceed 4 percent.
Slag Cement	ASTM C989, Grade 100 or Grade 120.
Fine Aggregate	Non-reactive, clean natural sand, ASTM C33. Artificial or manufactured sand will not be acceptable.
Coarse Aggregate	Non-reactive crushed rock, washed gravel, or other inert granular material conforming to ASTM C33, class 4S, except that clay and shale particles shall not exceed 1 percent.
Water	Potable. Water from concrete production operations shall not be used.
Admixtures	
Water-Reducing	ASTM C494, Type A or D.
Air-Entraining	ASTM C260.
Superplasticizing	ASTM C494, Type F or G.
Reinforcing Steel	
Bars	ASTM A615, Grade 60, deformed.

Welded Wire Fabric	ASTM A185 or A497.
Bar Supports	CRSI Class 1, plastic protected; or Class 2, stainless steel protected.
Mechanical Connectors	Splicing system meeting Type 2 tensile requirements of ACI 318. Products shall have a current evaluation report verifying testing per ICC-ES AC 133. Use only where indicated on the drawings.
Stainless Steel Waterstops	ASTM A240, low carbon stainless steel, 14 gage minimum thickness, size as indicated on the Drawings.
PVC Waterstops	Material shall meet the requirements of CRD-C-572, shall be white (no pigment), ribbed, 3/8 inch thick, size as indicated on the drawings. Reclaimed material will not be acceptable. Provide hog rings or grommets spaced at 12 inches on center entire length.
6 inches wide, at construction joints	Sika Greenstreak “679”, JP Specialties “PVC637”, or Vinylex “R638”.
9 inches wide, at construction joints	Sika Greenstreak “646”, JP Specialties “PVC937”, or Vinylex “R938”.
Expandable Waterstops, permitted only at locations indicated on Drawings	
For concrete sections that are at least 10 inches thick and 6 feet high, and with at least two layers of reinforcement	Hydrophilic; bentonite free, chemically modified rubber. Adeka "Ultra Seal MC-2010MN" or Sika "Hydrotite CJ-1020-2K". Adhesive and sealant as recommended by the manufacturer.
For other concrete sections	Hydrophilic; chemically modified rubber. Adeka "KBA-1510FP" or Sika "Swellstop". Adhesive and sealant as recommended by the manufacturer.
Expansion joint materials	

PART 2 - ABOVE SURFACE FACILITIES

Filler	Preformed sponge rubber. ASTM D1752, Type I.
Filler Adhesive	As recommended by manufacturer.
Sealant	As specified in the Joint Sealants section.
Forms	
Plywood Product	Standard PS1, waterproof, resin-bonded, exterior type, Douglas fir.
Lumber	Straight, uniform width and thickness, and free from knots, offsets, holes, dents, and other surface defects.
Form Coating	Nonstaining and nontoxic after 30 days. Product shall not exceed VOC limits established by the federal, state, or local regulatory agency having jurisdiction over the project site.
Evaporation Reducer	Dayton Superior "AquaFilm Concentrate J74", Euclid "Eucbar", L&M Chemical "E-Con", Master Builders Solutions "MasterKure ER50", or Sika "SikaFilm".
Polyethylene Film	Product Standard PS17 or ASTM D4397, 6 mils or thicker.
Vapor retarder and seam tape	Polyolefin membrane, 15 mil min, ASTM E1745, Class A, with maximum water vapor permeance of 0.02 perms. Stego Industries “Stego Wrap 15 Mil”, Raven Industries “Vaporblock 15”, Reef Industries “Griffolyn 15 Mil Green”, W.R. Meadows “Perminator 15”, Insulation Solutions “Viper VaporCheck II”. Manufacturer recommended seam tape and pipe boots.
Membrane Curing Compound and Floor Sealer	ASTM C1315, Type I, Class A, minimum 25 percent solids, acrylic, non-yellowing, unit moisture loss 0.40 kg/m^2 maximum in 72 hours. Product shall not exceed VOC limits established by the federal, state, or

PART 2 - ABOVE SURFACE FACILITIES

	local regulatory agency having jurisdiction over the project site.
Concrete Surface Coloring/Hardener	Mineral aggregate dry-shake colored hardener for concrete flatwork. ChemSystems, Inc. “CSI Color Hardener”, Euclid “Surflex”, or Dayton Superior “Quartz Tuff”.
Epoxy Bonding Agent	ASTM C881, Type V, moisture insensitive, 100 percent solids; Dayton Superior “Sure Bond J58”, Euclid "Dural 452 MV", Prime Resins “Prime Bond 3900 High Mod LPL”, or SpecChem “SpecPoxy 2000”.

2-3. MIXTURE DESIGN AND TESTING. All reports and tests required for Engineer acceptance of materials and concrete mixtures shall be made at the expense of Contractor. Mixtures shall be adjusted in the field as necessary, within the limits specified, to meet the requirements of these specifications. If the source of any concrete materials is changed during the contract, concrete work shall pause until the new materials and the new mixture design are acceptable to Engineer.

2-3.01. Review of Materials. The source and quality of concrete materials shall be submitted to Engineer for review before concrete is placed.

2-3.02. Proposed Mixture Proportions. Proposed proportions of concrete shall meet the limiting requirements indicated herein.

2-3.03. Mixture Testing. Test results shall be submitted for review and shall be acceptable to Engineer before concrete work is started.

2-3.03.01. Field Test Record Data. Concrete mixtures may be qualified based on field test record performance data. Field test data records shall be from the production facility being used on the current Project and shall have been performed in the past 24 months. Field test records shall represent a single group of at least 10 consecutive strength tests for one mixture, using the same materials, under the same conditions, and encompassing a period of not less than 45 days.

2-3.03.02. Laboratory Trial Mixture Testing. If field test record data is not available, or does not meet the specified criteria, laboratory trial mixtures shall be performed to confirm concrete strength requirements. Laboratory trial mixtures shall meet a minimum compressive strength of f'_c + 1200 psi.

PART 2 - ABOVE SURFACE FACILITIES

2-4. FORMS. Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings. Forms shall be substantial and sufficiently tight to prevent leakage of mortar and shall be maintained in proper position and accurate alignment.

Forms for pavement, curbs, or gutters shall be made of steel and shall be supported on thoroughly compacted earth. The top face of pavement forms shall not vary from a true plane more than 1/4 inch in 10 feet.

Forms shall be thoroughly cleaned and coated before concrete is placed.

Form-facing materials shall be selected in accordance with ACI 347.3R, based upon the applicable formed concrete surface category. Formed concrete surface categories vary by structure and application, and shall be as indicated in the Finishing Formed Surfaces paragraph.

2-4.01. Form Ties. Form ties shall be of the removable end, permanently embedded body type, and shall have sufficient strength and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders. Form ties for walls with waterstops at joints shall be provided with waterstop washers located on the permanently embedded portions of the ties at the approximate center of the wall. Through-wall tapered removable ties will not be acceptable for liquid-containing walls.

2-4.02. Edges and Corners. Chamfer strips shall be placed in forms to bevel all salient edges and corners, except the top edges of walls and slabs which are to be tooled and edges which are to be buried. Unless otherwise noted, bevels shall be 3/4 inch wide.

2-4.03. Form Removal. Forms shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all dead, live, and construction loads. Care shall be taken in form removal to avoid surface gouging, corner or edge breakage, and other damage to the concrete.

2-5. REINFORCEMENT. Reinforcement shall be accurately formed and positioned and shall be maintained in proper position while the concrete is being placed and compacted. Unless otherwise indicated on the drawings, the details of fabrication shall conform to ACI 315 and 318. In case of conflict, ACI 318 shall govern. Reinforcement shall be free from dirt, loose rust, scale, and contaminants. Mechanical connections shall be used only as indicated on the drawings.

PART 3 - EXECUTION

3-1. BATCHING, MIXING, AND DELIVERY. Concrete shall be furnished by an acceptable ready-mixed concrete supplier, and shall conform to ASTM C94 except as indicated otherwise in this specification. The time from start of concrete mixing to completion of discharge from the truck shall not exceed 1-1/2 hours.

3-1.01. Delivery Tickets. A delivery ticket shall be prepared for each load of ready-mixed concrete and a copy of the ticket shall be handed to Engineer by the truck operator at the time of delivery. Tickets shall indicate the name and location of Contractor, the project name, the mixture identification, the quantity of concrete delivered, the quantity of each material in the batch, the outdoor temperature in the shade, the time at which the cementitious materials were added, and the numerical sequence of the delivery.

3-1.02. Mixing Water. Mixing water shall not be added in transit. Any amount of water withheld from the truck mixer shall be clearly indicated on the delivery ticket. Water added at the site shall not exceed the amount withheld, and shall not be added without oversight by Owner's on site inspector.

3-1.03. Consistency. The consistency of concrete shall be suitable for the placement conditions. Aggregates shall flow uniformly throughout the mass, and the concrete shall flow sluggishly when vibrated or spaded. The slump shall be kept uniform.

3-2. PLACEMENT. Contractor shall inform Engineer at least 24 hours in advance of the times and places at which he intends to place concrete.

Methods of conveying concrete to the point of final deposit and of placing shall prevent segregation or loss of ingredients. During and immediately after placement, concrete shall be thoroughly compacted and worked around all reinforcement and embedments and into the corners of the forms. Concrete shall be compacted by immersion-type vibrators, vibrating screeds, or other suitable mechanical compaction equipment. The use of "jitterbug" tampers to compact concrete flatwork will not be permitted.

3-2.01. Polyethylene Film. Where concrete is placed against gravel or crushed rock which does not contain at least 25 percent material passing a No. 4 sieve, such surfaces shall be covered with polyethylene film. Joints in the film shall be lapped at least 6 inches and taped.

3-2.02. Vapor Retarder. Not used.
3-2.03. Cold Weather Concreting. Except as modified herein, cold weather concreting shall comply with ACI 306.1.

When placed, heated concrete shall not be warmer than 80°F.

PART 2 - ABOVE SURFACE FACILITIES

3-2.04. Hot Weather Concreting. Except as modified herein, hot weather concreting shall comply with ACI 305.1.

At air temperatures of 90°F or above, concrete shall be kept as cool as practicable during placement. The temperature of the concrete when placed in the work shall not exceed 90°F.

Plastic shrinkage cracking due to rapid evaporation of moisture shall be prevented. Concrete shall not be placed when the evaporation rate (actual or anticipated) equals or exceeds 0.2 lb per square foot per hour, as determined using the nomograph in Appendix A of ACI 305.1.

3-2.05. Bonding to Hardened Concrete. The surface of hardened concrete upon which fresh concrete is to be placed shall be rough, clean, sound, and damp. Before placement of plastic concrete, the hardened surface shall be cleaned of all laitance and foreign substances (including curing compound), washed with clean water, wetted thoroughly, and the surface made free of standing water. Surface profile of the hardened concrete after surface preparation shall be as required for good bond.

Epoxy bonding agent shall only be required where specifically indicated on the project drawings or specifications. Fresh concrete shall be applied when bonding agent is still tacky. Bonding agent material that has exceeded the manufacturer's recommended pot life shall be removed.

3-3. WATERSTOPS. Each waterstop shall be continuous throughout the length of the joint in which it is installed. Waterstops shall be clean, free from coatings, and shall be maintained in proper position until surrounding concrete has been deposited and compacted.

Junctions between adjacent sections of metal waterstops shall be lapped 5 inches and securely bolted, screwed, or spot welded together.

Junctions between adjacent sections of elastomeric (PVC) waterstops shall be spliced in strict conformity with the recommendations of the manufacturer. Directional changes and intersections shall be factory fabricated by the waterstop manufacturer prior to delivery to the site of the work. Field splices will be acceptable only in straight sections.

3-4. TOLERANCES. Tolerances for cast-in-place concrete work shall be as indicated in ACI 117, and ACI 347.3R based upon the relevant formed concrete surface category.

Formed concrete surfaces that are to have a face-mounted flat steel or FRP member attached, including but not limited to items such as weir plates or shelf

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angles, shall have more stringent flatness requirements. The surface profile shall permit the installation of the flat member without grinding the concrete surface (except for removal of fins), deforming the flat member, or requiring usage of backer rods or shims.

3-5. FINISHING.

3-5.01. Finishing Formed Surfaces. Formed concrete surfaces shall meet all criteria of the relevant formed concrete surface category (CSC), as defined in ACI 347.3R, except as indicated otherwise herein. Surfaces shall be assigned to CSC's as indicated.

Formed Concrete Surface Category	Applicable Surfaces	Mockup Required
CSC1	Formed concrete surfaces that will be in permanent contact with earth backfill.	No
CSC2	All other formed concrete surfaces not designated otherwise.	No
CSC3	None.	Yes
CSC4	None.	Yes

3-5.01.01. Fins. Fins, form seams, and construction joints shall be ground flush on all surfaces in formed concrete surface categories CSC2, CSC3, and CSC4, and in CSC1 surfaces that are required to be dampproofed.

3-5.01.02. Tie Holes. All tie holes in formed surfaces, regardless of the relevant CSC, shall be cleaned, wetted, and filled with patching mortar. The patches shall be finished flush and cured and shall match the texture and color of the adjacent concrete.

3-5.01.03. Dampproofed Surfaces. Concrete surfaces to be dampproofed shall have fins removed and tie holes filled, but no additional finishing will be required.

3-5.01.04. Painted Surfaces. Concrete surfaces to be painted shall have sharp edges and projections removed to provide an acceptable condition for painting. The concrete surfaces shall have bug holes filled per the Protective Coatings section.

3-5.01.05. Mockups. Mockups shall be used to validate the means and methods to be used by Contractor, and to provide Owner a sample of the specified concrete surface. The use of a reference area within an existing structure shall not be acceptable as a mockup.

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Mockups shall incorporate the structure geometries; reinforcing bar size, spacing, arrangement, and cover; inserts; the approved concrete mixture; sample tie hole patching, and other likely required repair procedures. Contractor shall confirm in writing that the mockup quality represents work than can be accomplished in the actual structure.

3-5.02. Finishing Unformed Surfaces. Unless otherwise specified, unformed surfaces shall be screeded and given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance, with no unnecessary working of the surface.

Initial floating shall be followed by a second floating at the time of initial set. The second floating shall produce a finish of uniform texture and color and the completed finish for unformed surfaces unless indicated otherwise.

3-5.03. Troweling. Interior floor surfaces which will be exposed after construction is completed; exposed top surfaces of equipment bases and interior curbs; and other surfaces designated on the drawings shall be steel trowel finished. Troweling shall be performed after the second floating when the surface has hardened sufficiently to prevent an excess of fines being drawn to the surface. Troweling shall produce a dense, smooth, uniform surface free from blemishes and trowel marks.

3-5.04. Application of Evaporation Reducer. Concrete flatwork subject to rapid evaporation due to hot weather, drying winds, and sunlight shall be protected with an evaporation reducer. The evaporation reducer shall form a continuous film on the surface of fresh, plastic concrete to reduce evaporation.

Immediately following screeding, evaporation reducer shall be sprayed over the entire surface of fresh, plastic concrete flatwork at a rate of not less than 200 square feet per gallon, in accordance with the manufacturer's recommendations. The spray equipment shall have sufficient capacity to continuously spray the product at approximately 40 psi with a suitable nozzle as recommended by the manufacturer.

The sprayable solution shall be prepared as recommended by the manufacturer.

Under severe drying conditions, additional applications of evaporation reducer may be required following each floating or troweling, except the last finishing operation.

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3-6. CURING. Concrete shall be protected from loss of moisture for at least 7 days after placement unless indicated otherwise. Curing of concrete shall be done by methods which will keep the concrete surfaces adequately wet for the specified curing period.

3-6.01. Water Curing. Water curing shall be performed for concrete in liquid-containing structures and for all concrete containing slag cement. Other forms of curing will not be acceptable in these applications. Water curing shall be in accordance with ACI 308.1 except as modified herein.

Water saturation of concrete surfaces shall begin as soon as possible after initial set. The rate of water application shall be regulated to provide complete surface coverage with a minimum of runoff.

Water curing shall continue for 14 days for concrete containing slag cement, and for 7 days for other types of concrete. However, when concrete is being protected from low temperatures, the duration of water curing may be shortened to 1 day less than the duration of cold weather protection.

When forms are removed before the specified curing duration is completed, measures shall be taken to immediately continue water curing and to provide adequate thermal protection for the concrete.

3-6.02. Membrane Curing. Unless otherwise specified, membrane curing compound may be used instead of water curing on concrete in non-liquid-containing structures which will not be stained or etched, covered with chemical resistant linings, covered with additional concrete, or indicated in the Architectural drawings to be covered with a finish flooring material.

Membrane curing compound shall be evenly sprayed at a coverage rate of not more than 300 square feet per gallon. The spray equipment shall have sufficient capacity to continuously spray curing compound at approximately 40 psi with a suitable nozzle as recommended by the manufacturer. Unformed surfaces shall be covered with the first coat of curing compound within 30 minutes after final finishing. A second coat of curing compound shall be applied when the first coat has become tacky to the touch and shall be applied at right angles to the first coat.

Curing compound shall be suitably protected against abrasion during the curing period.

3-6.03. Film Curing. Unless otherwise specified, film curing with white polyethylene sheeting may be used instead of water curing on concrete in nonliquid-containing structures which will be covered later with mortar or additional concrete, or which will otherwise not be exposed to view.

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Film curing shall begin as soon as possible after initial set of the concrete. The concrete surfaces shall be completely covered with polyethylene sheeting. Sheeting shall overlap the edges of the concrete for proper sealing and anchorage, and joints between sheets shall be sealed. All tears, holes, and other damage shall be promptly repaired. Covering shall be anchored continuously at edges and as necessary to prevent billowing on the surface.

3-7. REPAIRING DEFECTIVE CONCRETE. Defective concrete shall be defined as any surface with undesirable visible effects in excess of that permitted by the relevant formed concrete surface category (CSC), except as indicated otherwise herein.

Defects in formed concrete surfaces shall be repaired to the satisfaction of Engineer within 24 hours of form removal. Surface repair work shall conform to Article 5.3.7 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing of the surrounding concrete. Surface repair material shall be adequately cured.

Defects in concrete that are more than 3 inches deep shall be brought to the attention of Engineer prior to any repair work. Contractor shall submit a proposed repair material and procedure for review by Engineer. The repair material and procedure required by Engineer may be more extensive than the process described in Article 5.3.7 of ACI 301.

3-8. OWNER'S FIELD CONTROL TESTING. Field control tests shall be performed by Engineer or Owner's testing laboratory personnel, at the expense of Owner. Contractor shall provide access to all facilities and the services of one or more employees as necessary to assist with the field control testing.

Field control testing will not be performed for concrete used in ductbanks, pipe blocking, pipe encasement, or other non-structural applications unless Owner specifically requests and schedules such testing. Other special inspection requirements applicable for these types of concrete will still be performed.

3-8.01. Air Content. An air content test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Air content shall be determined in accordance with ASTM C231.

3-8.02. Slump. A slump test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Slump shall be determined in accordance with ASTM C143.

3-8.03. Test Cylinders. Compression test specimens shall be made, cured (standard curing method), stored, and delivered to the laboratory in accordance

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with ASTM C31 and C39. Compressive strength tests will be evaluated in accordance with ACI 318 and as specified herein.

One set of concrete test cylinders shall be cast for each concrete pour. A set of test cylinders shall consist of four or six cylinders depending on the cylinder size selected. Half of the cylinders shall be tested at 7 days, and the remaining half shall be tested at 28 days. All concrete required for testing shall be furnished by, and at the expense of, Contractor.

End of Section

PART 2 - ABOVE SURFACE FACILITIES

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Section 05 81 00

ANCHORAGE IN CONCRETE

PART 1 - GENERAL

1-1. SCOPE. This section covers the design and installation of anchors in concrete. It includes cast-in-place anchor bolts and anchor rods, adhesive anchors for both threaded rods and reinforcing bars, expansion anchors, screw anchors, and undercut anchors.

1-2. GENERAL.

1-2.01. Anchors Designed by Engineer. Cast-in-place and post-installed anchors that are fully detailed on the Drawings have been designed by Engineer, unless noted otherwise.

Anchors detailed on the Drawings as cast-in-place shall not be changed to a post-installed type without approval of Engineer.

Post-installed anchors identified on the Drawings as a specific manufacturer and product shall not be changed to a different post-installed manufacturer or product without approval of Engineer.

Post-installed anchors identified on the Drawings as a specific anchor type, but indicating no specific product, may use any of the listed products of that anchor type.

Contractor shall reimburse Engineer, through Owner, for Engineer's design costs related to evaluating alternative anchor types, products, or details.

1-2.02. Anchors Designed by Contractor or Contractor's Suppliers. Contractor or Contractor's material suppliers shall be responsible for design of anchors for delegated design items such as railings, ladders, equipment, pipe supports, pre-engineered structures, and other manufactured items, as indicated in the Drawings and Specifications.

Cast-in-place anchors shall be used unless post-installed types are indicated on the Drawings or accepted by Engineer.

Adhesive anchors used in vibrating applications shall only be used if the anchor manufacturer submits documentation indicating that the product is suitable for the anticipated service conditions.

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Anchors shall be designed for loads due to all operating conditions, plus relevant snow, wind, and seismic loadings as indicated in the Meteorological and Seismic Design Criteria section.

Seismic anchorage design for non-structural components shall include the overstrength factors indicated in ASCE 7, Tables 13.5-1 and 13.6-1, when applicable.

Design of anchorage into concrete shall be in accordance with ACI 318 Chapter 17, shall consider concrete to be cracked, and shall not include the strengthening effects of supplementary reinforcement or anchor reinforcement unless approved by Engineer.

Post installed anchors shall be designed in accordance with the anchor manufacturer's research report, and shall consider the applicable effects of anchor spacing, edge distances, embedment depths, and temperature.

Anchorage calculations performed by Contractor's suppliers shall utilize design tools applicable to the specific anchorage products intended to be used by Contractor.

1-2.03. Materials. Unless otherwise indicated, anchors of structural steel members connected to concrete shall have a diameter of at least 3/4 inch. Anchors for ladders and equipment shall have a diameter of at least 1/2 inch. Anchors for pedestrian railing systems shall have a diameter of at least 3/8 inch.

Unless otherwise indicated on the Drawings, anchors used in the following locations and applications shall be of the indicated materials.

Cast-In-Place Anchor Bolts and Anchor Rods

Submerged locations	Stainless steel.
Locations subject to splashing	Stainless steel.
Buried locations	Stainless steel.
Anchorage of structural steel columns	Galvanized steel.
Other exterior locations	Galvanized steel.
Interior locations not subject to corrosion	Carbon steel.

Adhesive, Expansion, Screw, and Undercut Anchors

Submerged locations	Stainless steel.
Locations subject to splashing	Stainless steel.

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Buried locations	Stainless steel.
Anchorage of structural steel columns	Stainless steel.
Other exterior locations	Stainless steel.
Interior locations not subject to corrosion	Carbon steel.

1-3. SUBMITTALS. All submittals shall be made in accordance with the Submittal Procedures section.

The following items shall be submitted, as a minimum.

Manufacturer's information for all products supplied under this section, in the form of manufacturer's research reports (from independent organizations such as ICC-ES or IAPMO UES), technical data sheets, and certificates of compliance.

Shop drawings for anchor bolts, anchor rods, and post-installed anchors, including anchor manufacturer, products, and embedment depth. Shop drawings for anchors designed by Contractor's suppliers shall be sealed by a professional engineer licensed in the state of the project.

Anchorage calculations performed by Contractor's suppliers. Calculations shall be prepared and sealed by a professional engineer licensed in the state of the project.

1-4. DELIVERY, STORAGE, AND HANDLING. Materials shall be handled, transported, and delivered in a manner which will prevent damage or corrosion. Damaged materials shall be promptly replaced. Materials shall be shipped and stored in original manufacturer's packaging.

PART 2 - PRODUCTS

2-1. MATERIALS. Unless otherwise indicated on the drawings, materials shall be as indicated below.

Cast-In-Place Anchor Bolts and Anchor Rods

Carbon steel	ASTM F1554, Grade 36 with compatible nuts.

Galvanized steel	ASTM F1554, Grade 36 with compatible nuts; hot-dip galvanized, ASTM F2329.
Stainless steel	Bolts, ASTM F593, Alloy Group 1 or 2 (minimum yield strength of 45 ksi); nuts, ASTM F594, Alloy Group 1 or 2.
Flat Washers	ANSI B18.22.1; of the same material as anchor bolts and nuts.
Expansion Anchors in Concrete	Products shall be single component anchors tested in accordance with ICC AC193 and shall have a manufacturer's research report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete, and for resisting seismic forces.
Carbon Steel	Hilti "Kwik-Bolt TZ2", Simpson "Strong-Bolt 2", or DeWalt "Power-Stud+SD2".
Stainless Steel	Hilti "Kwik-Bolt TZ2 SS304", Hilti "Kwik-Bolt TZ2 SS316", Simpson "Strong-Bolt 2", DeWalt "Power-Stud+SD4", or DeWalt "Power-Stud+SD6".
Screw Anchors in Concrete	Products shall be single component anchors tested in accordance with ICC AC193 and shall have a manufacturer's research report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete, and for resisting seismic forces.
Carbon Steel	Hilti "KH-EZ", Simpson "Titen HD", or DeWalt "Screw-Bolt+".
Stainless Steel	Hilti "KH-EZ".
Undercut Anchors in Concrete	Products shall be tested in accordance with ICC AC193 and shall have a manufacturer's research report in compliance with the applicable building code.

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Carbon Steel	Hilti “HDA Undercut Anchor”, Simpson “TCA Undercut Anchor”, or DeWalt “CCU+ Undercut Anchor”.
Stainless Steel	Hilti “HDA-R Undercut Anchor”.
Adhesive Anchors in Concrete	Products shall be tested in accordance with ICC AC308 and shall have a manufacturer’s research report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete, and for resisting seismic forces.
Threaded Rods and Nuts (Carbon Steel)	ASTM A307 or ASTM F1554 Grade 36.
Threaded Rods and Nuts (Stainless Steel)	ASTM F593, CW.
Reinforcing Bars	ASTM A615, Grade 60, deformed.
Reinforcing Bars, weldable	ASTM A706, Grade 60, deformed.
Adhesive (Epoxy)	Hilti “HIT-RE 500 V3", Simpson “SET-3G”, or DeWalt “Pure 110+”.
Adhesive (Acrylic)	Hilti “HIT-HY 200 V3", Simpson “AT-XP”, or DeWalt “AC200+”.

2-2. ANCHORS.

2-2.01. Cast-in-Place Anchor Bolts and Anchor Rods. Cast-in-place anchor bolts and anchor rods shall have forged heads or embedded nuts and washers. Anchors shall be delivered in time to permit setting prior to the placing of structural concrete. Anchor sleeves shall not be used unless acceptable to Engineer. Unless installed in sleeves, anchor bolts and anchor rods shall be provided with sufficient threads to permit a nut to be installed on the concrete side of the concrete form or the supporting template. Two nuts, a jam nut, and a washer shall be furnished for cast-in-place anchor bolts and anchor rods indicated on the Drawings to have locknuts; two nuts and a washer shall be furnished for cast-in-place anchor bolts and anchor rods without locknuts.

2-2.02. Adhesive, Expansion, Screw, and Undercut Anchors. Unless otherwise noted, single nuts and washers shall be provided with adhesive anchors, expansion anchors, screw anchors, and undercut anchors. Adhesive anchors shall be free of coatings that would weaken the bond with the adhesive.

PART 3 - EXECUTION

3-1. GENERAL. Anti-seize thread lubricant shall be liberally applied to projecting, threaded portions of stainless steel anchors immediately before tightening of the nuts.

3-1.01. Compliance With Manufacturer's Instructions. Post-installed anchors shall be installed in accordance with the manufacturer's printed installation instructions and all applicable requirements of the manufacturer's research report for the specific anchor system. If conflicts are found between the Drawings, the manufacturer's printed installation instructions, and the manufacturer's research report installation requirements, Contractor shall notify Engineer for resolution.

3-2. CAST-IN-PLACE ANCHOR BOLTS AND ANCHOR RODS. Cast-in-place anchor bolts and anchor rods shall be carefully positioned with templates and secured in the forms prior to placing concrete. Contractor shall verify that anchorage devices are positioned in accordance with the Drawings and with applicable equipment or structure submittal drawings.

Threads, bolts, and nuts spattered with concrete during placement shall be cleaned prior to final installation of the bolts and nuts.

Sleeves shall be filled with non-shrink grout.

3-3. ADHESIVE ANCHORS. Adhesive shall be statically mixed in the field during application. All proportioning and mixing of the components shall be in accordance with the manufacturer's recommendations.

Anchors or bars shall be installed in holes hammer drilled into hardened concrete. Diameter of holes shall be 1/16 inch larger than the outside diameter of the rod or bar unless recommended otherwise by the anchor system manufacturer. Holes shall be prepared by removing all dust and debris using procedures recommended by the adhesive manufacturer.

Adhesive anchors and holes shall be clean, dry, and free of grease and other foreign matter at the time of installation. The adhesive shall be placed and the rods or bars shall be set in accordance with the recommendations of the manufacturer. Care shall be taken to ensure that all spaces and cavities are filled with adhesive, without voids.

3-3.01. Concrete Installation. Unless indicated otherwise on the Drawings, reinforcing bars shall be embedded to a depth of 15 bar diameters, and threaded rods shall be embedded to a depth that will develop the yield strength of the rod.

Adhesive anchors in concrete shall be installed under the following conditions.

Minimum Age of Concrete Prior to Anchor Installation	21 days.
Concrete Temperature Range	Maximum short-term temperature 162 F, maximum long-term temperature 110 F.
Moisture Condition	Dry concrete.
Type of Lightweight Concrete	N/A
Hole Drilling and Preparation	Hammer drill only.

Installation of adhesive anchors into concrete that are either horizontal or upwardly inclined shall be performed only by personnel certified by the ACI/CRSI Adhesive Anchor Installation Certification Program.

3-4. EXPANSION, SCREW, AND UNDERCUT ANCHORS. Expansion, screw, and undercut anchors shall be installed using all procedures and accessory devices recommended by the anchor manufacturer.

End of Section

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SECTION 26 05 11

ELECTRICAL

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the furnishing and installation of all equipment and materials needed for the electrical requirements of this Contract. It also covers conduit, wiring, and terminations for electrical equipment installed under Electrical Equipment Installation section.

B. This section covers the installation and interconnection of electrical equipment furnished under other sections, except electrical items designated to be installed under those sections.

C. This section covers installation of equipment furnished by Owner.

1.2 GENERAL

A. Electrical apparatus on all equipment shall be installed complete and placed in readiness for proper operation.

B. Electrical materials furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

C. Coordination

1. Electrical work shall conform to the construction schedule and the progress of other trades.

D. Anchor Bolts and Expansion Anchors

1. All anchor bolts, nuts, washers, and expansion anchors shall comply with Anchorage in Concrete and Masonry section, except smaller than 3/4 inch [19 mm] will be permitted to match NEMA standard size bolt holes on motors and electrical equipment.

E. Drawings

1. Supplementing this section, the Drawings indicate locations of equipment and enclosures and provide one-line and schematic diagrams regarding the connection and interaction with other equipment.

PART 2 - ABOVE SURFACE FACILITIES

1.3 CODES AND PERMITS

A. All work shall be performed and materials shall be furnished in accordance with the NEC - National Electrical Code, the NESC - National Electrical Safety Code, and the following standards where applicable:

AEIC	The Association of Edison Illuminating Companies
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
Fed Spec	Federal Specification
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IESNA	Illuminating Engineering Society of North America
NEIS	National Electrical Installation Standards
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
UL	Underwriters' Laboratories

B. Equipment covered by this section shall be listed by UL, or by a nationally recognized third party testing laboratory. All costs associated with obtaining the listing shall be the responsibility of Contractor. If no third-party testing laboratory provides the required listing, an independent test shall be performed at Contractor's expense. Before the test is conducted, Contractor shall submit a copy of the testing procedure to be used.

1.4 IDENTIFICATION.

A. Conduit

1. Conduits in manholes, handholes, building entrance pull boxes, junction boxes, and equipment shall be provided with identification tags. Identification tags shall be 19 gage stainless steel, with 1/2 inch stamped letters and numbers as indicated on the Drawings. Identification tags shall be attached to conduits with nylon tie wraps and shall be positioned to be readily visible.

B. Conductors

1. All conductors in power, control, and instrumentation circuits shall be identified and color coded as described herein.

2. Conductor Identification Number

a. Except for lighting and receptacle circuits, each individual conductor in power, control, and instrumentation circuits shall be provided with wire identification markers at the point of termination.

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b. The wire markers shall be of the heat-shrinkable tube type, with custom typed identification numbers.
c. The wire numbers shall be as indicated on the equipment manufacturer's drawings.
d. The wire markers shall be positioned to be readily visible for inspection.

3. Conductor Color Coding

a. Power conductors shall be color coded as indicated below. For conductors 6 AWG and smaller, the color coding shall be the insulation finish color. For sizes larger than 6 AWG, the color coding may be by marking tape. The equipment grounding conductor shall be green or green with one or more yellow stripes if the conductor is insulated.
b. The following color coding system shall be used:
   1) 120/240V single-phase — black, red, and white
   2) 120/208V, three-phase — black, red, blue, and white
   3) 120/240V, three-phase — black, orange, blue, and white
   4) 277/480V, three-phase — brown, orange, yellow, and gray

c. Where 120/240 and 120/208 volt systems share the same conduit or enclosure, the neutral for either the 120/240 volt system or the 208 volt system shall be white with a permanent identifiable violet stripe.
d. Control and instrumentation circuit conductors shall be color coded as indicated in the Cable Data Figures at the end of this section.

C. Circuit Breakers

1. Circuit breakers shall be provided with nameplates identifying related equipment. Nameplates shall be laminated black-over-white plastic, with 1/8 inch engraved letters, and shall be securely fastened to the circuit breakers.

D. Disconnect Switches

1. All switches shall have front cover-mounted permanent nameplates that include switch type, manufacturer's name and catalog number, and horsepower rating. An additional nameplate, engraved or etched, laminated black-over-white plastic, with 1/8 inch letters, shall be provided to identify the associated equipment. Both nameplates shall be securely fastened to the enclosure.

1.5 SUBMITTALS

A. Drawings and Data – General

1. Complete assembly, foundation, and installation drawings, together with complete engineering data covering the materials used, parts, devices, and accessories forming a part of the work performed by the Contractor, shall be submitted in accordance with the Submittal Procedures section 013300. The drawings and data shall include, but shall not be limited to, the following:

a. Drawings and data.

PART 2 - ABOVE SURFACE FACILITIES

b. Operating manuals.
c. Samples.
d. Test reports
e. Studies

B. Submittal Details & Identification

1. Information covering all materials and equipment shall be submitted for review in accordance with the Submittal Procedures section. Each sheet of descriptive literature submitted shall be clearly marked to identify the material or equipment as follows:

a. Lamp fixture descriptive sheets shall show the fixture schedule letter, number, or symbol for which the sheet applies.
b. Equipment and materials descriptive literature and drawings shall show the specification paragraph for which the equipment applies.
c. Sheets or drawings covering more than the item being considered shall have all inapplicable information crossed out.
d. A suitable notation shall identify equipment and materials descriptive literature not readily cross-referenced with the Drawings or Specifications.
e. Schematics and connection diagrams for all electrical equipment shall be submitted for review. A manufacturer's standard connection diagram or schematic showing more than one scheme of connection will not be accepted, unless it is clearly marked to show the intended connections.
f. Surge protective device submittals shall include drawings (including unit dimensions, weights, component and connection locations, mounting provisions, and wiring diagrams), equipment manuals that detail the installation, operation and maintenance instructions for the specified unit(s), and manufacturer’s descriptive bulletins and product sheets.

C. Engineering and Testing Firm

1. Contractor shall submit the name and qualifications of the Engineering and Testing Services firm proposed to perform the protective device study and the on-site testing.

D. Cable and Conduit Submittal

1. Within 90 days after the Notice to Proceed, Contractor shall furnish a submittal for all types of cable and conduit to be provided. The submittal shall include the cable manufacturer and type, and sufficient data to indicate that the cable and conduit meet the specified requirements.

E. Cable Samples

1. In addition to the complete specifications and descriptive literature, a sample of the largest size of each type of cable shall be submitted for review before installation. Each sample shall include legible and complete surface printing of the cable identification.

PART 2 - ABOVE SURFACE FACILITIES

1.6 PROTECTION AND STORAGE

A. During construction, the insulation on all electrical equipment shall be protected against absorption of moisture, and metallic components shall be protected against corrosion by strip heaters, lamps, or other suitable means. This protection shall be provided immediately upon receipt of the equipment and shall be maintained continuously.

PART 2 - PRODUCTS

2.1 CABLE

A. All cables of each type (such as lighting cable or 600 volt power cable) shall be from the same manufacturer.

B. All types of cable shall conform to the Cable Data Figures at the end of this section and as described herein.

C. Lighting Cable

1. Lighting cable (Figure 1-26 0511 THHN-THWN) shall be provided only in lighting and receptacle circuits operating at 277 volts or less. Lighting and receptacle circuits, 8 AWG [10 mm2] or larger, shall be as specified for 600 volt (Figure 3-26 0511THHN-THWN

D. 600 Volt Power Cable.

1. Cable in power, control, indication, and alarm circuits operating at 600 volts or less, except where lighting, multiconductor control, and instrument cables are required, shall be 600 volt (Figure 2- 26 05 11 XHHW-2) power cable.

E. Instrument Cable

1. Cable for electronic circuits to instrumentation, metering, and other signaling and control equipment shall be two- or three-conductor instrument cable twisted for magnetic noise rejection and protected from electrostatic noise by a total coverage shield. Types of instrument cables shall be (Figure 4-26 0511 single pair), (Figure 5-26 0511 single triad), or (Figure 6-26 0511 multiple pair and/or triad).

F. Multiconductor Control Cable.

1. When indicated on the Drawings, cable in control, indication and alarm circuits shall be multiconductor. Cable shall be Figure 7-26 05 11 14 AWG THHN-THWN.

2.2 RACEWAY

A. Rigid Steel Conduit

1. Rigid steel conduit shall be heavy wall, hot-dip galvanized, shall conform to NEMA C80.1, and shall be manufactured in accordance with UL 6.

B. Liquidtight Flexible Metal Conduit

1. Liquidtight flexible metal conduit shall be hot-dip galvanized steel, shall be covered with a moistureproof polyvinyl chloride jacket, and shall be UL labeled.

C. Rigid Nonmetallic (PVC) Conduit

1. PVC conduit shall be heavy wall, Schedule 40, UL labeled for aboveground and underground uses, and shall conform to NEMA TC-2 and UL 651.

D. PVC-Coated Rigid Steel Conduit: Not Used

E. Electrical Metallic Tubing (EMT). EMT shall be hot-dip galvanized, shall conform to NEMA C80.3, and shall be manufactured in accordance with UL 797.

F. Rigid Aluminum Conduit (RAC). Rigid aluminium conduit and fittings shall be manufactured of 6063-T1 alloy, shall conform to ANSI C80.5, and shall be manufactured in accordance with UL 6A.

G. PVC Coated Aluminum Rigid Conduit

1. Shall be listed to UL 6A and manufactured in accordance with ANSI C80.1.

2. Electrical equipment and materials shall be new and comply with the latest codes and standards. No used, re-built, refurbished and/or re-manufactured electrical equipment and materials shall be furnished on this project.

3. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction

2.3 WIRING DEVICES, BOXES, AND FITTINGS

A. Concealed conduit systems shall have flush-mounted switches and convenience outlets. Exposed conduit systems shall have surface-mounted switches and convenience outlets.

B. Conduit Boxes and Fittings

1. Galvanized or cadmium plated, threaded, malleable iron boxes and fittings shall be manufactured by Crouse-Hinds, Appleton, or O Z Gedney. In applications utilizing aluminum conduit systems, aluminum boxes and fittings manufactured by Crouse-Hinds, Appleton, or O Z Gedney shall be installed.

2. Rigid PVC device boxes and fittings shall be manufactured by Carlon or Cantex.

3. Sheet steel device boxes shall be manufactured by Appleton, Raco, or Steel City.

4. PVC coated device boxes shall be manufactured by Calbond, Ocal, or Robroy Industries.

5. Hub arrangements on threaded fittings shall be the most appropriate for the conduit arrangement to avoid unnecessary bends and fittings.

C. Device Plates.

1. Galvanized or cadmium-plated device plates shall be used on surface mounted outlet boxes where weatherproof plates are not required.

2. Device plates on flush mounted outlet boxes where weatherproof plates are not required shall be AISI Type 302 stainless steel, Eaton "93000 series", Hubbell "S series", or Leviton "840nn-40 series"; nylon or polycarbonate, Eaton "5000 series", Hubbell "Pn series", or Leviton "807nn-I series".

3. Device plate mounting hardware shall be countersunk and finished to match the plate.

4. Device plates for switches outdoors or indicated as weatherproof shall have provisions for padlocking switches "On" and "Off", and shall be Appleton "FSK-1VS", Crouse-Hinds "DS185" or O Z Gedney "FS-1-WSCA".

5. Device plates for receptacles indicated as weatherproof shall be Appleton "FSK-WRD", Crouse-Hinds "WLRD1", or O Z Gedney "FS-1-WDCA.

6. Flush-mounted, weatherproof plates shall be provided with adapter plates, Appleton "FSK-SBA" or Crouse-Hinds "FS031".

7. Device plates for ground fault interrupter receptacles indicated to be weatherproof shall be Appleton "FSK-WGFI", Eaton "S966", or O Z Gedney "FS-1-GFCA".

8. Receptacle covers outdoors or otherwise indicated to be weatherproof while in-use shall be die cast aluminum and shall include a padlock eye. Covers for standard convenience outlets shall be Hubbell “WP8M” or Thomas and Betts Red Dot “CKMUV”. Covers for ground fault interrupter receptacles shall be Hubbell “WP26M” or Thomas and Betts Red Dot “CKMUV”.

9. Engraved device plates, where required, shall be manufactured by Leviton, or equal.

10. Device plates on PVC conduit fittings shall be Carlon "E98 Series" or Cantex "513300 Series".

D. Receptacles

1. Standard convenience outlets shall be duplex, three-wire, grounding, 20 amperes, 125 volts, Eaton "AH5362V", Hubbell "5362I" or Leviton "5362-I" for 120 volt

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circuits, and 250 volts, Eaton "AH5462CV", Hubbell "5462I" or Leviton "5462-I" for 240 volt circuits.

2. Ground fault circuit interrupter receptacles shall be duplex, 20 amperes, 125 volts, Eaton "SGFH20", Hubbell "GFRST20I" or Leviton "G5362-I".

3. Ground fault circuit interrupter receptacles in damp or wet locations shall be duplex, 20 amperes, 125 volts, Hubbell "GFWRST20I" or Leviton "G5362-WTI".

2.4 JUNCTION BOXES, PULL BOXES, AND WIRING GUTTERS

A. Indoor boxes and gutters in corrosive areas indicated on the Drawings and outdoor boxes and gutters shall be NEMA Type 4X, ABS or stainless steel and shall be rigidly supported by PVC-coated or stainless steel framing materials. Mounting hardware, which includes nuts, bolts, and anchors, shall be stainless steel. All damaged coatings shall be repaired according to the manufacturer's instructions.

B. Bolt-on junction box covers 3 feet square or larger, or heavier than 25 lbs , shall have rigid handles. Covers larger than 3 by 4 feet shall be split.

C. Where indicated on the Drawings, junction and pull boxes with a removable side opposite the underground conduits shall be provided over building ends of underground conduit banks. Boxes shall be sized in accordance with the National Electrical Code, including space for full size continuations of all underground conduits not originally continued. Conduit arrangement shall leave maximum space for future conduits.

2.5 LIGHTING FIXTURES

A. Lighting fixtures shall be furnished as described in the fixture schedule and as indicated on the Drawings. Lighting fixtures shall be furnished complete with lamps. Pendant fixtures shall have swivel type box covers and threaded conduit pendants unless otherwise specified. Lighting fixtures shall be provided with disconnects in accordance with NEC requirements.

B. Electronic Drivers

1. Electronic drivers furnished with LED type lighting fixtures shall be certified as meeting requirements of ANSI C82.77 with a THD level of not more than 20 percent.

2.6 DISCONNECT SWITCHES

A. Unless otherwise specified, each disconnect switch shall be 3 pole, nonfusible, 600 volts, with a continuous current rating as indicated on the Drawings.

B. Where indicated on the Drawings, fused switches shall be furnished complete with fuses. Fuse sizing shall be as indicated on the Drawings, as required by the results of

PART 2 - ABOVE SURFACE FACILITIES

the protective device study, or as recommended by the respective protected equipment manufacturer.

C. Switches located outdoors shall have NEMA Type 4X enclosures.

D. Switches shall have high conductivity copper, visible blades; nonteasible, positive, quick-make, quick-break mechanisms; and switch assembly plus operating handle as an integral part of the enclosure base. Each switch shall have a handle whose position is easily recognizable and which can be locked in the "Off" position with three padlocks. The "On" and "Off" positions shall be clearly marked.

E. All switches shall be UL listed and horsepower rated, and shall meet the latest edition of NEMA KS1. Switches shall have defeatable door interlocks that prevent the door from being opened while the operating handle is in the "On" position.

2.7 PHOTOELECTRIC CONTROLS

A. Photoelectric controls shall be weatherproof, swivel adjustable, with built-in time delay to prevent accidental turnoff by momentary brightness. The photocell shall be rated 1800 VA, 120 volts ac, and shall be field adjustable from 1 ft/c turn-on to 15 ft/c turn-off.

PART 3 - EXECUTION

3.1 INSTALLATION, TESTING, AND COMMISSIONING

A. All material, equipment, and components specified herein shall be installed, tested, and commissioned for operation in compliance with NECA 1000 – NEIS Specification System. Where required in NECA 1000, testing and commissioning procedures shall be followed prior to energizing equipment.

3.2 CABLE INSTALLATION

A. General

B. Except as otherwise specified or indicated on the Drawings, cable shall be installed according to the following procedures, taking care to protect the cable and to avoid kinking the conductors, cutting or puncturing the jacket, contamination by oil or grease, or any other damage. Circuits to supply electric power and control to equipment and devices, communication and signal circuits as indicated on the one-line diagrams shall be installed continuous and may not be spliced unless approved by the Engineer.

1. Stranded conductor cable shall be terminated by lugs or pressure type connectors. Wrapping stranded cables around screw type terminals is not acceptable.

2. Stranded conductor cable shall be spliced by crimp type connectors. Twist-on wire connectors may only be used for splicing solid cable and for terminations at lighting fixtures.

3. Splices may be made only at readily accessible locations.

4. Cable terminations and splices shall be made as recommended by the cable manufacturer for the particular cable and service conditions.

5. Cable shall not be pulled tight against bushings nor pressed heavily against enclosures.

6. Cable-pulling lubricant shall be compatible with all cable jackets; shall not contain wax, grease, or silicone; and shall be Polywater "Type J".

7. Where necessary to prevent heavy loading on cable connections, in vertical risers, the cable shall be supported by Kellems, or equal, woven grips.

8. Spare cable ends shall be taped, coiled, and identified.

9. Cables shall not be bent to a radius less than the minimum recommended by the manufacturer. For cables rated higher than 600 volts, the minimum radius shall be 8 diameters for nonshielded cable and 12 diameters for shielded cable.

10. All cables in one conduit, over 1 foot long, or with any bends, shall be pulled in or out simultaneously.

11. Circuits to supply electric power and control to equipment and devices are indicated on the one-line diagrams. Conductors in designated numbers and sizes shall be installed in conduit of designated size. Circuits shall not be combined to reduce conduit requirements unless acceptable to Engineer.

12. Instrument cable shields and drain wires shall be continuous over the entire length of the circuit and grounded at one end only. In general, the field end of the shield shall be ungrounded. At the ungrounded termination of the circuit, the shield and drain wire shall be insulated by taping to prevent grounding.

3.3 RACEWAY INSTALLATION

A. Contractor shall be responsible for routing all raceway. This shall include all conduits indicated on the one-lines, riser diagrams, and home-runs shown on the plan Drawings. Conduits shall be routed as defined in these Specifications. Where conduit routing is shown on plans, it shall be considered a general guideline and shall be field verified to avoid interferences.

B. Except as otherwise specified or indicated on the Drawings, conduit installation and identification shall be completed according to the following procedures.

C. Installation of Interior and Exposed Exterior Conduit

1. This section covers the installation of conduit inside structures, above and below grade, and in exposed outdoor locations. In general, conduit inside structures shall be concealed. Large conduit and conduit stubs may be exposed unless otherwise specified or indicated on the Drawings. No conduit shall be exposed in water chambers unless so indicated on the Drawings.

2. Unless otherwise indicated on the Drawings, Contractor shall be responsible for routing the conduit to meet the following installation requirements:

   a. Conduit installed in all exposed indoor locations, except corrosive areas indicated on the Drawings, and in floor slabs, walls, and ceilings of hazardous (classified) locations, shall be rigid aluminum. Exposed conduit shall be rigidly supported by aluminum hardware and framing materials, including nuts and bolts.

   b. Conduit installed in floor slabs and walls in non-hazardous locations shall be rigid Schedule 40 PVC.

   c. Conduit installed in all exposed outdoor locations shall be rigid aluminum conduit, rigidly supported by aluminum framing materials. Mounting hardware, which includes nuts, bolts, and anchors, shall be aluminum.

   d. Final connections to dry type transformers, to motors without flexible cords, and to other equipment with rotating or moving parts shall be liquidtight flexible metal conduit with watertight connectors installed without sharp bends and in the minimum lengths required for the application, but not longer than 6 feet unless otherwise acceptable to Engineer.

   e. Not used.

   f. Exposed conduit shall be installed either parallel or perpendicular to structural members and surfaces.

   g. Two or more conduits in the same general routing shall be parallel, with symmetrical bends.

   h. Conduits shall be at least 6 inches from high temperature piping, ducts, and flues.

   i. Conduit installed in corrosive chemical feed and storage areas as indicated by Area Type on the Drawings shall be rigid Schedule 80 PVC. Exposed conduit in corrosive areas shall be supported by FRP framing materials with stainless steel hardware, including nuts and bolts.

   j. Rigid Schedule 40 and 80 PVC conduit shall have supports and provisions for expansion as required by NEC Article 352.

PART 2 - ABOVE SURFACE FACILITIES

k. Metallic conduit connections to sheet metal enclosures shall be securely fastened by locknuts inside and outside.

l. Rigid Schedule 40 and 80 PVC conduit shall be secured to sheet metal device boxes using a male terminal adapter with a locknut inside or by using a box adapter inserted through the knockout and cemented into a coupling.

m. Conduits in walls or slabs, which have reinforcement in both faces, shall be installed between the reinforcing steel. In slabs with only a single layer of reinforcing steel, conduits shall be placed under the reinforcement. Conduits larger than 1/3 of the slab thickness shall be concrete encased under the slab.

n. Conduits that cross structural joints where structural movement is allowed shall be fitted with concretetight and watertight expansion/deflection couplings, suitable for use with metallic conduits and rigid Schedule 40 or 80 PVC conduits. The couplings shall be Appleton Type DF, Crouse-Hinds Type XD, or O-Z Type DX.

o. Conduit shall be clear of structural openings and indicated future openings.

p. Conduits through roofs or metal walls shall be flashed and sealed watertight.

q. Conduit installed through any openings cut into non-fire rated concrete or masonry structure elements shall be neatly grouted. Conduit penetrations of fire rated structure elements shall be sealed in a manner that maintains the fire rating as indicated on the Architectural Drawings.

r. Conduits shall be capped during construction to prevent entrance of dirt, trash, and water.

s. Exposed conduit stubs for future use shall be terminated with galvanized pipe caps.

t. Concealed conduit for future use shall be terminated in equipment or fitted with couplings plugged flush with structural surfaces.

u. Where the Drawings indicate future duplication of equipment wired hereunder, concealed portions of conduits for future equipment shall be provided.

v. Horizontal conduit shall be installed to allow at least 7 feet of headroom, except along structures, piping, and equipment or in other areas where headroom cannot be maintained.

PART 2 - ABOVE SURFACE FACILITIES

w. Conduit shall not be routed across the surface of a floor, roof, or walkway unless approved by Engineer.

x. PVC-coated rigid steel conduit shall be threaded and installed as recommended by the conduit manufacturer's installation procedure using appropriate tools.

y. All conduits that enter enclosures shall be terminated with acceptable fittings that will not affect the NEMA rating of the enclosure.

z. Conduit which turns out of concrete slabs or walls, shall be connected to a 90 degree elbow of PVC-coated rigid steel conduit before it emerges. Conduits shall have PVC-coated rigid steel coupling embedded a minimum of 3 inches when emerging from slabs or walls and the coupling shall extend 2 inches from the wall.

aa. Not used.

ab. Power conductors to and from adjustable frequency drives shall be installed in steel conduit.

D. Underground Conduit Installation

1. All excavation, backfilling, and concrete work shall conform to the respective sections of these Specifications. Underground conduit shall conform to the following requirements:

a. All underground conduits shall be concrete encased unless indicated otherwise on the Drawings. Concrete encasement within 15 feet of building entrances, under and within 5 feet of roadways, and within 10 feet of indicated future excavations shall be reinforced as detailed on the Drawings.
b. Concrete encased conduit shall be schedule 40 PVC. Conduits shall have PVC-coated rigid steel coupling embedded a minimum of 3 inches when emerging from walls and the coupling shall extend 2 inches from the wall. All PVC joints shall be solvent welded in accordance with the recommendations of the manufacturer.
c. Concrete encasement on exposed outdoor conduit risers shall continue to 6 inches above grade, with top crowned and edges chamfered.
d. Conduit and concrete encasement installed underground for future extension shall be terminated flush at the bulkhead with a coupling and a screw plug. The termination of the duct bank shall be reinforced with bars 100 diameters long that shall be terminated 2 inches from the bulkhead. Matching splice bars shall be 50 bar diameters long. Each longitudinal bar shall be provided with a Lenton "Form Saver" coupler and plate or a Dayton "Superior DBR" coupler at the bulkhead. The coupler shall be threaded to accept a dowel of like diameter in the future. Threads shall be protected with screw-in plastic caps. A 1-3/4 by 3/4 inch deep horizontal shear key shall be formed in the concrete encasement above and below the embedded conduits. After concrete placement, conduit and bar connector ends shall be cleaned and coated with two coats of thixotropic coal tar.

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e. Underground conduits indicated not to be concrete encased shall be rigid Schedule 40 PVC.
f. Underground conduit bend radius shall be at least 2 feet at vertical risers and at least 3 feet elsewhere.
g. Underground conduits and conduit banks shall have at least 2 feet of earth cover, except where indicated otherwise.
h. Underground conduit banks through building walls shall be cast in place, or concreted into boxouts, with water stops on all sides of the boxout. Water stops are specified in the Cast-In-Place Concrete section.
i. Underground nonmetallic conduits, which turn out of concrete or earth in outdoor locations, shall be connected to 90 degree elbows of PVC-coated rigid steel conduit before they emerge.
j. Conduits not encased in concrete and passing through walls, which have one side in contact with earth, shall be sealed watertight with special rubber-gasketed sleeve and joint assemblies or with sleeves and modular rubber sealing elements.
k. Underground conduits shall be sloped to drain from buildings to manholes.
l. Each 5 kV or higher voltage cable, each 250 kcmil or larger cable, and each conduit group of smaller cables shall be supported from manhole walls by Kindorf "D-990" or Unistrut "P-3259" inserts, with Kindorf "F-721-24" or Unistrut "P-2544" brackets and Unistrut "P1753" or "P1754" fiberglass reinforced polyester cable saddles.
m. Telephone cables shall not be installed in raceways, conduits, boxes, manholes, or handholes containing other types of circuits.
n. Intercommunication and instrument cables shall be separated the maximum possible distance from all power wiring in pull-boxes, manholes, and handholes.

E. Sealing of Conduits

1. After cable has been installed and connected, conduit ends shall be sealed by forcing nonhardening sealing compound into the conduits to a depth at least equal to the conduit diameter. This method shall be used for sealing all conduits at handholes, manholes, and building entrance junction boxes, and for 1 inch and larger conduit connections to equipment.

2. Conduits entering chlorine feed and storage rooms shall be sealed in a junction box or conduit body adjacent to the point of entrance.

3. Conduits entering hazardous (classified) areas and submersible or explosion proof enclosures shall have Appleton "Type ESU" or Crouse-Hinds "EYS" sealing fittings with sealing compound.

F. Reuse of Existing Conduits

1. Existing conduits may be reused subject to the concurrence of Engineer and compliance with the following requirements:

a. A wire brush shall be pulled through the conduit to remove any loose debris.
b. A mandrel shall be pulled through the conduit to remove sharp edges and burrs.

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3.4 WIRING DEVICES, BOXES, AND FITTINGS INSTALLATION

A. Metallic and nonmetallic conduit boxes and fittings shall be installed in the following locations:

B. Conduit Boxes and Fittings

1. Galvanized or cadmium plated, threaded, malleable iron boxes and fittings shall be installed in concrete walls, ceilings, and floors; in the outdoor faces of masonry walls; and in all locations where weatherproof device covers are required. These boxes and fittings shall also be installed in exposed rigid steel and intermediate metal conduit systems.

2. Galvanized or cadmium plated sheet steel boxes shall be installed in the indoor faces of masonry walls, in interior partition walls, and in joist supported ceilings.

3. Rigid PVC device boxes shall be installed in exposed nonmetallic conduit systems.

4. PVC coated boxes and fittings shall be installed in PVC coated conduit systems.

5. Telephone conduit shall be provided with separate junction boxes and pull fittings.

C. Device Plates

1. Oversized plates shall be installed where standard-sized plates do not fully cover the wall opening.

D. Receptacles

1. Convenience outlets shall be 18 inches above the floor unless otherwise required.

2. After circuits are energized, each receptacle shall be tested for correct polarity and each GFCI receptacle shall be tested for proper operation.

3. Conduit and wire for convenience outlet installation is not shown on the Drawings and shall be sized, furnished, and installed by Contractor. Conductors shall be minimum 12 AWG and conduit shall be minimum 3/4 inch for convenience outlet installation.

3.5 EQUIPMENT INSTALLATION

A. Except as otherwise specified or indicated on the Drawings, the following procedures shall be used in performing electrical work.

B. Setting of Equipment

1. All equipment, boxes, and gutters shall be installed level and plumb. Boxes, equipment enclosures, metal raceways, and similar items mounted on water- or

earth-bearing walls shall be separated from the wall by at least 1/4 inch thick corrosion-resistant spacers. Where boxes, enclosures, and raceways are installed at locations where walls are not suitable or available for mounting, concrete equipment pads, framing material, and associated hardware shall be provided.

C. Sealing of Equipment

1. All outdoor equipment shall be permanently sealed at the base, and all openings into equipment shall be screened or sealed with concrete grout to keep out rodents and insects the size of wasps and mud daubers. Small cracks and openings shall be sealed from inside with silicone sealant, Dow-Corning "795" or General Electric "SCS1200".

3.6 GROUNDING

A. General

1. The electrical system and equipment shall be grounded in compliance with the National Electrical Code and the following requirements:
   a. All ground conductors shall be at least 12 AWG soft drawn copper cable or bar, bare or green-insulated in accordance with the National Electrical Code.
   b. Ground cable splices and joints, ground rod connections, and equipment bonding connections shall meet the requirements of IEEE 837, and shall be exothermic weld connections or irreversible high-compression connections, Cadweld "Exothermic" or Burndy "Hyground". Mechanical connectors will not be acceptable. Cable connections to bus bars shall be made with high-compression two-hole lugs.
   c. Ground cable through exterior building walls shall enter within 3 feet below finished grade and shall be provided with a water stop. Unless otherwise indicated, installation of the water stop shall include filling the space between the strands with solder and soldering a 12 inch copper disc over the cable. The copper disc shall be installed on the exterior of the wall and shall be a minimum thickness of 12 gauge and have a diameter that is a minimum of 2 inch larger than the diameter of the core hole that the ground cable passes through. The copper disc shall be soldered to the ground cable and caulk shall be applied around the outside edge of the copper disc where it adjoins the exterior wall. Caulk rated for submerged application shall comply with the Joint Sealants section.
   d. Ground cable near the base of a structure shall be installed in earth and as far from the structure as the excavation permits, but not closer than 24 inches . The tops of ground rods and ground cable interconnecting ground rods shall be buried a minimum of 30 inches below grade, or below the frost line, whichever is deeper.

e. All powered equipment, including lighting fixtures and receptacles, shall be grounded by a copper ground conductor in addition to the conduit connection.

f. Ground connections to equipment and ground buses shall be made with copper or high conductivity copper alloy ground lugs or clamps. Connections to enclosures not provided with ground buses or ground terminals shall be made with irreversible high-compression type lugs inserted under permanent assembly bolts or under new bolts drilled and inserted through enclosures, other than explosion proof enclosures, or by grounding locknuts or bushings. Ground cable connections to anchor bolts; against gaskets, paint, or varnish; or on bolts holding removable access covers will not be acceptable.

g. The grounding system shall be bonded to the station piping by connecting to the first flange inside the building, on either a suction or discharge pipe, with a copper bar or strap. The flange shall be drilled and tapped to provide a bolted connection.

h. Ground conductors shall be routed as directly as possible, avoiding unnecessary bends. Ground conductor installations for equipment ground connections to the grounding system shall have turns with minimum bend radii of 12 inches .

i. Ground rods not described elsewhere shall be a minimum of 3/4 inch in diameter by 10 feet long, with a copper jacket bonded to a steel core.

j. Test wells and covers for non-traffic areas shall be molded high density polyethylene. Test wells for traffic areas shall be precast concrete construction rated for traffic duty with concrete or cast iron covers.

B. Grounding System Resistance

1. The ground system resistance shall comply with National Electrical Code.

2. The grounding system design depicted on the Contract Drawings is the minimum design required for each building or structure. Each system shall comply with the maximum resistance of 25 ohms to ground. Contractor shall confirm the system grounding resistance with the results of the testing specified herein. Systems exceeding the maximum resistance specified shall be supplemented with additional grounding provisions and retested until the maximum specified resistance is achieved.

C. Grounding System Testing

1. The grounding system of each new structure and each existing building or structure indicated below, shall be tested to determine the resistance to earth. Testing shall be performed by an independent electrical or grounding system testing organization. Testing shall be completed after not less than three full days

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without precipitation and without any other moistening or chemical treatment of the soil.

2. Existing Grounding Systems

a. Grounding systems of each existing building or structure indicated shall be tested for resistance to earth.

Existing building(s) or structure(s) to be tested	*Existing Grounding system.*

b. Where existing grounding systems can be isolated from the building power service or utility power service a three-point fall of potential test shall be completed as indicated above. Where isolation of the building grounding system is not practical, a clamp-on resistance test will be an acceptable alternative. Clamp-on resistance testing shall be completed utilizing a ground resistance tester specifically designed for clamp on resistance testing, such as the AEMC "Model 3711". Clamp-on resistance measurements shall be taken at the service side of the service entrance neutral, upstream of the neutral to ground bonding connection to ensure a single path between the grounding system and the utility reference.

3.7 LIGHTING FIXTURE INSTALLATION

A. The Drawings indicate the general locations and arrangements of the lighting fixtures. Fixtures in rows shall be aligned both vertically and horizontally unless otherwise specified. Fixtures shall be clear of pipes, mechanical equipment, structural openings, indicated future equipment and structural openings, and other obstructions.

B. Conduit and wire for lighting fixture installation is not shown on the Drawings and shall be sized, furnished and installed by Contractor. Circuits to emergency lighting units, exit signs, and fixtures indicated to be night lights shall not be switched. Circuits to lighting fixtures indicated to have emergency battery packs shall include an additional un-switched hot conductor. Conductors shall be minimum 12 AWG and conduit shall be minimum 3/4 inch for lighting fixture installation.

3.8 MODIFICATIONS TO EXISTING EQUIPMENT

A. Modifications to existing equipment shall be completed as specified herein and indicated on the Drawings. All existing facilities shall be kept in service during construction. Temporary power or relocation of existing power and control wiring, equipment, and devices shall be provided as required during construction. Coordination and timing of outages shall be as specified in other sections of these Specifications. Electrical power interruptions will only be allowed where agreed upon in advance with Owner, and scheduling at times of low demand may be required.

B. Demolition

1. Unless otherwise specified or indicated on the Drawings, all cable and all exposed conduit for power and control signals of equipment indicated to be removed shall be demolished. Conduit supports and electrical equipment mounting hardware shall be removed, and holes or damage remaining shall be grouted or sealed flush. Conduit partially concealed shall be removed where exposed, and plugged with expanding grout flush with the floor or wall. Repairs shall be refinished to match the existing surrounding surfaces. Demolished equipment shall be discarded or salvaged as indicated on the Drawings and as specified in other sections of these Specifications.

End of Section

PART 2 - ABOVE SURFACE FACILITIES

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STANDARD SPECIFICATIONS

REFERENCE: UL 83, ICEA S-95-658 (NEMA WC70).

CONDUCTOR: Solid, uncoated copper. Maximum operating temperature 90°C dry, 75°C wet.

INSULATION: Polyvinyl chloride, UL 83, Type THHN and THWN, ICEA S-95-658.

SHIELD: None.

JACKET: Conductor: Nylon, 4 mils (100 µm) minimum thickness, UL 83.

FACTORY TESTS: Cable shall meet the requirements of UL 83 for Type THHN and THWN.

Cable Details

Size		Number of Strands	Conductor Insulation Thickness*		Maximum Outside Diameter	
AWG or kcmil	mm^2		in.	µm	in.	mm
12	4.0	1	0.015	380	0.17	4.32
10	6.0	1	0.020	510	0.20	5.08

*The average thickness shall be not less than that indicated above. The minimum thickness shall not be less than 90 percent of the values indicated above.

A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches (600 mm). Marking shall include manufacturer's name, THWN or THHN, conductor size, and 600 volt.

600 Volt, Single Conductor Lighting Cable (600-1-PVC-THHN-THWN)

BLACK & VEATCH	Cable Data	Figure 1-26 05 11

STANDARD SPECIFICATIONS

REFERENCE: ICEA S-95-658 (NEMA WC 70).

CONDUCTOR: Concentric-lay, uncoated copper; strand Class B. Wet/dry maximum operating temperature 90°C.

INSULATION: Cross-linked thermosetting polyethylene, ICEA S-95-658, Paragraph 3.6.

SHIELD: None.

JACKET: None.

FACTORY TESTS: Cable shall meet the requirements of ICEA S-95-658.

Cable Details

Size		Number of Strands	Conductor Insulation Thickness*		Maximum Outside Diameter	
AWG or kcmil	mm^2		in.	μm	in.	mm
14	2.5	7	0.030	760	0.17	4.32
12	4.0	7	0.030	760	0.19	4.83
10	6.0	7	0.030	760	0.21	5.33
8	10.0	7	0.045	1140	0.27	6.86
6	16.0	7	0.045	1140	0.31	7.87
4	25.0	7	0.045	1140	0.36	9.14
2	35.0	7	0.045	1140	0.42	10.67
1	40.0	19	0.055	1400	0.48	12.19
1/0	50.0	19	0.055	1400	0.52	13.21
2/0	70.0	19	0.055	1400	0.57	14.48
4/0	95.0	19	0.055	1400	0.68	17.27
250	120.0	37	0.065	1650	0.75	19.05
350	185.0	37	0.065	1650	0.85	21.59
500	300.0	37	0.065	1650	0.98	24.89
750	400.0	61	0.080	2030	1.22	31.00
1,000	500.0	61	0.080	2030	1.37	34.80

*The average thickness shall be not less than that indicated above. The minimum thickness shall be not less than 90 percent of the values indicated above.

A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches (600 mm). Marking shall include manufacturer's name, XLP, XHHW-2, conductor size, and voltage class.

600 Volt, Single Conductor Lighting/Power Cable (600-1-XLP-NONE-XHHW-2)

BLACK & VEATCH	Cable Data	Figure 2- 26 05 11

STANDARD SPECIFICATIONS

REFERENCE: UL 83, ICEA S-95-658 (NEMA WC 70).

CONDUCTOR: Stranded, uncoated copper. Maximum operating temperature 90°C dry, 75°C wet.

INSULATION: Polyvinyl chloride, UL 83, Type THHN and THWN, ICEA S-95-658.

SHIELD: None.

JACKET: Conductor: Nylon, 4 mils (100 μm) minimum thickness, UL 83.

FACTORY TESTS: Cable shall meet the requirements of UL 83 for Type THHN and THWN.

Cable Details

Size		Number of Strands	Conductor Insulation Thickness*		Maximum Outside Diameter	
AWG or kcmil	mm^2		in.	μm	in.	mm
14	2.5	19	0.015	381	0.12	3.05
12	4.0	19	0.015	381	0.14	3.56
10	6.0	19	0.020	508	0.17	4.32
8	10.0	19	0.030	762	0.23	5.84
6	16.0	19	0.030	762	0.26	6.60
4	25.0	19	0.040	1016	0.33	8.38
2	35.0	19	0.040	1016	0.39	9.91
1	40.0	19	0.050	1270	0.44	11.18
1/0	50.0	19	0.050	1270	0.50	12.70
2/0	70.0	19	0.050	1270	0.54	13.72
4/0	95.0	19	0.050	1270	0.66	16.76
250	120.0	37	0.060	1520	0.72	18.29
350	185.0	37	0.060	1520	0.83	21.08
500	300.0	37	0.060	1520	0.96	24.38
750	400.0	61	0.070	1780	1.17	29.72
1,000	500.0	61	0.070	1780	1.32	33.53

*The average thickness shall be not less than that indicated above. The minimum thickness shall be not less than 90 percent of the values indicated above.

A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches (600 mm). Marking shall include manufacturer's name, THWN or THHN, conductor size, and 600 volt.

600 Volt, Single Conductor Power Cable (600-1-PVC-THHN-THWN)

BLACK & VEATCH	Cable Data	Figure 3-26 0511

STANDARD SPECIFICATIONS

REFERENCE: UL 66, UL 1277.

CONDUCTOR: 16 AWG (1.5 mm^2), 7-strand, concentric-lay, uncoated copper. Maximum operating temperature 90°C dry, 75°C wet.

INSULATION: Polyvinyl chloride, not less than 15 mils (380 μm) average thickness; 13 mils (330 μm) minimum thickness, UL 66, Type TFN.

LAY: Twisted pair with 1-1/2 inch to 3 inch (38.10 mm - 63.5 mm) lay.

SHIELD: Cable assembly, combination aluminum-polyester tape and 7-strand, 20 AWG (0.5 mm^2) minimum size, tinned copper drain wire, shield applied to achieve 100 percent cover over insulated conductors.

JACKET: Conductor: Nylon, 4 mils (100 μm) minimum thickness, UL 66.

Cable assembly: Black, flame-retardant polyvinyl chloride, UL 1277, applied over tape-wrapped cable core.

CONDUCTOR IDENTIFICATION: One conductor black, one conductor white.

FACTORY TESTS: Insulated conductors shall meet the requirements of UL 66 for Type TFN. Assembly jacket shall meet the requirements of UL 1277. Cable shall meet the vertical-tray flame test requirements of UL 1277.

Cable Details

	Assembly Jacket Thickness*		Maximum Outside Diameter	
	in.	**μm**	**in.**	**mm**
Single Pair	0.045	1140	0.34	8.64

*The average thickness shall be not less than that indicated above. The minimum thickness shall be not less than 80 percent of the value indicated above.

A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches (600 mm). Marking shall include manufacturer's name, Type TC, Type TFN, conductor size, single pair, and voltage class.

600 Volt, Single Pair, Shielded Instrument Cable (600-SINGLE-PAIR-SH-INSTR)

BLACK & VEATCH	Cable Data	Figure 4-26 05 11

STANDARD SPECIFICATIONS

REFERENCE:	UL 66, UL 1277.
CONDUCTOR:	16 AWG (1.5 mm^2), 7-strand, concentric-lay, uncoated copper. Maximum operating temperature 90°C dry, 75°C wet.
INSULATION:	Polyvinyl chloride, not less than 15 mils (380 µm) average thickness; 13 mils (330 µm) minimum thickness, UL 66, Type TFN.
LAY:	Twisted triad with 1-1/2 inch to 3 inch (38.10 mm - 63.5 mm) lay.
SHIELD:	Cable assembly, combination aluminum-polyester tape and 7-strand, 20 AWG (0.5 mm^2) minimum size, tinned copper drain wire, shield applied to achieve 100 percent cover over insulated conductors.
JACKET:	Conductor: Nylon, 4 mils (100 µm) minimum thickness, UL 66. Cable assembly: Black, flame-retardant polyvinyl chloride, UL 1277, applied over tape-wrapped cable core.
CONDUCTOR IDENTIFICATION:	One conductor black, one conductor white, one conductor red.
FACTORY TESTS:	Insulated conductors shall meet the requirements of UL 66 for Type TFN. Assembly jacket shall meet the requirements of UL 1277. Cable shall meet the vertical-tray flame test requirements of UL 1277.

Cable Details

	Assembly Jacket Thickness*		Maximum Outside Diameter	
	in.	**µm**	**in.**	**mm**
Single Triad	0.045	1140	0.35	8.87

*The average thickness shall be not less than that indicated above. The minimum thickness shall be not less than 80 percent of the value indicated above.

A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches (600 mm). Marking shall include manufacturer's name, Type TC, Type TFN, conductor size, single triad, and voltage class.

600 Volt, Single Triad, Shielded Instrument Cable (600-SINGLE-TRIAD-SH-INSTR)

BLACK & VEATCH	**Cable Data**	**Figure 5-26 05 11**

STANDARD SPECIFICATIONS

REFERENCE: UL 66, UL 1277.

CONDUCTOR: 18 AWG (0.75 mm^2), 7-strand, concentric-lay, uncoated copper. Maximum operating temperature 90°C dry, 75°C wet.

INSULATION: Polyvinyl chloride, not less than 15 mils (380 μm) average thickness; 13 mils (330 μm) minimum thickness, UL 66, Type TFN.

LAY: Twisted pairs or triads with 1-1/2 inch to 3 inch (38.10 - 63.5 mm) lay.

SHIELD: Each pair or triad and cable assembly: Combination aluminum-polyester tape and 7-strand, 20 AWG (0.5 mm^2) minimum size, tinned copper drain wire, shield applied to achieve 100 percent cover over insulated conductors. Shield tape on pair and/or triad assemblies shall be applied in such a way as to give total shield isolation from all other pairs' or triads' shields.

JACKET: Conductor: Nylon, 4 mils (100 μm) minimum thickness, UL 66.

Cable Assembly: Black, 90°C, flame-retardant polyvinyl chloride, UL 1277, Table 10.17, applied over tape-wrapped cable core.

CONDUCTOR IDENTIFICATION:

Pair: One conductor black, one conductor white.

Triad: One conductor black, one conductor white, one conductor red.

PAIR Identification: Each pair and/or triad numbered.

FACTORY TESTS: Insulated conductors shall meet the requirements of UL 66 for Type TFN. Assembly jacket shall meet the requirements of UL 1277. Cable shall meet the vertical-tray flame test requirements of UL 1277.

Cable Details

	Assembly Jacket Thickness*		**Maximum Outside Diameter**	
	in.	**μm**	**in.**	**mm**
Number of Pairs				
4	0.045	1140	0.554	14.07
8	0.060	1520	0.749	19.02
12	0.060	1520	0.896	22.76
24	0.060	1520	1.256	31.90
Number of Triads				
4	0.060	1520	0.648	16.46
8	0.060	1520	0.823	20.99
12	0.080	2030	1.030	26.16
24	0.080	2030	1.393	35.38

*The average thickness shall be not less than that indicated above. The minimum thickness shall be not less than 80 percent of the values indicated above.

A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches (600 mm). Marking shall include manufacturer's name, Type TC, Type TFN, conductor size, number of pairs or triads, and voltage class.

600 Volt, Multiple Pair and/or Triad, Shielded Instrument Cable
(600-MULTI-PAIRS-TRIADS-SH-INSTR)

BLACK & VEATCH	**Cable Data**	**Figure 6-26 05 11**

STANDARD SPECIFICATIONS

REFERENCE: UL 83, UL 1277, ICEA S-73-532, ICEA S-58-679.

CONDUCTOR: 14 AWG (2.5 mm^2), 7 or 19 strands, concentric-lay, uncoated copper. Maximum operating temperature 90°C dry, 75°C wet.

INSULATION: Polyvinyl chloride, not less than 15 mils (380 μm) average thickness; 13 mils (330 μm) minimum thickness, UL 83, Type THHN and THWN.

SHIELD: None.

JACKET: Conductor: Nylon, 4 mils (100 μm) minimum thickness, UL 83.

Cable assembly: Black, flame-retardant polyvinyl chloride, UL 1277, applied over tape-wrapped cable core.

CONDUCTOR IDENTIFICATION: ICEA S-58-679, Method 1, Table 2 or ICEA S-58-679, Method 3, Table 2. White or green conductors shall not be provided.

FACTORY TESTS: Insulated conductors shall meet the requirements of UL 83 for Type THHN-THWN. Assembly jacket shall meet the requirements of UL 1277. Cable shall meet the flame test requirements of UL 1277 for Type TC power and control tray cable.

Cable Details

Number of Conductors	Assembly Jacket Thickness*		Maximum Outside Diameter	
	in.	μm	in.	mm
2	0.045	1140	0.38	9.65
3	0.045	1140	0.39	9.91
4	0.045	1140	0.44	11.18
5	0.045	1140	0.46	11.68
7	0.045	1140	0.49	12.45
9	0.045	1140	0.61	15.49
12	0.060	1520	0.66	16.76
19	0.060	1520	0.77	19.56
24	0.060	1520	0.93	23.62
30	0.080	2030	0.98	24.89
37	0.080	2030	1.05	26.67

*The average thickness shall be not less than that indicated above. The minimum thickness shall be not less than 80 percent of the values indicated above.

A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches (600 mm). Marking shall include manufacturer's name, Type TC, Type THWN or THHN, conductor size, number of conductors, and voltage class.

600 Volt, Multiconductor 14 AWG (2.5 mm^2) Control Cable (600-MULTI-THHN-THWN)

BLACK & VEATCH	Cable Data	Figure 7-26 05 11

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SECTION 26 05 19

ELECTRICAL EQUIPMENT INSTALLATION

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the installation of electrical equipment.

1.2 GENERAL

A. Equipment specified to be installed under this section shall be erected, and placed in proper operating condition in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

B. The electrical equipment identified as being provided by others will be furnished complete for installation by Contractor. Technical specifications under which the equipment will be purchased are available.

C. Coordination

1. When manufacturer's field services are provided by the equipment manufacturer, Contractor shall coordinate the services with the equipment manufacturer. Contractor shall give Engineer written notice at least 14 days prior to the need for manufacturer's field services furnished by others.

2. Submittals for equipment furnished under the original procurement contract will be furnished to Contractor upon completion of review by Engineer. Contractor shall review equipment submittals and coordinate with the requirements of the Work and the Contract Documents. Contractor accepts sole responsibility for determining and verifying all quantities, dimensions, and field construction criteria.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. When sills are required for electrical equipment, they shall be shipped ahead of the scheduled equipment delivery to permit installation before concrete is placed.

B. Storage

1. Upon delivery, all equipment and materials shall immediately be stored and protected by Contractor in accordance with Product Storage and Handling Requirements section, and in accordance with manufacturer's written instructions,

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until installed in the Work. Equipment shall be protected by Contractor against damage and exposure from the elements. At no time shall the equipment be stored on earth or grass surfaces or come into contact with earth or grass. Contractor shall keep the equipment clean and dry at all times. Openings shall be plugged or capped (or otherwise sealed by packaging) during temporary storage.

C. Handling

1. Electrical equipment shall be moved by lifting, jacking, or skidding on rollers as described in the manufacturer's instructions. Special lifting harness or apparatus shall be used when required. Lifting and jacking points shall be used when identified on the equipment. Contractor shall have required unloading equipment on site to perform unloading work on the date of equipment delivery.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 INSTALLATION, TESTING, AND COMMISSIONING

A. All installation work shall be in accordance with manufacturer's written instructions.

B. All material, equipment, and components specified to be installed according to this section shall be installed, tested, and commissioned for operation in compliance with NECA 1000 – NEIS Specification System. Where required in NECA 1000, testing and commissioning procedures shall be followed prior to energizing equipment.

C. Electrical equipment cubicles and vertical sections shall be installed plumb and level. Drawout equipment carriages, circuit breakers, and other removable components shall operate free and easy without binding or distortion.

D. Unless otherwise indicated or specified, all indoor floor-mounted electrical equipment and control cabinets shall be installed on concrete equipment pads four inches [102 mm] in height.

E. Indoor metalclad switchgear shall be bolted to steel floor channels which are installed level and flush with the top of the concrete floor or equipment pad.

F. Outdoor metalclad switchgear and interrupter gear with integral floor channels or beams shall be secured to concrete pads with anchor bolts and clips.

G. Motor control centers with integral floor sills shall be secured to concrete floors or equipment pads with anchor bolts.

H. Adequate bracing shall be provided for seismic forces. The bracing shall be designed to meet the requirements of the Meteorological and Seismic Design Criteria section.

I. Cleaning

1. All deposits of oil, grease, mud, dirt or debris shall be cleaned from the electrical equipment following installation and field wiring. A detergent water based solution, or other liquid cleaners not harmful to material or equipment finishes, shall be used as recommended by the manufacturer.

End of Section

PART 2 - ABOVE SURFACE FACILITIES

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SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for clearing of all areas within the Contract limits and other areas shown, including work designated in permits and other agreements, in accordance with the requirements of Division 1.

B. Related Work Specified in Other Sections Includes:

1. Section 02 40 00 - Demolition
2. Section 31 23 16 - Excavation - Earth and Rock
3. Section 31 23 23 - Backfilling
4. Section 32 92 00 – Lawn Restoration

1.2 DEFINITIONS

A. Clearing: Clearing is the removal from the ground surface and disposal, within the designated areas, of trees, brush, shrubs, down timber, decayed wood, other vegetation, rubbish and debris as well as the removal of fences.

B. Grubbing: Grubbing is the removal and disposal of all stumps, buried logs, roots larger than 1-1/2 inches, matted roots and organic materials.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 TREES AND SHRUBS TO BE SAVED

A. Protection: Protect trees and shrubs within the construction site that are so delineated or are marked in the field to be saved from defacement, injury and destruction.

1. Work within the limits of the tree drip line with extreme care using either hand tools or equipment that will not cause damage to trees.

a. Do not disturb or cut roots unnecessarily. Do not cut roots 1-1/2 inches and larger unless approved.

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b. Immediately backfill around tree roots after completion of construction in the vicinity of trees.

c. Do not operate any wheeled or tracked equipment within drip line.

2. Protect vegetation from damage caused by emissions from engine-powered equipment.

3. During working operations, protect the trunk, foliage and root system of all trees to be saved with boards or other guards placed as shown and as required to prevent damage, injury and defacement.

a. Do not pile excavated materials within the drip line or adjacent to the trunk of trees.

b. Do not allow runoff to accumulate around trunk of trees.

c. Do not fasten or attach ropes, cables, or guy wires to trees without permission. When such permission is granted, protect the tree before making fastening or attachments by providing burlap wrapping and softwood cleats.

d. The use of axes or climbing spurs for trimming will not be permitted.

e. Provide climbing ropes during trimming.

4. Remove shrubs to be saved, taking a sufficient earth ball with the roots to maintain the shrub.

a. Temporarily replant if required, and replace at the completion of construction in a condition equaling that which existed prior to removal.

b. Replace in kind if the transplant fails.

5. Have any tree and shrub repair performed by a tree surgeon properly licensed by the State of Florida and within 24 hours after damage occurred.

3.2 CLEARING AND GRUBBING

A. Clearing: Clear all items specified to the limits shown and remove cleared and grubbed materials from the site.

1. Do not start earthwork operations in areas where clearing and grubbing is not complete, except that stumps and large roots may be removed concurrent with excavation.

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2. Comply with erosion, sediment control and storm management measures as specified in Division 1.

B. Grubbing: Clear and grub areas to be excavated, areas receiving less than 3 feet of fill and areas upon which structures are to be constructed.

1. Remove stumps and root mats in these areas to a depth of not less than 18 inches below the subgrade of sloped surfaces.

2. Fill all depressions made by the removal of stumps or roots with material suitable for backfill as specified in Section 31 23 23.

C. Limited Clearing: Clear areas receiving more than 3 feet of fill by cutting trees and shrubs as close as practical to the existing ground. Grubbing will not be required.

D. Dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris away to an approved dump. The cost of disposal (including hauling) of cleared and grubbed material and debris shall be considered a subsidiary obligation of the Contractor; the cost of which shall be included in the prices bid for the various classes of work.

3.3 TOPSOIL

A. Stripping: Strip existing topsoil from areas that will be excavated or graded prior to commencement of excavating or grading and place in well-drained stockpiles in approved locations.

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

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SECTION 31 23 16

EXCAVATION - EARTH AND ROCK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for performing opencut excavations to the widths and depths necessary for constructing structures, pipelines and conduits including excavation of any material necessary for any purpose pertinent to the construction of the Work.

B. Related Work Specified In Other Sections Includes:

1. Section 31 10 00 - Site Clearing
2. Section 31 40 00 - Shoring, Sheeting and Bracing
3. Section 31 23 23 - Backfilling
4. Section 03 30 53 – Miscellaneous Cast-in-Place Concrete

1.2 DEFINITIONS

A. Earth: "Earth" includes all materials which, in the opinion of the ENGINEER, do not require blasting, barring, wedging or special impact tools for their removal from their original beds, and removal of which can be completed using standard excavating equipment. Specifically excluded are all ledge and bedrock and boulders or pieces of masonry larger than one cubic yard in volume.

B. Rock: "Rock" includes all materials which, in the opinion of the ENGINEER, require blasting, barring, wedging and/or special impact tools such as jack hammers, sledges, chisels, or similar devices specifically designed for use in cutting or breaking rock for removal from their original beds and which have compressive strengths in their natural undisturbed state in excess of 300 psi. Boulders or masonry larger than one cubic yard in volume are classed as rock excavation.

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Dewatering Excavation Plan: Develop an excavation dewatering plan that considers site ground and groundwater conditions, the type and arrangement of the equipment to be used and the proper method of groundwater disposal. Prepare the dewatering plan before beginning excavations below groundwater. Maintain one copy of the dewatering plan at the project site to be available for inspection while all dewatering operations are underway.

PART 2 - ABOVE SURFACE FACILITIES

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 GENERAL

A. Clearing: Clear opencut excavation sites of obstructions preparatory to excavation. Clearing in accordance with Section 31 10 00, includes removal and disposal of vegetation, trees, stumps, roots and bushes, except those specified to be protected during trench excavation.

B. Banks: Shore or slope banks to the angle of repose to prevent slides or cave-ins in accordance with Section 31 40 00.

C. Safety: Whenever an excavation site or trench is left unattended by the CONTRACTOR or when an area is not within 100 feet of observation by the CONTRACTOR, the excavation site or trench shall be filled and/or, at the OWNER's discretion, protected by other means to prevent accidental or unauthorized entry. Such protection shall include barricades and other protection devices requested by the ENGINEER or OWNER, including temporary fencing, snow fencing, or temporary "structure" tape. Such safety items shall not relieve the CONTRACTOR of any site safety requirements or liabilities established by Federal, State and local laws and agencies, including OSHA, but is intended as additional safety measures to protect the general public.

D. Hazardous Materials: If encountered, take care of hazardous materials not specifically shown or noted in accordance with Section 01 57 00.

E. During excavation and any site work, storm water pollution prevention measures shall be taken to ensure that water quality criteria are not violated in the receiving water body and all state and local regulatory requirements are met.

3.2 STRUCTURE EXCAVATION

A. Excavation Size: Provide excavations of sufficient size and only of sufficient size to permit the Work to be economically and properly constructed in the manner and of the size specified.

B. Excavation Shape: Shape and dimension the bottom of the excavation in earth or rock to the shape and dimensions of the underside of the structure or drainage blanket wherever the nature of the excavated material permits.

C. Compaction: Before placing foundation slabs, footings or backfill, proof roll the bottom of the excavations to detect soft spots.

PART 2 - ABOVE SURFACE FACILITIES

1. For accessible areas, proof roll with a ten wheel tandem axle dump truck loaded to at least 15 tons or similarly loaded construction equipment.

2. For small areas, proof roll with a smooth-faced steel roller filled with water or sand, or compact with a mechanical tamper.

3. Make one complete coverage, with overlap, of the area.

4. Overexcavate soft zones and replace with compacted select fill in accordance with Part 3, Section 3.9.

3.3 TRENCH EXCAVATION

A. Preparation: Properly brace and protect trees, shrubs, poles and other structures which are to be preserved. Unless shown or specified otherwise, preserve all trees and large shrubs. Hold damage to the root structure to a minimum. Small shrubs may be preserved or replaced with equivalent specimens.

B. Adequate Space: Keep the width of trenches to a minimum, however provide adequate space for workers to place, joint and backfill the pipe properly.

1. The minimum width of the trench shall be equal to the outside diameter of the pipe at the joint plus 8-inches for unsheeted trench or 12 inches for sheeted trench.

The maximum width of trench, measured at the top of the pipe, shall not exceed the outside pipe diameter plus 2 feet, unless otherwise shown on the drawing details or approved by the ENGINEER. Trench walls shall be maintained vertical from the bottom of the trench to a line measured one foot above the top of the pipe. From one foot above the top of the pipe to the surface the trench walls shall conform with OSHA Regulations.

2. In sheeted trenches, measure the clear width of the trench at the level of the top of the pipe to the inside of the sheeting.

3. Should the maximum trench widths specified above be exceeded without written approval, provide concrete cradle or encasement for the pipe as directed. No separate payment will be made for such concrete cradle or encasement.

C. Depth:

1. Excavate trenches to a minimum depth of 8 inches below the bottom of the pipe or the bottom of encasement for electrical ducts, unless otherwise shown, specified or directed, so that bedding material can be placed in the bottom of the trench and shaped to provide a continuous, firm bearing for duct encasement, pipe barrels and bells.

2. Standard trench grade shall be defined as the bottom surface of the utility to be constructed or placed within the trench. Trench grade for utilities in rock or

PART 2 - ABOVE SURFACE FACILITIES

other non-cushioning material shall be defined as additional undercuts backfilled with #57 stone compacted in 6-inch lifts, below the standard 8-inches minimum trench undercut. Excavation below trench grade that is not ordered in writing by the ENGINEER shall be backfilled to trench grade and compacted.

D. Unstable or Unsuitable Materials: If unstable or unsuitable material is exposed at the level of the bottom of the trench excavation, excavate the material in accordance with the subsection headed "Authorized Additional Excavation".

1. Material shall be removed for the full width of the trench and to the depth required to reach suitable foundation material.

2. When in the judgment of the ENGINEER the unstable or unsuitable material extends to an excessive depth, the ENGINEER may advise, in writing, the need for stabilization of the trench bottom with additional select fill material, crushed stone, washed shell, gravel mat or the need to provide firm support for the pipe or electrical duct by other suitable methods.

3. Crushed stone, washed shell and gravel shall be as specified in Section 31 23 23.

4. Payment for such trench stabilization will be made under the appropriate Contract Items or where no such items exist, as a change in the Work.

E. Length of Excavation: Keep the open excavated trench preceding the pipe or electrical duct laying operation and the unfilled trench, with pipe or duct in place, to a minimum length which causes the least disturbance. Provide ladders for a means of exit from the trench as required by applicable safety and health regulations.

F. Excavated Material: Excavated material to be used for backfill shall be neatly deposited at the sides of the trenches where space is available. Where stockpiling of excavated material is required, the Contractor shall be responsible for obtaining the sites to be used and shall maintain his operations to provide for natural drainage and not present an unsightly appearance.

G. Water: Allow no water to rise in the trench excavation until sufficient backfill has been placed to prevent pipe or duct flotation.

3.4 SHORT TUNNEL EXCAVATION

A. Short Tunnel Requirements: In some instances, trees, shrubs, utilities, sidewalks and other obstructions may be encountered, the proximity of which may be a hindrance to opencut trench excavation. In such cases, excavate by means of short tunnels in order to protect such obstructions against damage.

1. Construct the short tunnel by hand, auger or other approved method approximately 6 inches larger than the diameter of pipe bells or outer electrical duct encasement.

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2. Consider such short tunnel work incidental to the construction of pipelines or conduits and all appurtenances. The need for short tunnels will not be grounds for additional payment.

3.5 ROCK EXCAVATION

A. Rock Excavation: Excavate rock within the boundary lines and grades as shown, specified or required.

1. Rock removed from the excavation becomes the property of the CONTRACTOR. Transport and dispose of excavated rock at an off site disposal location. Obtain the off site disposal location.

2. Remove all shattered rock and loose pieces.

B. Structure Depths: For cast-in-place structures, excavate the rock only to the bottom of the structure, foundation slab, or drainage blanket.

C. Trench Width: Maintain a minimum clear width of the trench at the level of the top of the pipe of the outside diameter of the pipe barrel plus 4 feet, unless otherwise approved.

D. Trench Depth: For trench excavation in which pipelines or electrical ducts are to be placed, excavate the rock to a minimum depth of 8 inches below the bottom of the pipe or duct encasement. Provide a cushion of sand or suitable crushed rock. Refill the excavated space with pipe bedding material in accordance with Section 31 23 23. Include placing, compacting and shaping pipe bedding material in the appropriate Contract Items.

E. Manhole Depths: For manhole excavation, excavate the rock to a minimum depth of 8 inches below the bottom of the manhole base for pipelines 24 inches in diameter and larger and 6 inches below the bottom manhole base for pipelines less than 24 inches in diameter. Refill the excavated space with pipe bedding material in accordance with Section 31 23 23. Include placing, compacting and shaping pipe bedding material for manhole bases in the appropriate Contract Items.

F. Over-excavated Space: Refill the excavated space in rock below structures, pipelines, conduits and manholes, which exceeds the specified depths with 2,500 psi concrete, crushed stone, washed shell, or other material as directed. Include refilling of over-excavated space in rock as part of the rock excavation.

G. Other Requirements: Follow, where applicable, the requirements of the subsections on "Trench Excavation" and "Structure Excavation".

H. Payment: Rock excavation, including placing, compacting and shaping of the select fill material, will be paid for under the appropriate Contract Items or where no such items exist, as a change in the Work.

I. Blasting is not permitted for this project.

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3.6 FINISHED EXCAVATION

A. Finish: Provide a reasonably smooth finished surface for all excavations, which is uniformly compacted and free from irregular surface changes.

B. Finish Methods: Provide a degree of finish which is ordinarily obtainable from blade-grade operations, except as otherwise specified in Section 31 23 23.

3.7 PROTECTION

A. Traffic and Erosion: Protect newly graded areas from traffic and from erosion.

B. Repair: Repair any settlement or washing away that may occur from any cause, prior to acceptance. Re-establish grades to the required elevations and slopes.

C. It shall be the CONTRACTOR's responsibility to acquaint himself with all existing conditions and to locate all structures and utilities along the proposed utility alignment in order to avoid conflicts. Where actual conflicts are unavoidable, work shall be coordinated with the facility owner and performed so as to cause as little interference as possible with the service rendered by the facility disturbed. Facilities or structures damaged in the prosecution of the work shall be repaired and/or replaced immediately, in conformance with current standard practices of the industry, or according to the direction of the owner of such facility, at the CONTRACTOR's expense.

D. Other Requirements: Conduct all Work in accordance with the environmental protection requirements specified in Division 1.

3.8 AUTHORIZED ADDITIONAL EXCAVATION

A. Additional Excavation: Carry the excavation to such additional depth and width as authorized in writing, for the following reasons:

1. In case the materials encountered at the elevations shown are not suitable.

2. In case it is found desirable or necessary to go to an additional depth, or to an additional depth and width.

B. Refill Materials: Refill such excavated space with either authorized 2500 psi concrete or compacted select fill material, in compliance with the applicable provisions of Section 31 23 23.

C. Compaction: Where necessary, compact fill materials to avoid future settlement. As a minimum, unless otherwise specified or directed, backfill layers shall not exceed 6-inches in thickness for the full trench width and compaction shall equal 95% of maximum density, or 98% if under paved area of roadway, as determined by using ASTM D 1557. Compaction density tests shall be made at all such backfill areas with spacing not to exceed 100 feet apart and on each 6-inch compacted layer.

D. Payment: Additional earth excavations so authorized and concrete or select fill

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materials authorized for filling such additional excavation and compaction of select fill materials will be paid for under the appropriate Contract Items or where no such items exist, as a change in the Work.

3.9 UNAUTHORIZED EXCAVATION

A. Stability: Refill any excavation carried beyond or below the lines and grades shown, except as specified in the subsection headed "Authorized Additional Excavation", with such material and in such manner as may be approved in order to provide for the stability of the various structures.

B. Refill Materials: Refill spaces beneath all manholes, structures, pipelines, or conduits excavated without authority with 2500 psi concrete or compacted select fill material, as approved.

C. Payment: Refill for unauthorized excavation will not be measured and no payment will be made therefor.

3.10 SEGREGATION STORAGE AND DISPOSAL OF MATERIAL

A. Stockpiling Suitable Materials: Stockpile topsoil suitable for final grading and landscaping and excavated material suitable for backfilling or embankments separately on the site in approved locations.

B. Stockpile Locations: Store excavated and other material a sufficient distance away from the edge of any excavation to prevent its falling or sliding back into the excavation and to prevent collapse of the wall of the excavation. Provide not less than 2 feet clear space between the top of any stockpile and other material and the edge of any excavation.

C. Excess Materials: CONTRACTOR shall be responsible to transport and dispose of surplus excavated material and excavated material unsuitable for backfilling or embankments at an off site disposal location secured by the CONTRACTOR.

3.11 REMOVAL OF WATER

A. Water Removal: At all times during the excavation period and until completion and acceptance of the WORK at final inspection, provide ample means and equipment with which to remove promptly and dispose of properly all water entering any excavation or other parts of the WORK. Removal of water from the site may be limited during portions of the year depending on wet or dry season. Contractor shall coordinate with OWNER and ENGINEER on discharge locations.

B. Dry Excavations: Keep the excavation dry.

C. Water Contact: Allow no water to rise over or come in contact with masonry and concrete until the concrete and mortar have attained a set and, in any event, not sooner than 12 hours after placing the masonry or concrete.

D. Discharge of Water: Dispose of water pumped or drained from the Work in a safe and

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suitable manner without damage to adjacent property or streets or to other work under construction. Contractor shall coordinate with OWNER and ENGINEER on discharge locations.

E. Protection: Provide adequate protection for water discharged onto streets. Protect the street surface at the point of discharge.

F. Sanitary Sewers: Discharge no water into sanitary sewers.

G. Storm Sewers: Discharge no water containing settleable solids into storm sewers.

H. Repair: Promptly repair any and all damage caused by dewatering the Work.

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

SECTION 31 23 23

BACKFILLING

PART 1 GENERAL

1.1 SUMMARY

A. General Requirements: Backfill all excavation to the original surface of the ground or to such other grades as may be shown or required. For areas to be covered by topsoil, leave or stop backfill (12) inches below the finished grade or as shown. Obtain approval for the time elapsing before backfilling against masonry structures. Remove from all backfill, any compressible, putrescible, or destructible rubbish and refuse and all lumber and braces from the excavated space before backfilling is started. Leave sheeting and bracing in place or remove as the work progresses.

B. Equipment Limitations: Do not permit construction equipment used to backfill to travel against and over cast-in-place concrete structures until the specified concrete strength has been obtained, as verified by concrete test cylinders. In special cases where conditions warrant, the above restriction may be modified providing the concrete has gained sufficient strength, as determined from test cylinders, to satisfy design requirements for the removal of forms and the application of load.

C. Related Work Specified in Other Sections Includes:

1. Section 31 10 00 - Site Clearing
2. Section 31 23 16 - Excavation – Earth and Rock

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM D 1557 - Standard Test Methods for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures Using 10 lb Rammer and 18 in Drop

PART 2 PRODUCTS

2.1 BACKFILL MATERIAL - GENERAL

A. General: Backfill with sound materials, free from waste, organic matter, rubbish, boggy or other unsuitable materials.

B. General Materials Requirements: Conform materials used for backfilling to the requirements specified. Follow common fill requirements whenever drainage or

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select fill is not specified. Determine and obtain the approval of the appropriate test method where more than one compaction test method is specified.

C. Frozen Materials: Do not use frozen material for backfilling.

2.2 DRAINAGE FILL

A. Materials for Drainage Fill: Use clean gravel, crushed stone, or other suitable material conforming to the gradation specified for drainage fill. Clay and fine particles are unacceptable in drainage fill. Provide drainage fill of a grade between the following limits:

U.S. Standard Sieve	Percent Passing By Weight
1-1/2 inch	100
1 inch	95-100
1/2 inch	45-65
#4	5-15
#16	0-4

2.3 SELECT FILL

A. Materials for Select Fill: Use clean gravel, crushed stone, washed shell, or other granular or similar material as approved which can be readily and thoroughly compacted to 95 percent of the maximum dry density obtainable by ASTM D 1557.

1. Allowed Materials: Grade select fill between the following limits:

U.S. Standard Sieve	Percent Passing By Weight
2 inch	100
1-1/2 inch	90-100
1 inch	75-95
1/2 inch	45-70
#4	25-50
#10	15-40
#200	5-15

2. Unallowed Materials: Very fine sand, uniformly graded sands and gravels, sand and silt, soft earth, or other materials that have a tendency to flow under pressure when wet are unacceptable as select fill.

2.4 COMMON FILL

A. Materials for Common Fill: Material from on-site excavation may be used as common fill provided that it can be readily compacted to 90 percent of the maximum dry density obtainable by ASTM D 1557, and does not contain unsuitable material. Select fill may be used as common fill at no change in the Contract Price.

B. Granular Materials On-Site: Granular on-site material, which is fairly well graded between the following limits may be used as granular common fill:

U.S. Standard Sieve	Percent Passing by Weight
3 inch	100
#10	50-100
#60	20-90
#200	0-20

A. Cohesive Materials On-Site: Cohesive site material may be used as common fill.

1. The gradation requirements do not apply to cohesive common fill.

2. Use material having a liquid limit less than or equal to 40 and a plasticity index less than or equal to 20.

B. Material Approval: All material used as common fill is subject to approval. If there is insufficient on-site material, import whatever additional off-site material is required which conforms to the specifications and at no additional cost.

2.5 UTILITY PIPE BEDDING

A. Initial Bedding: Use #57 stone located 8-inches under pipe and to springline of pipe as shown on the drawings.

B. Final Bedding: Use select fill in 6-inch lifts from springline to backfill zone as shown on the drawings.

C. Backfill Zone: Use select fill in 6-inch lifts from final bedding to ground surface as shown on the drawings.

PART 2 - ABOVE SURFACE FACILITIES

PART 3 EXECUTION

3.1 ELECTRICAL DUCT AND PRECAST MANHOLE BEDDING

A. Bedding Compaction: Bed all electrical ducts and precast manholes in well graded, compacted, select fill conforming to the requirements except as otherwise shown, specified, or required. Extend electrical duct bedding a minimum of 6 inches below the bottom of the duct encasement for the full trench width. Compact bedding thickness no less than 6 inches for precast concrete manhole bases.

B. Concrete Work Mats: Cast cast-in-place manhole bases and other foundations for structures against a 2500 psi concrete work mat in clean and dry excavations, unless otherwise shown, specified or required.

C. Bedding Placement: Place select fill used for bedding beneath electrical ducts and precast manhole bases, in uniform layers not greater than 9 inches in loose thickness. Thoroughly compact in place with suitable mechanical or pneumatic tools to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.

D. Use of Select Fill: Bed existing underground structures, tunnels, conduits and pipes crossing the excavation with compacted select fill material. Place bedding material under and around each existing underground structure, tunnel, conduit or pipe and extend underneath and on each side to a distance equal to the depth of the trench below the structure, tunnel, conduit or pipe.

3.2 PIPE BEDDING AND INITIAL BACKFILL

A. Hand Placement: Place select fill by hand for initial pipe backfill from top of bedding to 1 foot over top of pipes in uniform layers not greater than 6 inches in loose thickness. Tamp under pipe haunches and thoroughly compact in place the select fill with suitable mechanical or pneumatic tools to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.

B. Stone Placement: Do not place large stone fragments in the pipe bedding or backfill to 1 foot over the top of pipes, nor nearer than 2 feet at any point from any pipe, conduit or concrete wall.

C. Unallowed Materials: Pipe bedding containing very fine sand, uniformly graded sands and gravels, sand and silt, soft earth, or other materials that have a tendency to flow under pressure when wet is unacceptable.

3.3 BEDDING PLACEMENT AND BACKFILL FOR PIPE IN SHORT TUNNEL

A. Bed pipelines or electrical ducts placed in short tunnels in select fill or 2500 psi concrete. Completely fill the remainder of the annular space between the outside of the pipe wall and the tunnel wall with select fill, suitable job-excavated material, or 2500 psi concrete, as approved. Suitably support pipelines or ducts in short tunnels to permit placing of backfill suitably tamped in place.

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3.4 TRENCH BACKFILL

A. General: Backfill material shall be clean earth fill composed of sand, clay and sand, sand and stone, crushed stone, or an approved combination thereof. Backfilling shall be accomplished under two specified requirements: First Lift, from trench grade to a point 12 inches above the top of the utility, and, Second Lift, from the top of the First Lift to the ground surface. Where thrust blocks, encasements, or other below-grade concrete work have been installed, backfilling shall not proceed until the concrete has obtained sufficient strength to support the backfill load.

B. First Lift: Fine material shall be carefully placed and tamped around the lower half of the utility. Backfilling shall be carefully continued in compacted and tested layers not exceeding 6 inches in thickness for the full trench width, until the fill is 12 inches above the top of the utility, using the best available material from the excavation, if approved. The material for these first layers of backfill shall be lowered to within 2 feet above the top of pipes before it is allowed to fall, unless the material is placed with approved devices that protect the pipes from impact. The "First Lift" shall be thoroughly compacted and tested before the "Second Lift" is placed. Unless otherwise specified, compaction shall equal 98% of maximum density, as determined by ASTM D 1557. The "First Lift" backfill shall exclude stones, or rock fragments larger than the following:

Pipe Type	(Greatest Dimension-Inches) Fragment Size (Inches)
Steel	2
Concrete	2
Ductile Iron	2
Plastic	1
Fiberglass	1

C. Second Lift: The remainder of the trench, above the "First Lift", shall be backfilled and tested in layers not exceeding 6 inches. The maximum dimension of a stone, rock, or pavement fragment shall be 6 inches. When trenches are cut in pavements or areas to be paved, compaction, as determined by ASTM D 1557, shall be equal to 98% of maximum density, with compaction in other areas not less than 95% of maximum density in unpaved portions of the Rights-of-Way or 90% of maximum density in other areas.

As an alternative, or if required under roadways, Flowable Fill may be substituted. If Flowable Fill is to be used, a fabric mesh shall be installed between the “first lift” and the Flowable Fill. Flowable Fill shall be in accordance with Section 4.7.AH of the Lee County Utilities Operations Manual.

D. Compaction Methods: The above specified compaction shall be accomplished using accepted standard methods (powered tampers, vibrators, etc.), with exception that the first two feet of backfilling over the pipe shall be compacted by hand-operated tamping devices. Flooding or puddling with water to consolidate backfill is not

PART 2 - ABOVE SURFACE FACILITIES

acceptable, except where sand is the only material utilized and encountered and the operation has been approved by the OWNER.

E. Density Tests: Density tests for determination of the above specified compaction shall be made by an independent testing laboratory and certified by a Florida Registered, Professional ENGINEER at the expense of the Developer or CONTRACTOR. Test locations will be determined by the OWNER but in any case, shall be spaced not more than 100 feet apart where the trench cut is continuous. If any test results are unsatisfactory, the CONTRACTOR shall re-excavate and re-compact the backfill at his expense until the desired compaction is obtained. Additional compaction tests shall be made to each site of an unsatisfactory test, as directed, to determine the extent of re-excavation and re-compaction if necessary.

Copies of all density test results shall be furnished on a regular basis by the ENGINEER, to Lee County Utilities. Failure to furnish these results will result in the project not being recommended for acceptance by Lee County

F. Dropping of Material on Work: Do trench backfilling work in such a way as to prevent dropping material directly on top of any conduit or pipe through any great vertical distance. Do not allow backfilling material from a bucket to fall directly on a structure or pipe and, in all cases, lower the bucket so that the shock of falling earth will not cause damage.

G. Distribution of Large Materials: Break lumps up and distribute any stones, pieces of crushed rock or lumps which cannot be readily broken up, throughout the mass so that all interstices are solidly filled with fine material.

3.5 STRUCTURE BACKFILL

A. Use of Select Fill: Use select fill underneath all structures, and adjacent to structures where pipes, connections, electrical ducts and structural foundations are to be located within this fill. Use select fill beneath all pavements, walkways, and railroad tracks, and extend to the bottom of pavement base course or ballast.

1. Place backfill in uniform layers not greater than 8 inches in loose thickness and thoroughly compact in place with suitable approved mechanical or pneumatic equipment.

2. Compact backfill to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.

B. Use of Common Fill: Use common granular fill adjacent to structures in all areas not specified above, unless otherwise shown or specified. Select fill may be used in place of common granular fill at no additional cost.

1. Extend such backfill from the bottom of the excavation or top of bedding to the bottom of subgrade for lawns or lawn replacement, the top of previously existing ground surface or to such other grades as may be shown or required.

PART 2 - ABOVE SURFACE FACILITIES

2. Place backfill in uniform layers not greater than 8 inches in loose thickness and thoroughly compact in place with suitable equipment, as specified above.

3. Compact backfill to not less than 90 percent of the maximum dry density as determined by ASTM D 1557.

C. Use of Clay: In unpaved areas adjacent to structures for the top 1 foot of fill directly under lawn subgrades use clay backfill placed in 6-inch lifts. Compact clay backfill to not less than 90 percent of the maximum dry density as determined by ASTM D 1557.

1. Use clay having a liquid limit less than or equal to 40 and a plasticity index less than or equal to 20.

3.6 COMPACTION EQUIPMENT

A. Equipment and Methods: Carry out all compaction with suitable approved equipment and methods.

1. Compact clay and other cohesive material with sheep's-foot rollers or similar equipment where practicable. Use hand held pneumatic tampers elsewhere for compaction of cohesive fill material.

2. Compact low cohesive soils with pneumatic-tire rollers or large vibratory equipment where practicable. Use small vibratory equipment elsewhere for compaction of cohesionless fill material.

3. Do not use heavy compaction equipment over pipelines or other structures, unless the depth of fill is sufficient to adequately distribute the load.

3.7 BORROW

A. Should there be insufficient material from the excavations to meet the requirements for fill material, borrow shall be obtained from pits secured and tested by the CONTRACTOR and approved by the OWNER. Copies of all test results shall be submitted to Lee County Utilities.

3.8 FINISH GRADING

A. Final Contours: Perform finish grading in accordance with the completed contour elevations and grades shown and blend into conformation with remaining natural ground surfaces.

1. Leave all finished grading surfaces smooth and firm to drain.

2. Bring finish grades to elevations within plus or minus 0.10 foot of elevations or contours shown.

PART 2 - ABOVE SURFACE FACILITIES

B. Surface Drainage: Perform grading outside of building or structure lines in a manner to prevent accumulation of water within the area. Where necessary or where shown, extend finish grading to ensure that water will be carried to drainage ditches, and the site area left smooth and free from depressions holding water.

3.9 RESPONSIBILITY FOR AFTERSETTLEMENT

A. Aftersettlement Responsibility: Take responsibility for correcting any depression which may develop in backfilled areas from settlement within one year after the work is fully completed. Provide as needed, backfill material, pavement base replacement, permanent pavement, sidewalk, curb and driveway repair or replacement, and lawn replacement, and perform the necessary reconditioning and restoration work to bring such depressed areas to proper grade as approved.

3.10 INSPECTION AND TESTING OF BACKFILLING

A. Sampling and Testing: Provide sampling, testing, and laboratory methods in accordance with the appropriate ASTM Standard Specification. Subject all backfill to these tests.

B. Compaction density tests shall be made at all such backfill areas with spacing not to exceed 100 feet apart and on each 6-inch compacted layer.

C. Correction of Work: Correct any areas of unsatisfactory compaction by removal and replacement, or by scarifying, aerating or sprinkling as needed and recompaction in place prior to placement of a new lift.

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

SECTION 31 40 00

SHORING, SHEETING AND BRACING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Work required for protection of an excavation or structure through shoring, sheeting, and bracing.

B. Related Work Specified in Other Sections Includes:

1. Section 31 23 16 - Excavation - Earth and Rock
2. Section 31 23 23 - Backfilling

1.2 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. CONTRACTOR's Submittals: All sheeting and bracing shall be the responsibility of the CONTRACTOR to retain qualified design services for these systems, and to be completed with strict adherence to OSHA Regulations. Submit complete design calculations and working drawings of proposed shoring, sheeting and bracing which have been prepared, signed and sealed by a Licensed Professional Engineer experienced in Structural Engineering and registered in the State of Florida, before starting excavation for jacking pits and structures. Use the soil pressure diagram shown for shoring, sheeting and bracing design. ENGINEER's review of calculations and working drawings will be limited to confirming that the design was prepared by a licensed professional engineer and that the soil pressure diagram shown was used.

1.3 REFERENCES

A. Design: Comply with all Federal and State laws and regulations applying to the design and construction of shoring, sheeting and bracing.

B. N.B.S. Building Science Series 127 "Recommended Technical Provisions for Construction Practice in Shoring and Sloping Trenches and Excavations.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Do work in accordance with the U.S. Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54), and the Florida Trench Safety Act. The

CONTRACTOR shall also observe 29 CFR 1910.46 OSHA's regulation for Confined Space Entry.

PART 2 PRODUCTS

2.1 MANUFACTURERS AND MATERIALS

A. Material Recommendations: Use manufacturers and materials for shoring, sheeting and bracing as recommended by the Licensed Professional Engineer who designed the shoring, sheeting, and bracing.

PART 3 EXECUTION

3.1 SHORING, SHEETING AND BRACING INSTALLATION

A. General: Provide safe working conditions, to prevent shifting of material, to prevent damage to structures or other work, to avoid delay to the work, all in accordance with applicable safety and health regulations. Properly shore, sheet, and brace all excavations which are not cut back to the proper slope and where shown. Meet the general trenching requirements of the applicable safety and health regulations for the minimum shoring, sheeting and bracing for trench excavations.

1. CONTRACTOR's Responsibility: Sole responsibility for the design, methods of installation, and adequacy of the shoring, sheeting and bracing.

B. Arrange shoring, sheeting and bracing so as not to place any strain on portions of completed work until the general construction has proceeded far enough to provide ample strength.

C. If ENGINEER is of the opinion that at any point the shoring, sheeting or bracing are inadequate or unsuited for the purpose, resubmission of design calculations and working drawings for that point may be ordered, taking into consideration the observed field conditions. If the new calculations show the need for additional shoring, sheeting and bracing, it should be installed immediately.

D. Monitoring: Periodically monitor horizontal and vertical deflections of sheeting. Submit these measurements for review.

E. Accurately locate all underground utilities and take the required measures necessary to protect them from damage. All underground utilities shall be kept in service at all times as specified in Division 1.

F. Driven Sheeting: Drive tight sheet piling in that portion of any excavation in paved or surface streets City collector and arterial streets and in State and County highways below the intersection of a one-on-one slope line from the nearest face of the excavation to the edge of the existing pavement or surface.

PART 2 - ABOVE SURFACE FACILITIES

G. Sheeting Depth: In general drive or place sheeting for pipelines to a depth at elevation equal to the top of the pipe as approved.

1. If it is necessary to drive sheeting below that elevation in order to obtain a dry trench or satisfactory working conditions, cut the sheeting off at the top of the pipe and leave in place sheeting below the top of the pipe.

2. Cut off sheeting not designated as "Sheeting Left in Place". The cut ends of sheeting left adjacent to the pipe will be paid for as "Sheeting Left in Place".

3. Do not cut the sheeting until backfill has been placed and compacted to the top of the pipe.

H. Sheeting Removal: In general, remove sheeting and bracing above the top of the pipe as the excavation is refilled in a manner to avoid the caving in of the bank or disturbance to adjacent areas or structures. Sheeting shall be removed as backfilling progresses so that the sides are always supported or when removal would not endanager the construction of adjacent structures. When required to eliminate excessive trench width or other damages, shoring or bracing shall be left in place and the top cut off at an elevation 2.5 feet below finished grade, unless otherwise directed.

1. Carefully fill voids left by the withdrawal of the sheeting by jetting, ramming or otherwise.

2. No separate payment will be made for filling of such voids.

I. Permission for Removal: Obtain permission before the removal of any shoring, sheeting or bracing. Retain the responsibility for injury to structures or to other property or persons from failure to leave such shoring, sheeting and bracing in place even though permission for removal has been obtained.

J. Preload internal braces to 50 percent of the design loads.

K. Proof test tie backs to 133 percent of the design loads and lock off tie backs at 75 percent of the design loads.

3.2 SHEETING LEFT IN PLACE FOR PROTECTION

A. Ordered Left in Place: In addition to sheeting specified or shown to be left in place, the ENGINEER may order, in writing, any or all other shoring, sheeting or bracing to be left in place for the purpose of preventing injury to the structures, pipelines or to other property or to persons.

PART 2 - ABOVE SURFACE FACILITIES

1. Cutoff sheeting left in place at the elevation shown or ordered, but, in general, at least 2.5 feet below the final ground surface.

2. Drive up tight any bracing remaining in place.

B. Right to Order: Do not construe the right to order shoring, sheeting and bracing left in place as creating any obligation to issue such orders.

C. Payment: Shoring, sheeting and bracing left in place, by written order, will be paid for under the appropriate Contract Items or where no such items exist, as changes in the work.

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

SECTION 32 10 01

PAVEMENT REPAIR AND RESTORATION

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and remove and replace pavements over trenches excavated for installation of pipelines as shown on the drawings and/or specified herein.

1.2 GENERAL

A. All damage, as a result of work under this project, done to existing pavement, driveways, paved areas, curbs and gutters, sidewalks, shrubbery, grass, trees, utility poles, utility pipe lines, conduits, drains, catch basins, or stabilized areas or driveways and including all obstructions not specifically named herein, shall be repaired in a manner satisfactory to the ENGINEER. Bid prices shall include the furnishing of all labor, materials, equipment, and incidentals necessary for the cutting, repair, and restoration of the damaged areas unless pay items for specific types of repair are included in the Bid Form.

B. Keep the surface of the backfilled area of excavation in a safe condition and level with the remaining pavement until the pavement is restored in the manner specified herein. All surface irregularities that are dangerous or obstructive to traffic are to be removed. The repair shall conform to applicable OWNER or State requirements for pavement repair and as described herein.

C. All materials and workmanship shall be first class and nothing herein shall be construed as to relieve the CONTRACTOR from this responsibility. The OWNER reserves the right to require soil bearing or loading tests or materials tests, should the adequacy of the foundation or the quality of materials used be questionable. Costs of these tests shall be borne by the OWNER, if found acceptable; the costs of all failed tests shall be borne by the CONTRACTOR.

D. All street and road repair shall be made in accordance with the details indicated on the drawings and in accordance with the applicable requirements of these Specifications and meeting the permit requirements and approval of the governing Department of Transportation agencies.

E. Pavement or roadway surfaces cut or damaged shall be replaced by the CONTRACTOR in equal or better condition than the original, including stabilization, base course, surface course, curb and gutter or other appurtenances. The CONTRACTOR shall obtain the necessary permits prior to any roadway work.

PART 2 - ABOVE SURFACE FACILITIES

Additionally, the CONTRACTOR shall provide advance notice to the appropriate authority, as required, prior to construction operations.

1. Roadway Restoration (within Lee County Department of Transportation & Engineering jurisdiction): Restoration shall be in accordance with the requirements set forth in the “Right-of-Way Utility Construction Activities Policy” and these Standards. The materials of construction and method of installation, along with the proposed restoration design for items not referred or specified herein, shall receive prior approval from Lee County DOT.

    a. Where existing pavement is to be removed, the surface shall be mechanical saw cut prior to trench excavation, leaving a uniform and straight edge parallel or perpendicular to the roadway centerline with minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimal.

    b. Immediately following the specified backfilling and compaction, a temporary sand seal coat surface shall be applied to the cut areas. This temporary surfacing shall provide a smooth traffic surface with the existing roadway and shall be maintained until final restoration. Said surfacing shall remain for a minimum of ten (10) days in order to assure the stability of the backfill under normal traffic conditions. Thirty (30) days following this period and prior to sixty (60) days after application, the temporary surfacing shall be removed and final roadway surface restoration accomplished.

    c. In advance of final restoration, the temporary surfacing shall be removed and the existing pavement mechanically sawed straight and clean to the stipulated dimensions, if needed. Following the above operation, the CONTRACTOR shall proceed immediately with final pavement restoration in accordance with the requirements set forth by Lee County Department of Transportation.

2. Roadway Restoration (outside Lee County Department of Transportation jurisdiction) – Work within the rights-of-way of public thoroughfares which are not under jurisdiction of Lee County, shall conform to the requirements of the Governmental agency having jurisdiction or the Florida Department of Transportation, if no governmental agencies have jurisdiction. Work within State Highway right-of-way shall be in full compliance with all requirements of the permit drawings, and to the satisfaction of the Florida Department of Transportation.

1.3 QUALITY ASSURANCE

A. Applicable provisions of the latest version of the Florida Department of Transportation "Standard Specifications for Road and Bridge Construction", and Supplemental Specifications hereunder govern the work under this Section. The Florida Department of Transportation will hereafter be referred to as FDOT.

PART 2 - ABOVE SURFACE FACILITIES

PART 2 PRODUCTS

2.1 MATERIALS

A. All materials utilized in flexible base pavement and base course shall be as specified in the latest version of the Florida Department of Transportation "Standard Specifications for Road and Bridge Construction".

PART 3 EXECUTION

3.1 CUTTING PAVEMENT

A. Cut and remove pavement as necessary for installing the new pipelines and appurtenances and for making connections to existing pipelines.

B. Before removing pavement, the pavement shall be marked for cuts nearly paralleling pipelines and existing street lines. Asphalt pavement shall be cut along the markings with a jackhammer, rotary saw, or other suitable tool, leaving a uniform and straight edge with minimum disturbance to the remaining adjacent surface.

C. No pavement shall be machine pulled until completely broken and separated along the marked cuts.

D. The pavement adjacent to pipeline trenches shall neither be disturbed nor damaged. If the adjacent pavement is disturbed or damaged, irrespective of cause, remove the damaged pavement and shall replace it at his own expense.

3.2 GENERAL RESTORATION

A. The restoration of existing street paving, driveways, etc., shall be restored, replaced or rebuilt using the same type of construction as was in the original. Be responsible for restoring all such work, including sub-grade and base courses where present. Obtain and pay for such local or other governmental permits as may be necessary for the opening of streets. Meet any requirements other than those herein set forth which may effect the type, quality and manner of carrying on the restoration of surfaces by reason of jurisdiction of such governmental bodies.

B. In all cases, maintain, without additional compensation, all permanent replacement of street paving, done by him under this Contract until accepted by the OWNER, including the removal and replacement of such work wherever surface depressions or underlying cavities result from settlement of trench backfill.

C. Complete all the final resurfacing or re-paving of streets or roads, over the excavations and relay paving surfaces of roadbed that have failed or been damaged prior to acceptance by the OWNER. Backfilling of trenches and the preparation of sub-grades shall conform to the requirements of Section 31 23 23.

PART 2 - ABOVE SURFACE FACILITIES

D. All re-paving or resurfacing shall be done in accordance with Florida Department of Transportation Specifications, to which the following requirement of trench backfill will be added: Where pipeline construction crossed paved areas such as streets, the top 24 inches of trench below the road bases or concrete slabs shall be backfilled with compacted A-4 or better matter that will provide a bearing value of not less than 75 when tested by the Florida Department of Transportation Soil Bearing Test Methods.

3.3 PRIME AND TACK COATS

A. The work shall consist of the application of bituminous prime and tack coats on the previously prepared base course in accordance with Section 300 of the FDOT Specifications.

3.4 WEARING COURSE

A. The work shall consist of the construction of plant-mixed hot bituminous pavement to the thickness indicated in the drawings conforming to Type III asphaltic concrete in accordance with Section 333 of the FDOT Specifications. The requirements for plant and equipment are specified in Section 320 and the general construction requirements for asphaltic concrete pavement are contained in Section 330 of the FDOT specifications.

3.5 TESTING

A. All field testing shall be performed by an independent laboratory employed by the OWNER. All materials shall be tested and certified by the producer. Tests repeated because sub-grade or base does not meet specified compaction shall be at the CONTRACTOR's expense.

3.6 MISCELLANEOUS RESTORATION

A. Sidewalks cut or damaged by construction shall be restored in full sections or blocks to a minimum thickness of four inches. Concrete curb or curb gutter shall be restored to the existing height and cross section in full sections or lengths between joints. Concrete shall be as specified on the drawings. Grassed yards, shoulders and parkways shall be restored to match the existing sections with grass seed or sod of a type matching the existing grass.

PART 2 - ABOVE SURFACE FACILITIES

3.7 CLEANUP

A. After all repair and restoration or paving has been completed, all excess asphalt, dirt, and other debris shall be removed from the roadways. All existing storm sewers and inlets shall be checked and cleaned of any construction debris.

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

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SECTION 32 92 00

LAWN RESTORATION

PART 1 GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. The work in this section consists of furnishing all labor, material and equipment to replace and maintain all areas disturbed during construction by establishing a stand of grass, within the areas called for by the furnishing and placing grass sod, or seeding, or seeding and mulching.

1.2 REFERENCE DOCUMENTS

A. The materials used in this work shall conform to the requirements of Florida Department of Transportation Standard Specifications for Road and Bridge Construction as follows:

1. Sod - Section 981-2
2. Fertilizer - Section 982
3. Water - Section 983

1.3 SUBMITTALS

A. Submit certifications and identification labels for all sodding supplied as specified in Section 01 33 00.

PART 2 PRODUCTS

2.1 SODDING

A. Types: Sod may be of either St. Augustine or Argentine Bahia grass or as that disturbed, as established prior to construction. It shall be well matted with roots. When replacing sod in areas that are already sodded, the sod shall be the same type as the existing sod.

B. Sod shall be provided as required in accordance with Florida Department of Transportation Specifications 575 and 981. The CONTRACTOR shall furnish sod equal to and similar in type as that disturbed. Placement and watering requirements shall be in accordance with FDOT Specifications Section 575.

C. The sod shall be taken up in commercial-size rectangles, preferably 12-inch by 24-inch or larger, except where 6-inch strip sodding is called for.

D. The sod shall be sufficiently thick to secure a dense stand of live grass. The sod shall be live, fresh and uninjured at the time of planting. It shall have a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary handling. It shall be reasonably free of weeds and other grasses. It shall be planted as soon as possible after being dug and shall be shaded and kept moist from the time it is dug until it is planted.

E. Sod should be handled in a manner to prevent breaking or other damage. Sod shall not be handled by pitch forks or by dumping from trucks or other vehicles. Care shall be taken at all times to retain the native soil on the roots of each sod roll during stripping and handling. Sod that has been damaged by handling during delivery, storage or installation will be rejected.

2.2 FERTILIZER

A. Chemical fertilizer shall be supplied in suitable bags with the net weight certification of the shipment. Fertilizer shall be 12-8-8 and comply with Section 982 of the FDOT Standard Specification for Road and Bridge Construction.

B. The numerical designations for fertilizer indicate the minimum percentages (respectively) of (1) total nitrogen, (2) available phosphoric acid and (3) water soluble potash, contained in the fertilizer.

C. The chemical designation of the fertilizer shall be 12-8-8, with at least 50 percent of the nitrogen from a nonwater-soluble organic source. The nitrogen source may be a unreaformaldehyde source provided it is not derived from a waste product of the plastic industry.

2.3 EQUIPMENT

A. The device for spreading fertilizer shall be capable of uniformly distributing the material at the specified rate.

2.4 NETTING

A. Netting is fabricated of material similar to Geoscope Landscape Fabric or approved equal.

2.5 GRASSING

A. The CONTRACTOR shall grass all unpaved areas disturbed during construction which do not require sod. All grassing shall be completed in conformance with FDOT Specifications Sections 570 and 981. The grassed areas shall be mulched and fertilized in accordance with FDOT Specifications.

B. Grass seed shall be Argentine Bahia, 60 #/acre March 1 to November 1, 50 #/acre with 20 #/acre of rye grass seed November 1 to March 1. Argentine Bahia seed shall be a scarified seed having a minimum active germination of 40% and total of 85%.

PART 2 - ABOVE SURFACE FACILITIES

C. Mulch material shall be free of weeds and shall be oat straw or rye, Pangola, peanut, Coastal Bermuda, or Bahia grass hay.

2.6 TOPSOIL

A. Topsoil stockpiled during excavation may be used. If additional topsoil is required to replace topsoil removed during construction, it shall be obtained off site at no additional cost to the OWNER. Topsoil shall be fertile, natural surface soil, capable of producing all trees, plants, and grassing specified herein.

2.7 MULCH

A. Mulch shall be fresh cypress mulch. Rate of application specified herein shall correspond to depth not less than 1-inch or more than 3-inches according to texture and moisture content of mulch material.

2.8 WATER

A. It is the CONTRACTOR'S responsibility to supply all water to the site, as required during seeding and sodding operations and through the maintenance period and until the work is accepted. The CONTRACTOR shall make whatever arrangements may be necessary to ensure an adequate supply of water to meet the needs for his work. Internal plant non-potable water is available for irrigating on the plant site. There are existing connections on-site. He shall also furnish all necessary hose, equipment, attachments, and accessories for the adequate irrigation of lawns and planted areas as may be required. Water shall be suitable for irrigation and free from ingredients harmful to plant life.

PART 3 EXECUTION

3.1 SOD BED PREPARATION

A. Areas to be sodded and/or seeded shall be cleared no all rough grass, weeds, and debris, and brought to an even grade.

B. The soil shall then be thoroughly tilled to a minimum 8-inch depth.

C. The areas shall then be brought to proper grade, free of sticks, stones, or other foreign matter over 1-inch in diameter or dimension. The surface shall conform to finish grade, less the thickness of sod, free of water-retaining depressions, the soil friable and of uniformly firm texture.

3.2 INSPECTION

A. Verify that soil preparation and related preceding work has been completed.

B. Do not start work until conditions are satisfactory.

PART 2 - ABOVE SURFACE FACILITIES

3.3 SOD HANDLING AND INSTALLATION

A. During delivery, prior to planting, and during the planting of sod areas, the sod panels shall at all times be protected from excessive drying and unnecessary exposure of the roots to the sun. All sod shall be stacked during construction and planting so as not to be damaged by sweating or excessive heat and moisture.

B. After completion of soil conditioning as specified above, sod panels shall be laid tightly together so as to make a solid sodded lawn area. On mounds and other slopes, the long dimension of the sod shall be laid perpendicular to the slope. Immediately following sod laying the lawn areas shall be rolled with a lawn roller customarily used for such purposes, and then thoroughly watered.

C. Sod shall be placed at all areas where sod existed prior to construction, on slopes of 3 horizontal on 1 vertical (3:1) or greater, in areas where erosion of soils will occur, and as directed by the ENGINEER. On areas where the sod may slide, due to height and slope, the ENGINEER may direct that the sod be pegged, with pegs driven through the sod blocks into firm earth, at suitable intervals.

3.4 USE OF SOD ON ROADWAY PROJECTS

A. In accordance with the FDOT District One Standard Practice, permanent green grass shall be established at the completion of roadway construction and maintenance work. The following shall apply to all restoration involving State or County roadways:

1. Sod in lieu of seed and mulch shall be used on all roadways with urban (raised curb) typical sections.
2. One inch water per week shall be required for a minimum of four (4) consecutive weeks for the purpose of establishing sod. This can be waived during construction, if and only if there is a minimum of one inch of rain per week on all sod on the project.
3. Sod shall be placed on slopes 1:3 or greater. Staked sod shall be placed on slopes 1:2 or greater.
4. On all curves with superelevation, sod shall be placed from the edge of pavement to the toe of slope on the downhill side(s) for the entire length of the superelevated roadway. On multi-lane divided rural facilities, sod shall be placed in the median and on the inside of the curve in the superelevated areas. This does not apply to reverse crowns.
5. For all projects with less than 10,000 square yards grass area, sod shall be used.
6. On tangent sections and on outside of curves, sod shall be used between the edge of pavement and a point 4 feet beyond the shoulder break point.
7. The entire width of sod should not exceed 15 feet from the edge of pavement.
8. Sod is to be used to eliminate narrow seed and mulch areas. Areas less than 6 feet in width shall be sodded.
9. Sod shall be placed around drainage structures as per the standard Indexes and extended to the edge of pavement.

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3.5 SOD MAINTENANCE

A. The sod shall produce a dense, well established growth. The CONTRACTOR shall be responsible for the repair and re-sodding of all eroded or bare spots until project acceptance. Repair to sodding shall be accomplished as in the original work.

B. Sufficient watering shall be done by the CONTRACTOR to maintain adequate moisture for optimum development of the seeded and sodded areas. Sodded areas shall receive no less than 1.5 inches of water per week for at least 2 weeks. Thereafter, the CONTRACTOR shall apply water for a minimum of 60 days as needed until the sod takes root and starts to grow or until final acceptance, whichever is latest.

3.6 CLEANING

A. Remove debris and excess materials from the project site.

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

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SECTION 33 05 01

LEAKAGE TESTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Testing for any signs of leakage in all pipelines and structures required to be watertight.

1. Test gravity sewers and drain lines by low pressure air testing.

2. Test all other pipelines with water under the specified pressures.

B. Operation of Existing Facilities: Conduct all tests in a manner to minimize as much as possible any interference with the day-to-day operations of existing facilities or other contractors working on the site.

1.2 PERFORMANCE REQUIREMENTS

A. Written Notification of Testing: Provide written notice when the work is ready for testing, and make the tests as soon thereafter as possible.

1. Personnel for reading meters, gauges, or other measuring devices, will be furnished.

2. Furnish all other labor, equipment, air, water and materials, including meters, gauges, smoke producers, blower, pumps, compressors, fuel, water, bulkheads and accessory equipment.

1.3 REFERENCES

A. Codes and standards referred to in this Section are:

1. AWWA C 600 - Installation of Ductile-Iron Water Mains and Their Appurtenances

1.4 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Testing Report: Prior to placing the sewer system in service submit for review and approval a detailed bound report summarizing the leakage test data, describing the test procedure and showing the calculations on which the leakage test data is based.

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1. Reference Sewer Line Data

a. For Low Pressure Air Testing

(1) The length and diameter of the section of line tested (MH to MH) including any laterals.

(2) A complete description of test procedures and methods, including:

(a) Trench backfilling and sewer cleaning status

(b) Type of plugs used and where

(c) Depth of sewer, and ground water pressure over sewer pipe

(d) Stabilization time period and air pressure

(e) Actual air test pressures used if ground water is present

(f) The allowed time by specifications

(g) The actual test time

(h) The air pressure at beginning and end of test

(3) The name of the inspector/tester and the date(s) and time(s) of all testing, including any retesting.

(4) A description of any repairs made.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 LEAKAGE TESTING

A. All new sewer and water pipelines installed shall be tested for leakage. The test used will be Hydrostatic Testing for pressure lines and Low Pressure Air Testing for gravity lines. Tests to be performed will be indicated by the ENGINEER and witnessed by the ENGINEER and the Lee County Utilities representatives.

1. Flushing

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a. All mains shall be flushed to remove all sand and other foreign matter. The velocity of the flushing water shall be at least 4 fps. Flushing shall be terminated at the direction of the ENGINEER. dispose of the flushing water without causing a nuisance or property damage.

b. Temporary flush out connections shall be installed on all dead end water mains at the locations shown on the Drawings and in accordance with the detail shown in Section 9 of the Lee County Utilities Operations Manual.

2. Hydrostatic Testing

Perform hydrostatic testing of the system as set forth in the following, and shall conduct said tests in the presence of representatives from the COUNTY and other authorized agencies, with 48 hours advance notice provided.

Piping and appurtenances to be tested shall be within sections between valves unless alternate methods have received prior approval from the COUNTY. Testing shall not proceed until concrete thrust blocks are in place and cured, or other restraining devices installed. All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter. While the piping is being filled with water, care shall be exercised to permit the escape of air from extremities of the test section, with additional release cocks provided if required.

Hydrostatic testing shall be performed with a sustained pressure for a minimum of two (2) hours at 150 psi pressure or 2-1/2 times working pressure, whichever is higher, unless otherwise approved by Lee County Utilities, for a period of not less than two (2) hours. Testing shall be in accordance with the applicable provisions as set forth in the most recent edition of AWWA Standard C600. The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formula:

$$L = \frac{SD\,(P)^{1/2}}{133{,}200}$$

Where,

L = Allowable leakage in gallons per hour;
S = Length of pipe tested in feet;
D = Nominal diameter of the pipe in inches;
P = Average test pressure maintained during the leakage test in pounds per square inch

For 150 psi, $L = (9.195 \times 10^{-5})\,SD$

The testing procedure shall include the continued application of the specified pressure to the test system, for the one hour period, by way of a pump taking

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supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container.

Should the test fail, necessary repairs shall be accomplished by the CONTRACTOR and the test repeated until results are within the established limits. The CONTRACTOR shall furnish the necessary labor, water, pumps, and gauges at specified location(s) and all other items required to conduct the required testing and perform necessary repairs.

General. All sanitary sewers and associated service lines shall be constructed watertight to prevent infiltration and/or exfiltration. All new sanitary sewer systems will be subject to low pressure air testing.

3. Low Pressure Air Test

After completing backfill of a section of gravity sewer line, conduct a Line Acceptance Test using low pressure air. The test shall be performed using the below stated equipment, according to state procedures and under the supervision of the ENGINEER and in the presence of a Lee County Utilities representative, with 48 hours advanced notice provided.

a. Equipment:

1. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.

2. Pneumatic plugs shall resist internal bracing or blocking.

3. All air used shall pass through a single control panel.

4. Three individual hoses shall be used for the following connections:

a. From control panel to pneumatic plugs for inflation.

b. From control panel to sealed line for introducing the low pressure air.

c. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

b. Procedures:

All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psi. The sealed pipe shall be pressurized

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to 5 psi. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

After a manhole to manhole reach of pipe has been backfilled and cleaned and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psi. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psi greater than the average back pressure of any ground water that may be over the pipe. At least two (2) minutes shall be allowed for the air pressure to stabilize. After the stabilization period (3.5 psi minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "Acceptable", if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psi (greater than the average back pressure of any ground water that may be over the pipe) is greater than the time shown for the given diameters in the following table:

Pipe Diameter In Inches	Minutes
8	4.0
10	5.0
12	5.5
16	7.5
18	8.5
24	11.5

Time in minutes = 0.472 D
D = Diameter of pipe in inches.

In areas where ground water is known to exist, the CONTRACTOR shall install capped pipe adjacent to the top of one of the sewer lines. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the ground water shall be determined by removing the pipe cap, and a measurement of the height in feet of water over the invert of the pipe shall be taken. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of water is 11-1/2 feet, then the added pressure will be 5 psi. This increases the 3.5 psi to 8.5 psi, and the 2.5 psi to 7.5 psi. The allowable drop of one pound and the timing remain the same).

If the installation fails to meet this requirement, the CONTRACTOR shall, at his own expense, determine the source of leakage. He shall then repair or replace all defective materials and/or workmanship.

PART 2 - ABOVE SURFACE FACILITIES

3.2 LEAKAGE TESTS FOR STRUCTURES

A. Structure Leakage Testing: Perform leakage tests of wet wells, tanks, vaults and similar purpose structures before backfilling, by filling the structure with water to the overflow water level and observing the water surface level for the following 24 hours.

1. Make an inspection for leakage of the exterior surface of the structure, especially in areas around construction joints.

2. Leakage will be accepted as within the allowable limits for structures from which there are no visible leaks.

3. If visible leaks appear, repair the structure by removing and replacing the leaking portions of the structure, waterproofing the inside, or by other methods approved.

4. Water for testing will be provided by the OWNER at the CONTRACTOR's expense.

END OF SECTION

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SECTION 33 05 03

LAYING AND JOINTING BURIED PIPELINES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Installation of all underground pipelines. Provide pipeline materials, coatings and linings as specified and pipe of the types, sizes and classes shown or specified.

1. Use proper and suitable tools and appliances for the safe and convenient cutting, handling, and laying of the pipe and fittings.

2. Use suitable fittings where shown and at connections or where grade or alignment changes require offsets greater than those recommended and approved.

3. Lay all underground pipelines not supported on piles or concrete cradle in select fill bedding material.

4. Close off all lines with bulkheads when pipe laying is not in progress.

B. Related Work Specified in Other Sections Includes:

1. Section 31 23 16 - Excavation - Earth and Rock
2. Section 31 23 23 - Backfilling
3. Section 33 05 01 - Leakage Tests
4. Section 33 11 01 - Polyvinyl Chloride (PVC) Water Main Pipe
5. Section 33 11 02 - High Density Polyethylene (HDPE) Pipe and Fittings
6. Section 33 11 03 - Ductile Iron Pipe and Fittings
7. Section 33 11 12 - Disinfection
8. Section 33 31 01 - Polyvinyl Chloride (PVC) Gravity Sewer Pipe
9. Section 33 31 02 - Buried Fiberglass Reinforced Plastic (FRP) Gravity Sewer Pipe
10. Section 33 34 01 - Polyvinyl Chloride (PVC) Force Main Pipe

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM D 2774 - Practice for Underground Installation of Thermoplastic Pressure Piping

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2. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances

3. ASTM A 307 - Specification for Carbon Steel Bolts and Studs, 60000 psi Tensile

4. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, C25, 125, 250, 800

5. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges

6. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

7. AWWA C115/A21.15 - Flanged Ductile-Iron Pipe With Threaded Flanges

8. ASTM E 165 - Practice for Liquid Penetrant Examination

9. ASTM E 709 - Practice for Magnetic Particle Examination

1.3 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:

B. Transportation and Delivery: Take every precaution to prevent injury to the pipe during transportation and delivery to the site.

C. Loading and Unloading: Take extreme care in loading and unloading the pipe and fittings.

1. Work slowly with skids or suitable power equipment, and keep pipe under perfect control at all times.

2. Under no condition is the pipe to be dropped, bumped, dragged, pushed, or moved in any way that will cause damage to the pipe or coating.

D. Sling: When handling the pipe with a crane, use a suitable sling around the pipe.

1. Under no condition pass the sling through the pipe.

2. Use a nylon canvas type sling or other material designed to prevent damage to the pipe and coating.

3. When handling reinforced concrete pipe or uncoated steel or ductile iron pipe, steel cables, chain or like slings are acceptable.

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E. Damaged Piping: If in the process of transportation, handling, or laying, any pipe or fitting is damaged, replace or repair such pipe or pipes.

F. Blocking and Stakes: Provide suitable blocking and stakes installed to prevent pipe from rolling.

1. Obtain approval for the type of blocking and stakes, and the method of installation.

G. Storage for Gaskets: Store gaskets for pipe joints in a cool place and protect gaskets from light, sunlight, heat, oil, or grease until installed.

1. Do not use any gaskets showing signs of checking, weathering or other deterioration.

2. Do not use gasket material stored in excess of six months without approval.

1.4 FIELD CONDITIONS

A. Repair of Sanitary Sewers and Services: Rebed, in compacted select fill material, sanitary sewers which cross over the new pipe or which cross under the new pipe with less than 12 inches clear vertical separation. Compact the bedding to densities required for new pipeline construction and extend bedding below the sewer to undisturbed earth. Reconstruct sewers damaged by pipeline construction.

1. Furnish and install all materials and do all work necessary for the reconstruction or repairs of sanitary sewers and services.

2. Provide pipe for reconstruction of sanitary sewers and services meeting the appropriate specification requirements.

3. Provide pipe of the same size as the existing sewer or when the same size is not available, use the next larger size of pipe. Obtain approval of joints made between new pipe and existing pipe.

PART 2 PRODUCTS

A. The materials allowed for buried sewer pipes are PVC, HDPE or fiberglass. Use of ductile iron pipe is not allowed for sewer construction without specific approval of Lee County Utilities.

PART 2 - ABOVE SURFACE FACILITIES

PART 3 EXECUTION

3.1 PREPARATION

A. Dry Trench Bottoms: Lay pipe only in dry trenches having a stable bottom.

1. Where groundwater is encountered, make every effort to obtain a dry trench bottom.

2. If a dry trench bottom has not been obtained due to improper or insufficient use of all known methods of trench dewatering, then the order to excavate below grade and place sufficient select fill material, crushed stone, or 2500 psi concrete over the trench bottom may be given.

3. If all efforts fail to obtain a stable dry trench bottom and it is determined that the trench bottom is unsuitable for pipe foundation, obtain an order, in writing, for the kind of stabilization to be constructed.

4. Perform trench excavation and backfill in accordance with Sections 31 23 16 and 31 23 23.

3.2 INSTALLATION

A. General: Install all piping in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1. Where pipe deflections are used, do not exceed 80 percent of the maximum deflection limits shown in AWWA C600.

1. Arrange miscellaneous pipelines, which are shown in diagram form on the Plans, clear of other pipelines and equipment.

B. Code Requirements: Provide pipeline installations complying with AWWA C600 for iron pipe, AWWA Manual M11 for steel pipe, ASTM D 2774 for thermoplastic pressure piping, and as modified or supplemented by the Specifications.

C. Pipe Laying - General:

1. For pipelines intended for gravity flow, begin pipeline laying at the low end of a run and proceed upgrade.

2. Generally, lay all pipe with bells pointing ahead.

3. Carefully place each pipe and check for alignment and grade.

4. Make adjustments to bring pipe to line and grade by scraping away or filling in select fill material under the body of the pipe.

5. Wedging or blocking up the pipe barrel is not permitted.

6. Bring the faces of the spigot ends and the bells of pipes into fair contact and firmly and completely shove the pipe home.

7. As the work progresses, clean the interior of pipelines of all dirt and superfluous materials of every description.

8. Keep all lines absolutely clean during construction.

9. Lay pipelines accurately to line and grade.

10. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other material from entering the pipe.

D. Pipe Laying - Trenches:

1. Lay all pipelines in trench excavations on select fill bedding, concrete cradle or other foundations as shown, specified or ordered in writing.

2. Properly secure the pipe against movement and make the pipe joints in the excavation as required.

3. Carefully grade and compact pipe bedding.

4. Bell Holes:

a. Cut out bell holes for each joint as required to permit the joint to be properly made and allow the barrel of the pipe to have full bearing throughout its length.

b. Thoroughly tamp bell holes full of select fill material following the making of each joint.

E. Other Foundations: Install pipelines laid on other types of foundations as specified for such other foundations or as ordered in writing.

F. Ductile Iron Pipe Mechanical Joints:

1. Assembly: In making up mechanical joints, center the spigot in the bell.

a. Thoroughly brush the surfaces with which the rubber gasket comes in contact with a wire brush just prior to assembly of the joint.

b. Brush lubricant over the gasket just prior to installation.

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c. Place the gasket and gland in position, bolts inserted, and the nuts tightened fingertight.

d. Tighten the nuts with a torque wrench so that the gland is brought up toward the pipe evenly. Torque wrenches shall be set as specified in AWWA C111. Spanner type wrenches not loner than specified in AWWA C111 may be used with the permission of Lee County Utilities.

e. Prime all bolts by dipping with a bituminous coating, except the threads. Coat threads immediately prior to installation of nuts.

2. Torques: Apply the following range of bolt torques:

Size Inches	Range of Torque - ft. lbs
5/8	45 - 60
3/4	75 - 90
1	85 - 100
1-1/4	105 - 120

3. Remaking of Joints: If effective sealing is not obtained at the maximum torque listed above, disassemble and reassemble the joint after thorough cleaning.

G. Ductile Iron Pipe Rubber Gasket Joints:

1. Assembly: In making up the rubber gasket joint, brush the gasket seat in the socket thoroughly with a wire brush and wipe the gasket with a cloth.

a. Place the gasket in the socket with the large round end entering first so that the groove fits over the bead in the seat.

b. Apply a thin film of lubricant to the inside surface of the gasket that will come in contact with the entering pipe.

c. Brush the plain end of the pipe to be entered thoroughly with a wire brush and place it in alignment with the bell of the pipe to which it is to be joined.

d. Exert sufficient force on the entering pipe so that its plain end is moved past the gasket until it makes contact with the base of the socket to make the joint.

2. Positioning: Before proceeding with backfilling, feel completely around the joint using a feeler gauge to confirm that the gasket is in its proper position.

a. If the gasket can be felt out of position, withdraw the pipe and examine the gasket for cuts or breaks.

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b. If the gasket has been damaged, replace it with a new one before re-installing the pipe.

3. Optional Mechanical Joints: Use mechanical joint fittings that meet the requirements of Section 33 11 03 with the rubber gasket joint pipe when specified or when rubber gasket fittings are not available.

H. Temporary Bulkheads: Provide temporary bulkheads at the ends of sections where adjoining pipelines have not been completed, and in connections built into pipelines where adjoining pipelines or structures have not been completed and are not ready to be connected.

1. Remove bulkheads encountered in connecting sewers or structures included in this Contract, or in pipelines or structures previously built, when they are no longer needed or when ordered.

I. Sleeve Type Couplings: For sleeve type couplings, equally tighten diametrically opposite bolts on the connection so that the gaskets will be brought up evenly all around the pipe.

1. Torque Wrenches: Do the final tightening with torque wrenches set for the torque recommended by the coupling manufacturer.

J. Concrete Encasement: Concrete encasement shall be constructed in accordance with Lee County standard details when:

1. A waterline crosses at a depth which provides less than 18 inches clear distance from sewer lines. Encasement shall extend a minimum 10 feet on each side of the point of crossing. Encase the sewer main unless specifically approved by Lee County Utilities.

2. A waterline running parallel to a sewer line provides less than 10 feet separation. Encase the sewer main unless specifically approved by Lee County Utilities.

3. The Engineer has ordered the line encased.

The points of beginning and ending of pipe encasement shall be not more than 6 inches from a pipe joint to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.

K. Valve Box Setting: Install valve boxes vertical and concentric with the valve stem.

1. Satisfactorily reset any valve box which is moved from its original position, preventing the operation of the extension valve stem.

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2. Replace any extension valve stem which has been damaged so that it can be operated.

L. Jacking:

1. General: Perform jacking as shown. After jacking is completed, seal the ends of the casing pipe with brick masonry.

   a. Jacking Pit: Provide jacking pit of adequate length to provide room for the jacking frame, the jacking head, reaction block, the jacks, rig, and jacking pipe.

   b. Construct the pit to be sufficiently wide to allow ample working space on each side of the jacking frame and sufficiently deep so that the invert of the pipe will be at the elevation desired for the completed line when placed on the guide frame.

   c. Tightly sheet the pit and keep it dry at all times.

   d. Provide adequate protective railings at the top of the pit at all times.

2. Jacking Frame: Design the jacking frame so that it applies a uniform pressure over the entire pipe wall area of the pipe to be jacked.

3. Reaction Blocks: Adequately design the reaction blocks to carry the thrust of the jacks to the soil without excessive soil deflection in a manner which avoids any disturbance of adjacent structures or utilities.

4. Hydraulic Jacks: Use hydraulic jacks in the jacking operation, and take extreme care to hold the casing pipe to exact line and grade.

5. Advance Excavation: Advance excavation by augering.

6. Casing Pipe: Furnish steel casing pipe, unless otherwise specified, conforming to ASTM A 139 with wall thicknesses and pipe diameters shown on the Plans. Provide full penetration butt welded pipe joints.

7. Fill Material: Use fill material, consisting of 1-1/4 pounds of Bentonite per gallon of water, during jacking to fill any voids between the casing pipe and the earth.

M. Identification:

1. Identification Tape: For all types of pipe to be installed, 3-inch detectable marking tape, of appropriate color, shall be placed along the entire pipe length. In all cases, marking tape shall be installed 12 inches to 18 inches below the finished grade during backfill operations. All PVC pipe, PVC fittings, and identification tape shall be color-coded per standards outlined in the Utility

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Location and Coordinating Council's Uniform Color Code as specified in Section 4 of the Lee County Utilities Operations Manual.

2. Locating Wire: A locating tracing wire shall also be installed with PVC, HDPE and fiberglass pipes and shall be a continuous No. 12 insulated copper tracing wire laid in the trench on top of the utility pipe and attached to the pipe at ten (10) foot intervals. This continuous tracing wire shall run along the entire pipe and be stubbed out at valves, pressure clean-outs and air release valves.

3.3 FIELD QUALITY CONTROL

A. Testing: Test pipelines in accordance with Section 33 05 01.

1. Test valves in place, as far as practicable, and correct any defects in valves or connections.

B. Inspection: Clean, inspect, and examine each piece of pipe and each fitting and special for defects before it is installed.

1. Cut away any lumps or projections on the face of the spigot end or the shoulder.

2. Do not use any cracked, broken, or defective pieces in the work.

3. If any defective piece should be discovered after having been installed, remove and replace this piece with a sound piece in a satisfactory manner at no increase in Contract Amount.

3.4 CLEANING

A. General: Thoroughly clean all pipe before it is laid and keep it clean until it is accepted in the completed work.

B. Removal of Materials: Exercise special care to avoid leaving bits of wood, dirt, and other foreign particles in the pipe. If any particles are discovered before the final acceptance of the work, remove and clean the pipe.

3.5 DISINFECTION

A. General: Disinfect all pipelines that are to carry potable water in accordance with Section 33 11 12.

END OF SECTION

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SECTION 33 31 01

POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required, and install PVC gravity sewer pipe and appurtenances as shown on the Drawings and as specified herein.

1.2 SUBMITTALS DURING CONSTRUCTION

A. Submittals during construction shall be made in accordance with Section 01 33 00, Shop Drawings, Working Drawings, and Samples.

B. Submit to the ENGINEER not less than fourteen (14) calendar days after the date of the Notice to Proceed, a list of materials to be furnished, the names of suppliers and an expected schedule of delivery of materials to the site.

C. Furnish in duplicate to the ENGINEER sworn certificates that all tests and inspections required by the Specifications under which the pipe is manufactured have been satisfied.

1.3 INSPECTION AND TESTS

A. All pipe and accessories to be installed under this Contract shall be inspected and tested at the place of manufacture by the manufacturer as required by the Standard Specifications to which the material is manufactured.

B. In the event that any of the test specimens fail to meet the applicable standards, all pipe presented by such tests shall be subject to rejections. The CONTRACTOR may furnish two additional test specimens from the same shipment or delivery for each specimen that failed and the pipe will be considered acceptable if all of these additional specimens meet the requirements of the applicable standards.

C. Pipe which has been rejected by the ENGINEER shall be removed from the site of the work by the CONTRACTOR and replaced with pipe which meets these specifications.

D. Other testing requirements specific to the type of pipe are included under the appropriate Paragraph in Part 2, below.

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PART 2 PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) PIPE

A. Polyvinyl chloride (PVC) gravity sewer pipe and fittings 4-inch through 12-inch diameter shall conform to ASTM D-3034, "Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings," DR 26. If any portion of a gravity sewer has less than four feet of cover, the entire run shall be constructed of AWWA C-900 DR 18 or thicker wall pipe.

B. The pipe shall be joined with an integral bell and spigot type rubber gasketed joints. Each integral bell joint shall consist of a formed bell with a rubber gasket. Flexible gasketed joints shall be elastomeric compression types conforming to ASTM F1336 and ASTM F477. Joints shall permit contraction, expansion and settlement, and yet maintain a watertight connection. Joints shall be tested in accordance with ASTM D3212.

C. Pipe shall be furnished in standard laying lengths not exceeding 20 feet and shall be colored green in accordance with the Utility Location and Coordination Council Uniform Color Guide.

D. All fittings and accessories shall be furnished by the pipe supplier and shall have bell and/or spigot configurations compatible with the pipe.

PART 3 EXECUTION

3.1 LAYING POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Polyvinyl Chloride (PVC) gravity sewer pipe shall be laid in accordance with the instructions of the manufacturer, Section 31 23 23 and ASTM D-2321, "Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe." Bell holes shall be excavated so that after installation only the pipe barrel shall bear upon the trench bottom. Proper selection and placement of bedding and backfill materials are necessary to minimize deflection of the pipe diameter. No blocking under the pipe will be permitted. For gravity sewers 12 inches in diameter and larger, Laser leveling shall utilize two (2) laser beams to check gradient and deflection. One laser beam shall be positioned 1-1/2 inches or less from the inside top of pipe. The second laser beam shall be positioned 2 inches or less from the inside bottom of pipe. Both beams must hit the target for the entire run of pipe being installed between manholes.

For pipelines less than 12 inches in diameter, a single laser level beam shall be utilized and centered inside the pipe.

B. Use care in handling and installing pipe and fittings. Storage of pipe on the job site shall be done in accordance with the pipe manufacturer's recommendation and with approval of the ENGINEER. Under no circumstances shall pipe or fittings be dropped

either into the trench or during unloading. The interior of the pipe shall be kept clean of oil, dirt, and foreign matter, and the machined ends and couplings shall be wiped clean immediately prior to jointing.

C. Use a PVC pipe cutter where necessary to cut and machine all PVC pipe in the field. A "full insertion mark" shall be provided on each field cut pipe end. Field-cut pipe shall be beveled with a beveling tool made especially for plastic pipe. Bevels shall be in accordance with the manufacturer's requirements.

D. Each length of pipe and fitting shall be marked with the nominal size, the SDR designation, the name of the manufacturer or his trademark, and the date of manufacture.

E. Rubber gaskets shall be marked with manufacturers identification sizes and proper insertion direction.

F. Pipe stubs for all manhole connections shall not exceed 2 feet in length unless otherwise shown on the drawings. Install caps where required.

G. Each time the work on the sewer is halted, the ends of the pipe shall be sealed to prevent foreign material from entering the pipe.

3.2 TESTS FOR GRAVITY SEWERS - GENERAL

A. Gravity sewers shall be required to pass a leakage test before acceptance. Leakage tests shall be as described in Section 33 05 01.

B. All polyvinyl chloride and fiberglass sewer pipe shall be subject to deflection testing assuring that the maximum deflection of 5% has not been exceeded. Any pipe failing this test is subject to removal and replacement at the CONTRACTOR’s expense. Do not use pipe rounders.

3.3 TELEVISION INSPECTION

A. All sanitary sewer gravity lines shall be televiewed in accordance with Section 33 01 36.

END OF SECTION

PART 2 - ABOVE SURFACE FACILITIES

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Section 40 05 19

DUCTILE IRON PIPE

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing and installation of ductile iron pipe. Ductile iron pipe shall be furnished complete with all fittings, specials, adapters, closure pieces, blowoffs, outlets, caps and plugs, temporary bulkheads, access manholes, jointing materials, pipe hangers and supports, anchors, blocking, encasement, appurtenances, and accessories specified and indicated on the Drawings, and as required for proper installation and functioning of the piping.

The size, service, and locations of ductile iron pipelines are covered in the Ductile Iron Pipe Schedule.

Piping furnished hereunder shall be complete with all joint gaskets, bolts, nuts and other jointing materials required for installation of any valves and equipment furnished by Owner or others for installation under this Contract.
Pipe hangers and supports, pressure and leakage testing, and cleaning and disinfection are covered in other sections. Pipe trenching, embedment, and backfill are covered in the Trenching and Backfilling section.

1-2. GOVERNING STANDARDS. Except as modified or supplemented herein, all ductile iron pipe, fittings, and specials shall conform to the applicable requirements of the following standards and other standards named in this section:

ANSI/AWWA Standards	Title
C151	Ductile-Iron Pipe, Centrifugally Cast, For Water
C600	Installation of Ductile Iron Water Mains and Their Appurtenances
M41	Ductile Iron Pipe and Fittings - Manual of Water Supply Practices
C104	Cement Mortar Lining for Ductile Iron Pipe and Fittings
C105	Polyethylene Encasement for Ductile Iron Pipe Systems
C110	Ductile-Iron and Gray-Iron Fittings
C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
C115	Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges

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1-3. PIPE MANUFACTURER AND FIELD SERVICES. All ductile iron pipe, fittings, specials, bolts, gaskets, other jointing materials, and appurtenances shall be fabricated, lined, coated, and furnished under the direction and management of one pipe manufacturer. The pipe manufacturer responsibilities, which shall include, at a minimum; coordinating and furnishing all pipe materials, gaskets, bolts, and other jointing materials, and pipe appurtenances (except for furnished coupled joints and other similar products by a specified manufacturer) for a complete piping system that meets the specified test pressures and service conditions; ensuring and certifying that all pipe, fittings, specials, and other pipe materials, pipe gaskets and bolts specified herein, are being manufactured in full accordance with the Contract Documents; preparing and submitting all submittal information and shop drawings; and making any corrections that may be required to submittal information and shop drawings.

The pipe manufacturer's minimum required experience qualifications shall include manufacture of interior and buried plant piping of similar diameters of at least two water or wastewater plants with joints, linings, and coatings suitable for the same or higher pressure rating, which has performed satisfactorily for the past 5 years.

All ductile iron pipe shall be installed in accordance with the pipe manufacturer's recommendations.

1-4. SUBMITTALS. Drawings, details, specifications, and installation schedules covering all ductile iron pipe and accessories shall be submitted in accordance with the Submittals Procedures section. The drawings and data shall include, but shall not be limited to, the following:

Certification of pipe manufacturer's experience requirements; to be submitted prior to award of contract.

Certification by manufacturer (affidavit of compliance) for each item furnished in accordance with the ANSI/AWWA Standards.

Restrained joints details.

Specifier. See the applicable specifier notes for discussion of when the following three optional paragraphs should be included.

Certification of gaskets by pipe manufacturer, certifying that gasket material is suitable for test pressures and services intended.

Certification that all materials in contact with treated or potable water are ANSI/NSF 61 approved.

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Certification of joint lubricant.

Certification of proof-of-design tests for joints, including restrained joints.

Certification of proof-of-design tests for welded-on outlets and experience documentation. Air test documentation for the welded-on outlets used for this project.

Two samples of the polyethylene encasement, each sample clearly identified as required by the Governing Standards and test results from an independent third party laboratory of the requirements specified in ANSI/AWWA C105/A21.5.

The method that the Contractor proposes to use for measuring deflection of pipe joints.

Submittal data shall clearly indicate the country of origin of pipe, fittings, flanges, restraining devices, and accessories. When requested by Engineer, certified copies of physical and chemical test results as outlined in ANSI/AWWA C151/A21.51 shall be submitted for the materials to be provided.

1-4.01. Emergency Repair Manual. Not used.

1-5. SPARE MATERIALS. Not Used.

1-6. SHIPPING, HANDLING, AND STORAGE. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section, and as specified herein.

Pipe, fittings, and accessories shall be handled in a manner that will ensure installation in sound, undamaged condition. Equipment, tools, and methods used in handling and installing pipe and fittings shall not damage the pipe and fittings. Hooks inserted in ends of pipe shall have broad, well-padded contact surfaces. Unpadded hooks, wire brushes or other abrasive tools shall not be permitted to come into contact with polyethylene lining if such lining is specified.

Contractor-furnished pipe and fittings in which the lining has been damaged shall be replaced by and at the expense of Contractor. With the concurrence of Engineer, small and readily accessible damaged areas may be repaired.

If the lining of Owner-furnished pipe or fittings is damaged by Contractor during unloading or handling, the damaged pipe or fittings shall be replaced by and at the expense of Contractor. Where the damaged areas are small and readily accessible, Contractor may be permitted to repair the lining.

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Contractor shall repair any damage to pipe coatings and linings before the pipe is installed.

PART 2 - PRODUCTS

2-1. PIPE CLASS. The class of ductile iron pipe shall be as indicated in the Ductile Iron Pipe Schedule. The specified class includes service allowance and casting allowance.

Pipe Size inches	ANSI/AWWA Pressure Class
64 thru 30	150
24	200
20 thru 14	250
12 and smaller	350

Pipe wall thickness for grooved and threaded end pipe shall be increased if necessary to comply with the following minimum thickness:

Pipe Size	Minimum Thickness Class	
inches	Threaded Ends (1)	Grooved Ends (2)
4-16	53	53
18	53	54
20	53	55
24	53	56
30-54	53	--
60 & 64	350 (3)	--

(1) Complies with ANSI/AWWA C115/A21.15 for minimum pipe wall thickness for threaded flanges.

(2) Complies with ANSI/AWWA C606 for grooved and shouldered joint ductile iron pipe.

(3) Minimum class for 60 and 64 inch pipe is pressure class 350.

2-2. MATERIALS.

Pipe	Ductile iron, ANSI/AWWA C151/A21.51
Gaskets – All Joint Types	Synthetic rubber unless otherwise specified; natural rubber will not be acceptable. All gaskets shall be furnished by the pipe manufacturer unless another manufacturer's product is indicated. Pipe manufacturer shall submit certificates of gasket suitability certifying that the gasket materials are compatible with the joints specified, are recommended for the specified field test pressure and service conditions. Gaskets for treated or potable water service shall be certified for chlorinated and chloraminated potable water. Gas and oil-resistant gaskets shall be made of Nitrile (NBR [Acrylonitrile Butadiene]) rubber. The name of the material shall be permanently marked or molded on the gasket. Gaskets shall also be certified as suitable where soils may be contaminated with gas and oil products.
Joint Lubricant	Vegetable-based lubricant recommended by the pipe manufacturer. Petroleum or animal-based lubricants will not be acceptable. Lubricants that will be in contact with treated or potable water shall be certified as being in compliance with ANSI/NSF 61.
Fittings	ANSI/AWWA C110/A21.10 (except shorter laying lengths will be acceptable for U.S. Pipe), or ANSI/AWWA C153/A21.53, minimum working pressure rating as follows, unless indicated otherwise on the Drawings.

Fitting Size in.	Material	Type	Min. Working Pressure Rating, psi
4 to 24	DI	Flanged joints	250
30 to 48	DI	All joints	250
54 to 64	DI	All joints	150

All fittings shall be ductile iron and suitable for the rated working pressure plus a surge or test pressure allowance of 100 psi or 1.5 times rated working pressure, whichever is less, without leakage or damage.	
Flanged Joints	ANSI/AWWA C115/A21.15.
Flanges	

		Class 250 (Where identified on the Drawings)	Ductile iron, flat faced, with ANSI/ASME B16.1, Class 250 diameter and drilling.
		All Others	Ductile iron, Class 125, ANSI/AWWA C115/A21.15.
	Flanges		All flanges shall be suitable for test pressure of 1.5 times rated pressure without leakage or damage.
	Bolts		ASTM A307, chamfered or rounded ends projecting 1/4 to 1/2 inch beyond outer face of nut.
	Nuts		ASTM A563, hexagonal, ANSI/ASME B18.2.2, heavy semifinished pattern.
	Gaskets		ASTM D1330, Grade I rubber, full face type, 1/8 inch thick unless otherwise required by pipe manufacturer and accepted by Engineer. Pipe manufacturer shall submit certification of gaskets furnished as indicated above under Gaskets - All Joint Types.
Insulated Flanges			
	Flanges		As specified herein, except bolt holes shall be enlarged as needed to accept bolt insulating sleeves.
	Insulation Kits		As manufactured by Advanced Products or Pipeline Seal and Insulator, Inc.
		Insulating Gaskets	Type E, G-10, 1/8 inch [3 mm] thick, with Nitrile or EPDM sealing element for water and air service and Viton sealing elements for wastewater service unless otherwise required by pipe manufacturer and accepted by Engineer. Pipe manufacturer shall submit certification of gaskets furnished as indicated above under Gaskets - All Joint Types.
		Bolt Insulating Sleeves	G-10, 1/32 inch thick.
		Insulating Washers	G-10, 1/8 inch thick, two for each flange bolt.
		Backing Washers	Steel, 1/8 inch thick, two for each flange bolt.
Mechanical Joints			ANSI/AWWA C111/A21.11., with ductile iron glands.

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	Restrained Mechanical Joints (factory prepared spigot), (4 inch through 48 inch), working pressure rating at least 250 psi.	American "MJ coupled Joints", or Griffin U.S. Pipe "Mech-Lok" (thru 36" size only).
	Restrained Mechanical Joints, (field cut spigot), (4 inch through 24 inch), working pressure rating 350 psi for 4 through 16 inch and at least 250 psi for 18 through 24 inch.	EBAA Iron "Megalug" Series 1100, Sigma "One Lok" SLDE series, or Star Pipe Products "StarGrip 3000" without exception.
Restrained mechanical joints shall be suitable for a test or working pressure plus surge pressure of the rated working pressure plus 100 psi		
	Wall Pipes or Castings	Mechanical joint with water stop and tapped holes; single casting or fabricated ductile iron pipe; holes sized in accordance with the details on the Drawings and provided with removable plugs.
	Mechanical Joints with Tie Rods	As indicated on the Drawings.
	Tie Rods	ASTM A307.
	Steel Pipe	ASTM A53, Schedule 40 or 80 as indicated on the Drawings.
	Washers	ANSI/ASME B18.22.1, plain steel.
Threaded Connections		ANSI/ASME B1.20.1, NPT; with boss or tapping saddle wherever wall thickness minus the foundry tolerance at the tapped connection is less than that required for 4-thread engagement as set forth in Table A.1, Appendix A, of ANSI/AWWA C151/A21.51.
Mechanical Couplings		
	Couplings	Dresser "Style 38"; Smith-Blair "411 Steel Coupling"; or Romac "Style 400" or "Style 501"; without pipe stop.
	Gaskets	Oil-resistant synthetic rubber gaskets shall be as recommended by the coupling manufacturer. Pipe manufacturer shall submit certification of gaskets furnished as indicated above under Gaskets - All Joint Types.

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Restrained Mechanical Couplings		American Pipe “Restrained Coupling Gland Joint” coordinated with mechanical couplings furnished.
Restrained Flange Adapters		
	Restrained (4 inch through 24 inch). Unless otherwise indicated on the Drawings, flanged coupling adapters shall be restrained.	EBAA Iron “Series 2100 Megaflange” or Romac “Style RFCA”
Flanged Coupling Adapters		[Not Used]
	Restrained (4 inch through 12 inch). Unless otherwise indicated on the Drawings, flanged coupling adapters shall be restrained.	Smith-Blair "Type 912" or Romac "Style FCA501", with anchor studs of sufficient size and number to withstand test pressures.
	Unrestrained (14 inch and larger)	Smith-Blair "Type 913" or Romac "Style FC400".
Dismantling Joints		
	Restrained (3 inch and larger) Unless otherwise indicated on the Drawings, dismantling joints shall be restrained.	Romac "DJ400"; Dresser "Style 131 Dismantling Joint" or Viking Johnson. For use in potable water systems, coating to be in accordance with NSF-61.
Tapping Saddles		Ductile iron, with stainless steel straps and synthetic rubber sealing gasket, 250 psi pressure rating.
Watertight/Dusttight Pipe Sleeves		GPT " Link-Seal", insulating type with modular rubber sealing elements, nonmetallic pressure plates, and stainless steel bolts and nuts.
Shop Coating and Lining		
	Cement Mortar Lining with Seal Coat	ANSI/AWWA C104/A21.4.
	Protective Fusion-Bonded	ANSI/AWWA C116/A21.16.
	Ceramic Epoxy Lining	Induron "Protecto 401 Ceramic Epoxy".
	Glass Lining	Two-coat system applied over blast-cleaned surface; ground and finish coats separately fired; finished lining thickness at least 10 mils, Mohs’ Hardness 5 to 6 density as determined by ASTM D792; U.S. PipeFast Fabricators, Inc. "MEH 32" or "SG-14", or C&B Piping “CBGL911”.
	Universal Primer	Manufacturer’s standard. If in contact with treated or potable water, certify as

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		being in compliance with ANSI/NSF 61.
	Asphaltic Coating	Manufacturer's standard.
	Zinc Coating	ISO 8179
	Coal Tar Epoxy	Manufacturer's standard.
	Liquid Epoxy	ANSI/AWWA C210, non-coal tar modified, or when in contact with treated or potable water, certify as being in compliance with ANSI/NSF 61.
Anti-Seize Thread Lubricant		Jet-Lube "Nikal", John Crane "Thred Gard Nickel", Bostik/Never-Seez "Pure Nickel Special" or Permatex "Nickel Anti-Seize".
Corrosion Protection		
	Polyethylene Encasement	Seamless, ANSI/AWWA C105/A21.5; LLDPE - 8 mil [200 µm] or HDCLPE - 4 mil.
	Heat-shrinkable Coating and Primer (Shrink Sleeve)	ANIS/AWWA C216, cross-linked polyethylene sheeting precoated with adhesive; minimum 80 mils; type and recovery as recommended by Shrink Sleeve manufacturer; Canusa-CPS or Berry Plastics Water Wrap.
	Wax Tape and Primer	ANSI/AWWA C217, cold-applied petroleum wax primer and cold-applied petroleum wax tape; Trenton Wax-Tape and Primer.
	Medium Consistency Coal Tar	Carboline "Bitumastic 50" or Tnemec "46-465 H.B. Tnemecol."

2-3. OUTLETS. Where a 12 inch or smaller branch outlet is indicated and the diameter of the parent pipe is at least twice the diameter of the branch, a tee, a factory welded-on boss, or a tapping saddle will be acceptable.

Where a 4 inch or larger branch outlet is indicated on the Drawings and the diameter of the branch pipe for a given diameter of parent pipe is less than or equal to the maximum diameter listed herein, a factory welded-on outlet fabricated from centrifugally cast ductile iron pipe will be acceptable.

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Parent Pipe Diameter Versus Maximum Branch Pipe Diameter for Welded-On Outlets			
Parent Pipe Dia inches	Max Branch Pipe Dia inches	Parent Pipe Dia inches	Max Branch Pipe Dia inches
8	4	30	20
10	6	36	24
12	8	42	30
14	8	48	30
16	10	54	36
18	12	60	36
20	14	64	36
24	16		

All 30 inch and smaller branch pipe diameter welded-on outlets shall be rated for a working pressure of 250 psi, 36 inch branch diameter welded-on outlets shall be rated for a working pressure of 200 psi, and all outlets shall have a minimum factor of safety of 2.0. The pipe manufacturer shall provide test data and certification of proof of design. It is not necessary that these tests be performed on pipe manufactured specifically for this project. Certified reports covering tests made on other pipe of the same size and design as specified herein and manufactured from materials of equivalent type and quality may be accepted as adequate proof of design.

Welded-on outlets may be provided as a radial (tee) outlet, a tangential outlet, or a lateral outlet fabricated at a specific angle to the parent pipe (in 15 degrees increments between 45 degrees and 90 degrees from the axis of the parent pipe), as indicated on the Drawings. The fillet weld dimensions for welded-on outlets shall be as specified herein. Parent pipe and branch pipe shall meet hydrostatic test requirements in accordance with ANSI/AWWA C151/A21.51 prior to fabrication.

Welded-on Outlet Fillet Weld Dimensions for Specified Outlet Configurations					
Radial and Lateral Outlets			Tangential Outlets		
Parent Pipe Dia inches	Branch Pipe Dia inches	Weld Fillet Size inches	Parent Pipe Dia inches	Branch Pipe Dia inches	Weld Fillet Size inches
24 and smaller	24 and smaller	1 x 1	8-30	24 and smaller	1-1/4 x 1-1/4

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Welded-on Outlet Fillet Weld Dimensions for Specified Outlet Configurations					
Radial and Lateral Outlets			Tangential Outlets		
Parent Pipe Dia inches	Branch Pipe Dia inches	Weld Fillet Size inches	Parent Pipe Dia inches	Branch Pipe Dia inches	Weld Fillet Size inches
30-48	24 and smaller	1-1/4 x 1-1/4	36-54	24 and smaller	1-1/2 x 1-1/2
54-64	24 and smaller	2-1/4 x 2-1/2	60-64	24 and smaller	2-1/2 x 2-1/2
42-64	30	2-1/2 x 2-1/2	42-54	30	2-1/2 x 2-1/2
54-64	36	2-3/4 x 2-3/4	60-64	30	2-3/4 x 2-3/4

All joints on welded-on branch outlets shall be made in accordance with the latest revision of ANSI/AWWA C111/A21.11 and/or ANSI/AWWA C115/A21.15, as applicable. All outlets shall be fabricated from centrifugally cast ductile iron pipe designed in accordance with ANSI/AWWA C150/A21.50 and manufactured and tested in accordance with ANSI/AWWA C151/A21.51. Ni-Rod FC 55® electrodes manufactured by International Nickel Corporation (or an electrode with equivalent properties) shall be used in the manufacture of the fillet welds. Carbon steel electrodes will not be acceptable. Special Thickness Class 53 pipe shall be used for all branch pipe and parent pipe in 4 to 54 inch sizes. Pressure Class 350 pipe shall be used for 60 inch and 64 inch parent pipe. After welding, each fabricated outlet shall be subjected to a 15 psi air test. A soap and water solution shall be applied during the testing procedure to inspect the weld for leakage. Any welds that show air seepage shall be refabricated and retested.

Welded-on outlets shall be fabricated by the pipe manufacturer at its production facilities. Manufacturers of welded-on outlets shall have at least 5 years of satisfactory experience in the manufacture and performance of these products. The manufacturer shall have a documented welding quality assurance system and shall maintain resident quality assurance records based on ANSI/AWS D11.2, the Guide for Welding Iron Castings. The manufacturer shall also maintain appropriate welding procedure specifications (WPS) and procedure qualification (PQR), and welder performance qualification (WPQR) records.

The type of pipe end for the branch outlet shall be as specified or indicated on the Drawings. The maximum size and laying length of the welded-on branch outlet shall be as recommended by the pipe manufacturer and shall be acceptable to Engineer for the field conditions and the connecting pipe or valve.

At locations acceptable to Engineer, drilling and tapping of the pipe wall for 2 inch and smaller pipe connections will also be acceptable, provided that the wall thickness, minus the casting allowance, at the point of connection equals or

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exceeds the wall thickness required for 4-thread engagement in accordance with Table A.1, Appendix A of ANSI/AWWA C151/A21.51.

2-4. JOINTS. Joints in buried and tunnel locations shall be mechanical type unless otherwise indicated on the Drawings or where required to connect to existing piping or to valves. Bells on wall castings and wall sleeves shall be mechanical joint type, with tapped holes for tie rods or stud bolts. All other joints shall be flanged unless otherwise indicated on the Drawings.

Certification of joint design shall be provided in accordance with ANSI/AWWA C111/A21.11, Performance Requirements, as modified herein. The joint test pressure shall be not less than 2 times the working pressure rating of the joint. The same certification and testing shall also be provided for restrained joints. For restrained joints, the piping shall not be blocked to prevent separation and the joint shall not leak or show evidence of failure. It is not necessary that such tests be made on pipe manufactured specifically for this project. Certified reports covering tests made on other pipe of the same size and design as specified herein and manufactured from materials of equivalent type and quality may be accepted as adequate proof of design. Any new proof-of-design testing to meet the requirements for this project shall be independently verified and the Owner shall be given the opportunity to witness the testing.

Unless otherwise indicated on the drawings or acceptable to the Engineer, field closure pieces shall be located away from the bends or dead ends beyond the length over which joints are to be restrained.

The length of pipe having restrained joints shall be as indicated on the drawings or specified. All vertical bends and eccentric reducers shall have restrained joints.

2-4.01 Flanged Joints. Pipe shall extend completely through screwed-on flanges. The pipe end and flange face shall be finish machined in a single operation. Flange faces shall be flat and perpendicular to the pipe centerline.

2-4.02. Flanged Coupling Adaptors. Not used.

2-4.03. Dismantling Joints. Dismantling joints shall be provided for restrained couplings 6 inch and larger piping where indicated on the Drawings and as specified herein. Dismantling joints shall comply with AWWA C219 and shall be restrained flange by flange couplings manufactured as a single unit. Unless otherwise indicated on the Drawings, dismantling joints shall be restrained.

The inner and outer surfaces of dismantling joints, except flange mating surfaces, shall be prepared for coating in accordance with instructions of the coating manufacturer and shall then be shop coated with liquid epoxy in accordance with ANSI/AWWA C210. The flange mating surfaces shall be cleaned and shop primed with universal primer.

2-4.04. Mechanical Couplings. The piping layout for mechanical couplings shall provide a space of at least 1/4 inch, but not more than 1 inch, between the pipe ends.

All surfaces, including the interior surfaces of the middle rings, shall be prepared for coating in accordance with instructions of the coating manufacturer and shall be shop coated with 16 mils liquid epoxy in accordance with ANSI/AWWA C210.

A ductile iron pipe factory spacer shall be provided for the piping where indicated on the drawings. The spacer shall be shop lined and coated with 16 mils of liquid epoxy. Piping surfaces within the coupling shall be shop coated with 16 mils of liquid epoxy.

Tie bolts shall be provided to restrain mechanical coupling connections where indicated on the Drawings. The connecting pipe shall be furnished with welded retainer rings as recommended by pipe manufacturer. The pipe manufacturer shall also coordinate the restrained connection with the pressure rating, length, and diameter dimensions of the mechanical coupling being furnished to assure proper clearance is provided for completing the restrained coupling installation.

2-4.05. Grooved-End Couplings. Not used.

2-5. REDUCERS. Reducers shall be eccentric or concentric as indicated on the Drawings. Reducers of eccentric pattern shall be installed with the straight side on top, so that no air traps are formed.

2-6. BLOWOFFS. Not used.

2-7. ACCESS OPENINGS. Not used.

2-8. WALL AND FLOOR PIPES. Not used.

2-9. WALL AND FLOOR SLEEVES. Wall and floor sleeves shall be installed where indicated on the Drawings and shall be installed where ductile iron pipe passes through concrete walls and floors or masonry walls, unless otherwise noted. To minimize sleeve size, piping on either side of the sleeve shall be provided with a screw-on flange, grooved coupling, or mechanical coupling with anchor studs to allow the pipe to pass through the sleeve. Where required, sleeves in masonry walls may be enlarged enough for flange or other joint restraint to pass through the sleeve.

Where specified or indicated on the Drawings, one or two sets of modular casing seals shall be installed at the face of walls to seal against soil or provide a dust or water tight seal. Contractor shall coordinate the diameter of wall or floor sleeves with the modular casing seal manufacturer. When soil may be present at wall sleeves, two sets of modular casing seals shall be installed, one at each face of the wall. Unless otherwise indicated on the Drawings, modular casing seals shall

PART 2 - ABOVE SURFACE FACILITIES

not be used in submerged conditions unless the hydrostatic pressure is less than 20 feet and piping is less than 24 inch size.

2-10. SHOP COATING AND LINING. The interior of all pipe and fittings, unless noted otherwise, shall be cement mortar lined.

The exterior surfaces of all pipe and fittings which will be exposed in both interior and exterior locations shall be shop primed. Field painting of exposed exterior surfaces is covered in the Protective Coatings section. Flange faces shall be coated with a suitable rust-preventive compound. Exterior surfaces of all other pipe and fittings shall be coated with asphaltic coating.

PART 3 – EXECUTION

3-1. INSPECTION. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation; pipe ends shall be examined with particular care. All defective pipe and fittings shall be removed from the site.

3-2. PROTECTION AND CLEANING. The interior of all pipe and fittings shall be thoroughly cleaned of all foreign material prior to installation and shall be kept clean until the work is completed. Before jointing, all joint contact surfaces shall be wire brushed if necessary and wiped clean.

Precautions shall be taken to prevent foreign material from entering the pipe during installation. Debris, tools, clothing, or other objects shall not be placed in or allowed to enter the pipe.

Whenever pipe laying is stopped, the open end of the pipe shall be closed to prevent entry of dirt, mud, rodents, and other material. All water in the trench shall be removed prior to removing the closure.

3-3. CUTTING PIPE. Cutting shall be done in a neat manner, without damage to the pipe or the lining. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the ends of the pipe shall be dressed with a file or a power grinder to remove all roughness and sharp edges. The cut ends of push-on joint pipe shall be suitably beveled.

All field cutting of existing gray cast iron pipe shall be done with mechanical pipe cutters, except where the use of mechanical cutters would be difficult or impracticable.

Ends of ductile iron pipe shall be cut with a portable guillotine saw, abrasive wheel, saw, milling cutter, or oxyacetylene torch. The use of hydraulic squeeze type cutters will not be acceptable. Field-cut holes for saddles shall be cut with mechanical cutters; oxyacetylene cutting will not be acceptable.

Contractor shall use factory prepared pipe ends unless a field cut is required for connections.

3-4. ALIGNMENT AND GRADE. Buried piping shall be laid to the lines and grades indicated on the Drawings and as specified. Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the values stipulated for full-length push-on joint pipe for full-length mechanical joint pipe of AWWA C600, unless specially designed bells and spigots are provided. Contractor shall submit his proposed methods to measure deflection of deflected joints in accordance with the Submittal section. Whenever deflections would exceed the values stipulated in AWWA C600, either shorter pipe sections or fittings shall be installed where needed to conform to the alignment or grade indicated on the Drawings and as acceptable to the Engineer.

Unless otherwise specified or acceptable to Engineer, laser beam equipment, surveying instruments, or other suitable means shall be used to maintain alignment and grade. At least one elevation reading shall be taken on each length of pipe. If laser beam equipment is used, periodic elevation measurements shall be made with surveying instruments to verify accuracy of grades. If such measurements indicate thermal deflection of the laser beam due to differences between the ground temperature and the air temperature within the pipe, precautions shall be taken to prevent or minimize further thermal deflections.

Additional requirements for alignment and grade are covered in the Project Requirements and Trenching and Backfilling sections and on the Drawings.

3-4.01. Tolerances. Each section of pipe shall be laid to the alignment and grade indicated on the Drawings and pipe laying schedule with pipe ends within the following tolerances;

+/- 0.10 foot in grade at any point
+/- 0.20 foot in alignment at any point

In addition, piping shall be visually straight or on a smooth curve between the points of defection or curvature indicated on the Drawings. Stricter tolerances than specified above shall be used as necessary to maintain minimum cover, to maintain required clearances, to make connections to existing pipe, to maintain the correct slope to avoid high or low points along the pipeline other than at locations indicated on the Drawings, or to meet other restrictions as required or directed by the Engineer.

3-5. LAYING PIPE. Buried pipe shall be protected from lateral displacement by placing the specified pipe embedment material installed as specified in the Trenching and Backfilling section. Under no circumstances shall pipe be laid in water, and no pipe shall be laid under unsuitable weather or trench conditions. Pipe embedment material and trench backfill shall be placed and compacted

PART 2 - ABOVE SURFACE FACILITIES

under and around each side of outlets and fittings to hold the pipe in proper position and alignment during the subsequent pipe jointing, embedment, and backfilling.

Pipe shall be laid with the bell ends facing the direction of laying, except where reverse laying is specifically acceptable to Engineer.

3-6. JOINTS.

Each joint, including restrained joints, shall be checked by Contractor as recommended by the pipe manufacturer to verify that the joint and the restraints are installed properly. Restrained joints shall be extended after they are assembled to minimize further take-up.

3-7. MECHANICAL JOINTS. Mechanical joints shall be carefully assembled in accordance with the pipe manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Bolts shall be uniformly tightened to the torque values listed in Appendix A of ANSI/AWWA C111/A21.11. Over tightening of bolts to compensate for poor installation practice will not be acceptable.
The holes in mechanical joints with tie rods shall be carefully aligned to permit installation of the tie rods. In flange and mechanical joint pieces, holes in the mechanical joint bells and the flanges shall straddle the top centerline for horizontal piping.

3-8. PUSH-ON JOINTS. Not used.

3-9. FLANGED JOINTS. When bolting flanged joints, care shall be taken to avoid restraint on the opposite end of the pipe or fitting which would prevent uniform gasket compression or would cause unnecessary stress in the flanges. One flange shall be free to move in any direction while the flange bolts are being tightened. Bolts shall be tightened gradually in a crisscross pattern and at a uniform rate, to ensure uniform compression of the gasket around the entire flange. All flange joint bolting procedures shall be in accordance with the pipe manufacturer's recommendations.

Special care shall be taken when connecting piping to any pumping equipment to ensure that piping stresses are not transmitted to the pump flanges. All connecting piping shall be permanently supported to obtain accurate matching of bolt holes and uniform contact over the entire surface of flanges before any bolts are installed in the flanges.

Pump connection piping shall be free to move parallel to its longitudinal centerline while the bolts are being tightened. Each pump shall be leveled, aligned, and wedged into position which will fit the connecting piping, but shall not be grouted until the initial fitting and alignment of the pipe, so that the pump may be shifted on its foundation if necessary to properly install the connecting

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piping. Each pump shall, however, be grouted before final bolting of the connecting piping.

After final alignment and bolting, the pump connections shall be tested for applied piping stresses by loosening the flange bolts which, if the piping is properly installed, should result in no movement of the piping relative to the pump or opening of the pump connection joints. If any movement is observed, the piping shall be loosened and re-aligned as needed and then the flanges bolted back together. The flange bolts shall then be loosened and the process repeated until no movement is observed.

3-9.01. Insulated Flanged Joints. Insulated flanged joints shall be installed where indicated on the Drawings. In addition to one full-faced insulated gasket, each flange insulating assembly shall consist of one full-length sleeve, two insulating washers, and two backing washers for each flange bolt. The insulating gasket ID shall be 1/8 inch [3 mm] less than the ID of the flange in which it is installed. The insulated flanged joint accessories shall be installed in accordance with the instructions and recommendations of the insulating kit manufacturer.

3-10. FLANGED COUPLING ADAPTERS. Flange coupling adapters shall be installed in accordance with the coupling manufacturer's recommendations. After the pipe is in place and bolted tight, the locations of holes for the anchor studs shall be determined and the pipe shall be field-drilled. Holes for anchor studs shall be drilled completely through the pipe wall. Hole diameter shall be not more than 1/8 inch [3 mm] larger than the diameter of the stud projection. Unless indicated on the Drawings, all flange coupling adapters shall be restrained.

3-11. DISMANTLING JOINTS. Dismantling joints shall be installed in accordance with the coupling manufacturer's recommendations.

3-12. MECHANICAL COUPLINGS. Mechanical couplings shall be installed in accordance with the coupling manufacturer's recommendations. A space of at least 1/4 inch, but not more than 1 inch, shall be left between the pipe ends. Pipe and coupling surfaces in contact with gaskets shall be clean and free from dirt and other foreign matter during assembly. All assembly bolts shall be uniformly tightened so that the coupling is free from leaks, and all parts of the coupling are square and symmetrical with the pipe. Following installation of the coupling, damaged areas of shop coatings on the pipe and coupling shall be repaired to the satisfaction of Engineer.

3-13. GROOVED-END JOINTS. Not used.

3-14. GAS AND OIL-RESISTANT GASKETS. Gas and oil-resistant gaskets shall be installed where specified, indicated on the Drawings, or directed by Engineer where jointing gaskets may be subject to permeation when piping passes through areas where soil may be contaminated with gas or petroleum (oil) products or organic solvents or their vapors.

PART 2 - ABOVE SURFACE FACILITIES

3-15. CORROSION PROTECTION. Not used.

3-16. PROVISIONS FOR CATHODIC PROTECTION SYSTEMS. Not used.

3-17. CONNECTIONS WITH EXISTING PIPING. Connections between new work and existing piping shall be made using fittings suitable for the conditions encountered. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with service to customers, and as authorized by Owner. Facilities shall be provided for proper dewatering and for disposal of all water removed from dewatered lines and excavations without damage to adjacent property.

Special care shall be taken to prevent contamination when dewatering, cutting into, and making connections with existing potable water piping. Trench water, mud, or other contaminating substances shall not be permitted to enter the lines. The interior of all pipe, fittings, and valves installed in such connections shall be thoroughly cleaned and then swabbed with, or dipped in, a 500 mg/L chlorine solution.

3-18. CONCRETE ENCASEMENT. Not used.

3-19. REACTION ANCHORAGE AND BLOCKING. Concrete blocking shall be installed where indicated on the Drawings. Concrete and reinforcing steel shall be as specified in the Cast-in-Place Concrete section.

The blocking size shall be of the dimensions indicated on the Drawings, shall extend from the fitting to solid, undisturbed earth, and shall be installed so that all joints are accessible for repair. If adequate support against undisturbed ground cannot be obtained, restrained joints shall be installed to provide the necessary support. If the lack of suitable solid vertical excavation face is due to improper trench excavation, restrained joints shall be furnished and installed by and at the expense of Contractor.

Reaction blocking, anchorages, or other supports for fittings installed in fills or other unstable ground, installed above grade, or exposed within structures, shall be provided as indicated on the Drawings.

All ferrous metal clamps, rods, bolts, and other components of tapping saddles, reaction anchorages, or joint harness, subject to submergence or in contact with earth or other fill material and not encased in concrete, shall be protected from corrosion as specified in the Corrosion Protection paragraph of this section.

PART 2 - ABOVE SURFACE FACILITIES

3-20. PRESSURE AND LEAKAGE TESTS.

After installation, pipe and fittings shall be subjected to a pressure test and a leakage test. The Contractor shall provide all necessary pumping equipment; piping connections between the piping and the nearest available source of test water; pressure gauges; and other equipment, materials, and facilities necessary for the tests. The minimum test pressure shall be 120 psi or as indicated on the Drawings

All pipe, fittings, valves, pipe joints, and other materials which are found to be defective shall be removed and replaced with new and acceptable materials, and the affected portion of the piping shall be retested by and at the expense of Contractor.

All joints shall be watertight and free from visible leaks. Any visible leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.

3-21. CLEANING AND DISINFECTION. The interior of all pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean of any foreign matter until the work has been accepted. All joint contact surfaces shall be kept clean until the joint is completed.

End of Section

PART 2 - ABOVE SURFACE FACILITIES

Schedule 40 05 19-S01

Ductile Iron Pipe Schedule

Size		Location and Service	ANSI/AWWA Class	Lining Material
in.	mm			
24		Piping to Deep Injection Well No.2	CL53	Cement Mortar
20		Piping to Deep Injection Well No.2	CL53	Cement Mortar

End of Document

PART 2 - ABOVE SURFACE FACILITIES

Section 40 05 51.13

VALVE INSTALLATION

PART 1 - GENERAL

1-1. SCOPE. This section covers the installation of new valves and actuators purchased by Contractor as part of this Work or purchased by others under the valve specifications. The equipment to be furnished by others for installation by Contractor is identified in the applicable valve schedules.

Cleaning, disinfection, pressure and leakage testing, insulation, and pipe supports are covered in other sections.

The following specification sections are applicable to valves to be installed:

Title

Miscellaneous Ball Valves
Check Valves
Backflow Preventers
AWWA Butterfly Valves
AWWA Ball Valves
Resilient-Seated Gate Valves
Air Valves
Miscellaneous Valves

1-2. GENERAL. Equipment installed under this section shall be erected and placed in proper operating condition in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

Any valves and actuators that are identified as being provided by others will be furnished complete for installation by Contractor. Technical specifications under which the equipment will be purchased are available.

1-2.01. Coordination. When manufacturer's field services or installation check services are provided by the valve manufacturer, Contractor shall coordinate the services with the valve manufacturer. Contractor shall give Engineer written notice at least 30 days prior to the need for manufacturer's field services.

Submittals for equipment that will be furnished by others under each procurement contract will be furnished to Contractor upon completion of review by Engineer. Contractor shall review equipment submittals and coordinate with the requirements of the Work and the Contract Documents. Contractor accepts

PART 2 - ABOVE SURFACE FACILITIES

sole responsibility for determining and verifying all quantities, dimensions, and field construction criteria.
Flanged connections to valves including the bolts, nuts, and gaskets are covered in the appropriate pipe specification section. Valve ends shall match piping.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3-1. INSPECTION. All valves and accessories shall be inspected for damage and cleanliness before being installed. Any material damaged or contaminated in handling on the job shall not be used unless it is repaired and re-cleaned to the original requirements by Contractor. Such material shall be segregated from the clean material and shall be inspected and approved by Owner or his representative before its use.

3-2. INSTALLATION.

3-2.01. General. Valves shall be installed with sufficient clearance for proper operation of any external mechanisms, and with sufficient clearance to dismantle the valve for in-place maintenance. Installation shall be in accordance with the valve manufacturer's recommendations.

Unless otherwise indicated on the Drawings or specified, all valves installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the finish floor shall be installed with their operating stems vertical. Valves installed in horizontal runs of piping having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above the finish floor shall be installed with their operating stems horizontal. If adjacent piping prohibits this, the stems and operating handwheel shall be installed above the valve horizontal centerline as close to horizontal as possible. Valves installed in vertical runs of pipe shall have their operating stems oriented to facilitate the most practicable operation, as reviewed by Engineer.

3-2.02. Installation Checks. When specified in the valve sections, the valve manufacturer will provide installation checks. For installation checks, the manufacturer's field representative will inspect the valve installation immediately following installation by Contractor. The manufacturer's representatives will revisit the site as often as necessary to ensure installation satisfactory to Owner.

Contractor shall perform no work related to the installation or operation of materials or equipment furnished by others without direct observation and

guidance of the field representative, unless Engineer and manufacturer furnishing such materials concur otherwise.

3-2.03. AWWA Butterfly Valves. Butterfly valves shall be installed with the shaft horizontal unless otherwise necessary for proper operation or as acceptable to Engineer.

Whenever an actuator must be removed to permit installation of a valve, the actuator shall be promptly reinstalled and shall be inspected and readjusted by a representative of the valve manufacturer.

3-2.04. Check Valves.

3-2.04.01. Lift Check Valves. Not Used.

3-2.04.02. Swing Check Valves. Install valves oriented for the correct flow direction. Only valves designed for vertical installation shall be installed in vertical piping.

3-2.04.03. Low Pressure Air Service Check Valves. Not Used.

3-2.05. Plug Valves.

3-2.05.01. Eccentric Plug Valves. Eccentric plug valves shall be installed with the shaft horizontal and the plug in the upper half of the valve body. Valves in horizontal wastewater, sludge, or scum lines shall be installed with the seat on the upstream end. Valves in all vertical piping shall be installed with the seat at the upper end of the valve.

3-2.06. Resilient Seated Gate Valves.

3-2.06.01. Resilient Seated Gate Valves. Valves shall be handled and installed in accordance with the recommendations set forth in the Appendices to ANSI/AWWA C509 and C515 and with the recommendations of the manufacturer.

3-2.07. Air Release and Combination Air Valves. The exhaust from each valve shall be piped to a suitable point acceptable to Engineer. Air release valve exhaust piping leading to a trapped floor drain shall terminate at least 6 inches above the floor.

3-2.08. Hydrants. Not used.

3-2.09. Valve Boxes. Valve boxes shall be set plumb. Each valve box shall be placed directly over the valve it serves, with the top of the box brought flush with

PART 2 - ABOVE SURFACE FACILITIES

the finished grade. After each valve box is placed in proper position, earth fill shall be placed and thoroughly tamped around the box.

3-3. VALVE ACTUATORS. Valve actuators and accessories shall be factory mounted on the valve, calibrated, and tested by the valve or actuator manufacturer.

3-4. FIELD QUALITY CONTROL.

3.4.01. Field Testing. After installation, all valves shall be tested in accordance with the Pipeline Pressure and Leakage Testing section.

3-4.01.01. Pressure Tests. Pressure testing shall be in accordance with the Pipeline Pressure and Leakage Testing section.

3-4.01.02. Leakage Tests. All valves shall be free from leaks. Each leak that is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor. This requirement applies whether pressure testing is required or not.

3-5. ADJUSTING. After installation, the opening and closing time shall be adjusted as needed for each pneumatic, hydraulic and electric actuated valve.

End of Section

PART 2 - ABOVE SURFACE FACILITIES

Section 40 05 57

VALVE AND GATE ACTUATORS

PART 1 - GENERAL

1-1. SCOPE. This section covers furnishing manual and powered valve and gate actuators and accessories as specified herein.

1-2. GENERAL. Equipment provided under this section shall be fabricated and assembled in full conformity with Drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

Actuators shall be furnished with all necessary parts and accessories indicated on the Drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of actuators.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Governing Standards. Except as modified or supplemented herein, electric motor actuators shall conform to applicable requirements of ANSI/AWWA C542.

Except as modified or supplemented herein, actuators for butterfly and eccentric plug valves shall conform to the applicable requirements of ANSI/AWWA C504.

Except as modified or supplemented herein, manual actuators for ball valves shall conform to the applicable requirements of ANSI/AWWA C507.

1-2.03. Power Supply. Power supply to electric actuators will be as indicated in the valve and gate schedules.

1-2.04. Marking. Each actuator shall be marked with the manufacturer's name, model number, and the country of origin. An identifying serial number shall be stamped on a corrosion-resistant plate attached to the actuator.

1-2.05. Temporary Number Plates. Each actuator shall be factory tagged or marked to identify the actuator and the applicable valve or gate by number or service as indicated in the valve or gate schedule.

PART 2 - ABOVE SURFACE FACILITIES

1-3. SUBMITTALS. Complete drawings, details, and specifications covering the actuators and their appurtenances shall be submitted in accordance with the Submittal Procedures section. Submittal drawings shall clearly indicate the country of origin of each actuator and its components.

Submittal drawings shall include separate wiring diagrams for each electrically operated or controlled actuator and the electrical control equipment. Each actuator drawing shall be identified with the respective valve number or name.

For networked valve actuators, information on the available input and output assemblies shall be submitted for the protocol(s) specified to be provided. The submittal shall identify the version of the selected network protocol for which the device has been tested and certified.

For electric or cylinder actuators, certified copies of reports covering proof-of-design testing of the actuators as set forth in Section 5 of ANSI/AWWA C542 respectively, together with an affidavit of compliance as indicated in Section 6.3 of ANSI/AWWA C542 respectively, shall be submitted to Engineer before the actuators are shipped.

PART 2 - PRODUCTS

2-1. PERFORMANCE AND DESIGN REQUIREMENTS.

2-1.01. General. Actuators and appurtenances shall be designed for the conditions and requirements as indicated in the respective valve and gate sections.

Liberal factors of safety shall be used throughout the design, especially in the design of parts subject to intermittent or alternating stresses. In general, working stresses shall not exceed one-third of the yield point or one-fifth of the ultimate strength of each material.

2-1.02. Valve Actuators. Each actuator shall be designed to open or close the valve under all operating conditions. Actuators shall be designed for the maximum pressure differential across the valve and maximum velocities through the valve where indicated in the respective valve schedules.

Valve actuators shall be provided and adjusted by the valve manufacturer. Actuator mounting arrangements and positions shall facilitate operation and maintenance and shall be determined by the valve manufacturer unless indicated otherwise on the Drawings or directed by Engineer.

2-1.03. Gate Actuators. Not Used.

2-1.04. Limit Switches. Limit switches shall be provided as indicated on the Drawings or in the valve and gate schedules.

For manual type actuators, each limit switch shall be heavy duty type, with a cast NEMA Type 4 enclosure, a spring return roller lever, and four isolated contacts (two normally open and two normally closed) rated 10 amperes at 120 to 480 volts ac and 5 amperes at 125 volts dc. The switches shall be Allen Bradley "802T" or Square D "9007 Type C".

Limit switches for intelligent and standard electric actuators shall be as indicated in their respective paragraphs.

2-2. MATERIALS. Except as modified or supplemented herein, materials used in the manufacture of actuators shall conform to the requirements of the applicable governing standard(s).

2-3. VALVE MANUAL ACTUATORS.

2-3.01. General. Manual actuators of the types listed in the valve specifications or schedules shall be provided by the valve manufacturer.

Unless otherwise indicated or specified, each geared manual actuator shall be equipped with an operating handwheel.

The direction of rotation of the wheel, wrench nut, or lever to open the valve shall be to the left (counterclockwise). Each valve body or actuator shall have cast thereon the word "Open" and an arrow indicating the direction to open.

The housing of traveling-nut type actuators shall be fitted with a removable cover which shall permit inspection and maintenance of the operating mechanism without removing the actuator from the valve. Travel limiting devices shall be provided inside the actuator for the open and closed positions. Travel limiting stop nuts or collars installed on the reach rod of traveling-nut type operating mechanisms shall be field adjustable and shall be locked in position by means of a removable roll pin, cotter pin, or other positive locking device. The use of stop nuts or adjustable shaft collars which rely on clamping force or setscrews to prevent rotation of the nut or collar on the reach rod will not be acceptable.

Each actuator shall be designed so that shaft seal leakage cannot enter the actuator housing.

Valves for throttling service shall be equipped with an infinitely variable locking device or a totally enclosed gear actuator.

PART 2 - ABOVE SURFACE FACILITIES

Actuators shall produce the required torque with a maximum pull of 80 lbs on the lever, handwheel, or chain. Actuator components shall withstand, without damage, a pull of 200 lbs on the handwheel or chainwheel or an input of 300 foot-lbs on the operating nut.

2-3.02. Handwheels. Handwheel diameters shall be at least 8 inches but not more than 24 inches for 30 inch and smaller valves.

2-3.03. Chainwheels. Not Used.

2-3.04. Levers. Not Used.

2-3.05. Chain Levers. Not Used.

2-3.06. Wrench Nuts. Unless otherwise specified in the valve schedules or on the Drawings, wrench nuts shall be provided on all buried valves and on all valves that are to be operated through floor boxes. Unless otherwise directed by Owner, all wrench nuts shall comply with Section 4.4.13 of ANSI/AWWA C500. At least two operating keys shall be furnished for operation of the wrench nut operated valves.

2-3.07. Operating Stands. Operating stands shall be provided in the locations indicated on the Drawings or as indicated in the valve and gate schedules. Operating stands shall support the handwheel approximately 36 inches above the floor. A sleeve made from standard weight galvanized steel pipe shall be provided for the opening in the floor beneath each operating stand. When stems are 10 feet or longer, a suitable thrust bearing shall be provided in each operating stand to carry the weight of the extension stem.

2-3.08. Wall Brackets. Wall brackets shall be provided to support manual actuators in the locations indicated on the Drawings or in the respective valve schedules. The horizontal face of the bracket shall be predrilled to accept the actuator and the stem without modification. The top of the bracket shall extend sufficiently to bear on and transfer thrust loads to the top of the supporting structure.

2-4. GATE MANUAL ACTUATORS. Not used.

PART 2 - ABOVE SURFACE FACILITIES

2-5. ELECTRIC ACTUATORS.

2-5.01. General.

a. Where specified on the Drawings and for butterfly valves and eccentric plug valves, electric actuators shall be quarter-turn type. They shall be Harold Beck & Sons, no equal.
b. Comply with AWWA C542.
c. Actuators for Butterfly Valves: 120 Volt, 1 Phase, 60 Hz power supply.
d. Actuators for Valves 3-inch and Smaller: 120 Volt, 1 Phase, 60 Hz power supply.
e. Actuators for slide gates: 480 Volt, 3 Phase, 60 Hz power supply.
f. Electric actuators for modulating service shall be Harold Beck & Sons, no equal.
g. Electric actuators for explosion-proof service shall be Harold Beck & Sons, no equal.

Harold Beck & Sons Electric actuators shall pair the valve up at their plant for its configuration. LCD mounted on the actuator housing. The display language shall be English.

Electric actuators shall be provided with the capability to connect to a PLC network over which valve digital and analog signals commands and shall also communication with HART Version 7.

Each electric actuator shall have a motor, gearing, handwheel, configurable output relays, lubricants, wiring, and terminals. Each actuator shall be constructed as a self-contained unit with a ductile iron or aluminum alloy housing of a type as indicated in the valve and gate schedules and shall be integrally assembled on the applicable valve or gate by the Harold Beck & Sons manufacturer. Housings shall have seals, one on the controls compartment and one on the terminal cover.

Actuators shall be designed to cycle the valve or gate from the fully open to the fully closed position or the reverse in approximately time as needed for the process or as indicated in the valve and gate schedules.

2-5.02. Motors and Drives.

a. Design for valve actuation service with 120 Volt, 1 Phase, 60 Hertz power supply.
b. Synchronous inductor no-burnout motor that can withstand 60 starts/stops per minute or a temporary stall condition without overheating. The motor design shall be such that electrical and thermal overloads are not required.

c. Motor bearings shall be maintenance-free. Motor shall be non-coasting with instant magnetic braking and shall be self-locking and self-releasing without the use of a separate brake winding, mechanical brake, or worm gear mechanism. The control drive shall be designed to stay in place upon loss of power and shall be capable of holding a load equal to at least 200% of its rated output without AC power. The drive motor shall be TENV with Class H insulation.
d. Stall torque shall be self-limiting, not exceeding two- and one-half times the rated torque; torque switches shall not be required. Drive shall operate CW or CCW on increasing signal. Gear trains shall have high-efficiency spur gears constructed of heat-treated alloy steel or ductile iron only, no worm gears. Readily available gear modules shall provide a range of torque and timing combinations within the drive's rated capacity and be field interchangeable. Drive train parts shall be lubricated with a premium, heavy-duty lithium-based lubricant. No oil baths shall be used for lubrication. Control drives shall be able to operate in any mounting orientation.

2-5.03. Design Travel Rate.

a. Quarter Turn Valves: 30 seconds per 1 foot of throat diameter.

2-5.04. Manual Operation.

a. Handwheel, which does not rotate during motor operation.
b. Output contact with declutch mechanism to indicate manual operation.
c. Utilize the actuator worm shaft/worm wheel to maintain self-locking gearing and to facilitate the changeover from motor to manual operation when the actuator is under load. Do not use designs that bypass the actuator worm gear or break valve load at the worm gear.
d. Automatic return from manual to motor operation upon starting the motor.
e. Manual operation capable of the seized motor.

2-5.05. Local Electrical Operation. A five-position, drive-mounted electric hand switch to permit local electrical operation of the unit for control adjustment or the loss of control signal. With the hand switch in AUTO mode, the drive shall respond to remote control signals automatically. Auxiliary contacts on the hand switch shall be provided for remote indication when the switch is in AUTO.

2-5.06. Wiring and Terminals.

a. Tropical grade insulated stranded cable of appropriate size for the control and 3-phase power.
b. Include a removable plug and socket head for termination of all external wiring. Include actuators without plug and socket terminal connections

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having power and control disconnect switches for ease of maintenance and safety.

2-5.07. Controls.

a. Microprocessor: Based with mechanically and electronically interlocked reversing contactors for Open/Close duty and solid-state contactors for modulating duty.
b. Local/Off /Remote Selector Switch and Open/Stop/Close Pushbuttons: Mount on actuator face with red and green indication lights for open/close and amber for fault.
c. Remote On/Off Service: Actuator accepts one remote signal to open and a second remote signal to close.
d. Modulating Service: When in remote mode, the actuator provides control through an integral, digital control module which positions the drive in proportion to a 4-20 mA control input signal. The control module shall be capable of initiating shaft movement in steps down to 0.1°. Upon loss of input signal, the drive shall be field configurable to move to any predetermined position. Actuators for open/close service may use a 120/1/60 discrete contact closure signal to energize the motor directly without any electronics in the actuator required. Modulating actuator shall also be equipped with a contactless position sensing device and be capable of providing an isolated 4–20 mA feedback signal in linear proportion to the 0-100% valve position. The sensing device shall have infinite resolution.
e. Monitoring Relays: Remotely indicate fault signal for indication of power failure, phase failure, thermal switch tripped, torque switch tripped between travel stops, and Local-Off-Remote selector switch position.
f. Transmitter: Have easily accessible zero and span adjustment potentiometers.

2-5.08. Position Indication. Continuous mechanical dial indication of valve and gate position in step with the actuator at all times in both the hand wheel and motor operation. For modulating applications, graduations on the mechanical dial position indicator are to be 0 to 100 percent scale.

2-5.09. Limit Switches. Two SPDT over-travel limit switches shall be provided for over-travel protection. In addition, the drive shall have two auxiliary SPDT switches, adjustable over the full range of travel but set for remote indication of full open and full close status. Switches shall be rated for 6 amps at 120 volts AC. The drive shall have integral mechanical stops capable of limiting the travel of the drive and load. Drive shall also be provided with a dry contact for remote indication of actuator trouble, including loss of power, loss of control signal, over travel, and/or over torque with LED indicator lights on the actuator to indicate which condition has caused the alarm.

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2-5.10. 480 Volt Powered Actuators.

2-5.10.01. General. Three phase 60 hz supply rated, self-contained, totally enclosed with motor, integral reversing starters, local controls, reduction gearing, limit switch gearing, limit switches, control power transformer, torque switches, bored and keyed drive sleeve for non-rising stems, declutch lever, auxiliary Handwheel, and local position indication.

Separately seal motor and control compartments with space heaters in limit switch, motor, and control compartments.

Suitable for indoor and outdoor use, fully functional in an ambient temperature range from 40 to 140 degrees F at 100 percent relative humidity.

Size to guarantee full travel, seating, and unseating torque or thrust as specified by the valve or gate manufacturer.

Size to provide the torque required to operate the valve or gate at 90 percent of nominal voltage.

2-5.10.02. Design Travel Rate.

a. Gate Valves and Slide Gates: 12 inches per minute.
b. Globe Valves: 4 inches per minute.
c. Quarter Turn Valves: 30 seconds per 1 foot of throat diameter.

2-5.10.03. Enclosure. Cast iron construction, 0-ring sealed, watertight to NEMA 4X/6 and submersible to IP 68-8, 26 feet for 96 hours per EN 60529.

a. Operate successfully a minimum of 10 full cycles under submersion.
b. Where required on Valve and Gate Schedule, certified explosion proof for Class I, Division 1 and 2, Groups C and D.
c. External Fasteners: Type 316 stainless steel.
d. Include an anti-condensation heater suitable for continuous operation with alarm output to indicate heater failure.

2-5.10.04. Motors.

a. High-starting torque; low stall torque; low inertia, designed and built by actuator manufacturer.
b. Embed thermistor in each motor winding for thermal protection.
c. Insulation: Class F, with a duty rating of at least 15 minutes at 40 degrees F ambient temperature.
d. Allow motor removal without loss of lubricant.

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e. Hardware to ensure motor runs with correct rotation for the required direction of va travel regardless of power supply connection sequence.

2-5.10.05. Motor Protection.

a. De-energize without damage in the event of a stall condition when attempting to move a jammed valve.
b. De-energize in the event of an over-torque condition.
c. Imbed a minimum of three thermal devices in motor windings to de-energize the motor in case of overheating.
d. Lost phase protection algorithm

2-5.10.06. Gear Train.

a. Grease filled, O-ring sealed in cast or ductile iron gear case.
b. Suitable for operation in any orientation.
c. Hardened, machine-cut steel gears and precision machined alloy bronze worm gear.
d. Reduction gearboxes as specified in Paragraph “Gear-Assisted Manual Valve Actuators.”

2-5.10.07. Manual Operation.

a. Handwheel, which does not rotate during motor operation.
b. Output contact with declutch mechanism to indicate manual operation.
c. Utilize actuator worm shaft/worm wheel to maintain self-locking gearing and to facilitate the changeover from motor to manual operation when the actuator is under load. Do not use designs that bypass the actuator worm gear or break valve load at the worm gear.
d. Automatic return from manual to motor operation upon starting the motor.
e. Manual operation capable with the seized motor.

2-5.10.08. Position and Torque Calibration.

a. Sensing by an absolute encoder using hall effect sensors. Incremental encoders requiring batteries to retain settings upon loss of power are not acceptable. Settings stored in permanent non-volatile memory.
b. Torque and travel adjustment parameters:
    1) Position Setting Range: 1 to 500 turns, with a resolution of 2.81 degrees and accuracy to 5.0 degrees of actuator output.
    2) Torque Setting: 40 to 100 percent of rated torque.
c. Torque switch bypass for the torque sensing system to inhibit torque switch trip during unseating or during starting in mid-travel against high inertia loads.

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2-5.10.09. Wiring and Terminals.

a. Tropical grade insulated stranded cable of appropriate size for the control and 3-phase power.
b. Include a removable plug and socket head to terminate all external wiring. Include actuators without plug and socket terminal connections having power and control disconnect switches for ease of maintenance and safety.

2-5.10.10. Controls.

a. Microprocessor: Based with mechanically and electronically interlocked reversing contactors for Open/Close duty and solid-state contactors for modulating duty.
b. Local/Off /Remote Selector Switch and Open/Stop/Close Pushbuttons: Mount on actuator face with red and green indication lights for open/close and amber for fault.
c. Remote On/Off Service: Actuator accepts one remote signal to open and a second remote signal to close.
d. Modulating Service: When in remote mode, the actuator accepts a 4 to 20 mA DC position control signal and position valve 0 to 100 percent of travel in proportion to control the signal.
e. Monitoring Relays: Remotely indicate fault signal for indication of power failure, phase failure, thermal switch tripped, torque switch tripped between travel stops, and Local-Off-Remote selector switch position.
f. Gear Actuated Position Transmitter: On modulating duty actuator that is a two-wire device, produces 4 to 20 mA DC signal proportional to 0 to 100 percent travel.
g. Transmitter: Have easily accessible zero and span adjustment potentiometers.
h. DC Power Supply: Integral with operator and powered from 110-volt AC internal transformer. Positioner board to provide repeatable accuracy to 0.25 percent of span and have separate trim pots for zero, span, and dead band adjustment.

2-5.10.11. Position Indication. Continuous mechanical dial indication of valve and gate position in step with the actuator at all times in both the hand wheel and motor operation. For modulating applications, graduations on the mechanical dial position indicator to be 0 to 100 percent scale.

2-5.10.12. Limit Switches.

a. Adjustable type to trip at any point between fully opened and fully closed.
b. Mid-travel Switches: Provide as noted.

c. Do not allow the set position to be lost if over-travel occurs in either manual or electric modes of operation.
d. Two independent and fully adjustable rotary-type position limit switches, each with 2-5.25. Amp DPDT contacts for remote open/close position indication.

2-5.10.13. Torque Switches. Actuator with adjustable torque switches and be responsive to load encountered in either direction of travel.

2-5.10.14. Terminal Compartment.

a. Separate from the inner electrical components of the actuator with a watertight seal.
b. Three threaded cable entries.
c. Stud-type Terminals: Embed in a terminal block of high tracking-resistance compound.
d. Three-phase Power Terminals: Shroud from control terminals by means of an insulating cover.

2-5.10.15. Remote Control Stations. Where indicated, remote control stations for actuators located below the operating floor or located more than 7 feet above the operating floor.

2-5.11. Remote Electric Actuator Control Station. Not Used.

2-6. STANDARD ELECTRIC ACTUATORS. Not used.

2-7. HYDRAULIC CYLINDER ACTUATORS. Not used.

2-8. AIR CYLINDER ACTUATORS. Not used.

2-9. VANE TYPE PNEUMATIC ACTUATORS. Not used.

2-10. AIR-OIL CYLINDER ACTUATORS. Not used.

2-11. PORTABLE ELECTRIC ACTUATORS. Not used.
2-12. PORTABLE HYDRAULIC ACTUATORS. Not used.

2-13. ACTUATOR ACCESSORIES.

2-13.01. Extension Stems. Extension stems and stem guides shall be furnished when indicated in the respective valve schedules, indicated on the Drawings, or otherwise required for proper valve operation. Extension stems shall be of solid steel and shall be not smaller in diameter than the stem of the actuator shaft. Extension stems shall be connected to the actuator with a single Lovejoy

PART 2 - ABOVE SURFACE FACILITIES

"Type D" universal joint with grease-filled protective boot. All stem connections shall be pinned.

At least two stem guides shall be furnished with each extension stem, except for buried valves. Stem guides shall be of cast iron, bronze bushed, and adjustable in two directions. Stem guide spacing shall not exceed 100 times the stem diameter or 10 feet, whichever is smaller. The top stem guide shall be designed to carry the weight of the extension stem. The extension stem shall be provided with a collar pinned to the stem and bearing against the stem thrust guide.

2-13.02. Position Indicators. Unless otherwise specified, each valve actuator shall be provided with a position indicator to display the position of the plug or disc relative to the body seat opening.

Each actuator for butterfly valves, except where located in manholes, buried, or submerged, shall have a valve disc position indicator mounted on the end of the valve shaft. A disc position indicator shall also be provided on each operating stand or the actuator mounted thereon.

2-13.02.01. Position Indicators for Buried Actuators. Not used.

2-13.03. Floor Boxes. Not Used.

2-13.04. Torque Tubes. Torque tube shall utilize pipe rather than solid shafting between the valve input shaft and the output shaft of the valve floorstand operator. An adjustment of 2 inches [50 mm] shall be provided in the torque tube installation. Torque tube shall be coated with the same material as the submerged valve.

2-13.05. Valve Boxes. Not used.

2-14. SHOP PAINTING. All ferrous metal surfaces, except bearing and finished surfaces and stainless steel components of valve actuators and accessories, shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field painting.

The following surfaces shall be painted:

Polished or Machined Surfaces	Rust-preventive compound.
Other Surfaces	Epoxy.
Actuators and Accessories	Universal primer.

PART 2 - ABOVE SURFACE FACILITIES

PART 3 - EXECUTION

3-1. INSTALLATION. Actuators will be installed on the valves in accordance with the Valve Installation section and on gates in accordance with the Gate Installation section.

3-2. NETWORK SETUP. A manufacturer's representative for the intelligent electric actuator manufacturer shall inspect all network terminations for conformity with the manufacturer's recommended methods of terminating the network to each actuator, and shall notify the Contractor of any wiring modifications required. The manufacturer's representative shall also set addresses for each valve and prove communication over the network. The valve manufacturer shall furnish the required information to the control system supplier that will allow the specified control and monitoring for each intelligent electric actuator.

The Contractor shall coordinate these activities between the actuator manufacturer and the control system supplier.

End of Section

PART 2 - ABOVE SURFACE FACILITIES

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Section 40 05 61.23

RESILIENT-SEATED GATE VALVES

PART 1 - GENERAL

1-1. SCOPE. This section covers furnishing resilient-seated AWWA gate valves for clear water service and as indicated in the Resilient-Seated Gate Valve Schedule. Resilient-seated gate valves shall be furnished complete with actuators and accessories as specified herein, as indicated in the valve schedule, and as specified in the Valve and Gate Actuator section.

1-2. GENERAL. Equipment provided under this section shall be fabricated and assembled in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer unless exceptions are noted by Engineer.

Valves shall be furnished with all necessary parts and accessories indicated on the Drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of valves.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Governing Standard. Except as modified or supplemented herein, all resilient-seated gate valves shall conform to the applicable requirements of ANSI /AWWA C509.

1-2.03. Temporary Number Plates. Not used.

1-2.04. Identification. Resilient seated gate valves shall be tagged in accordance with the Equipment and Valve Identification section.

1-3. SUBMITTALS. Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the Submittals Procedures section.

All valves shall be tested in accordance with Section 5 of the governing standard. Certified copies of the results of all tests, together with an affidavit of compliance as indicated in Section 6.3 of the governing standard, shall be submitted to Engineer before the valves are shipped.

PART 2 - ABOVE SURFACE FACILITIES

PART 2 - PRODUCTS

2-1. MATERIALS. Except as modified or supplemented herein, materials used in the manufacture of resilient-seated gate valves shall conform to the requirements of the governing standard.

2-1.01. Bronze Components. All bronze valve components in contact with liquid shall contain less than 16 percent zinc. All aluminum bronze components in contact with liquid shall be inhibited against dealuminization in accordance with Section 4.2.3.5.4 of ANSI/AWWA C509.

2-1.02. Gaskets. Gaskets shall be free of asbestos and corrosive ingredients.

2-1.03. Shop Coatings.

Epoxy	
For Raw or Treated Water Service in potable water facilities (NSF certified systems)	PPG Amercoat "Amerlock 400 High-Solids Epoxy ", Carboline "Carboguard 891", Sherwin-Williams “Macropoxy 646NSF” or Tnemec "Series N140 Pota-Pox Plus".
For Liquid Service other than in potable water facilities	PPG Amercoat "Amerlock 385 Epoxy", Carboline "Carboguard 890", Sherwin-Williams “Macropoxy 646” or Tnemec "Series N69 Hi-Build Epoxoline II".
Rust-Preventive Compound	As recommended by manufacturer.
Universal Primer	As recommended by manufacturer

2-2. VALVE CONSTRUCTION.

2-2.01. Ends. Valve ends shall be compatible with connecting piping and shall be as indicated in the Resilient-Seated Gate Valve Schedule. Except as modified or supplemented herein, the ends shall conform to the applicable requirements of the governing standard.

Flanges shall be finished to true plane surfaces within a tolerance limit of 5 mils. The finished face shall be normal to the longitudinal valve axis within a maximum angular variation tolerance of 0.002 inch per inch of flange diameter.

2-2.02. Stem Seals. Valve stem shall be the rising type.The type of stem shall be as indicated in the Resilient-Seated Gate Valve Schedule. Stuffing box stem seals shall be provided for all gate valves with rising stems (outside screw-and-yoke type). O-ring stem seals shall be provided for all buried gate valves, and for all gate valves with non-rising stems.

2-2.03. Rotation. The direction of rotation of the handwheel or the wrench nut to open the valve shall be to the left (counterclockwise).

2-2.04. Shop Coatings. All interior and exterior ferrous metal surfaces of valves and accessories shall be shop coated for corrosion protection. Except as specified below, the valve manufacturer's standard fusion-bonded coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field coating.

Surfaces shall be coated as follows:

Unfinished Surfaces	
Interior Surfaces	Epoxy.
Exterior Surfaces of Valves to be Buried or Installed in Manholes or Valve Vaults	Epoxy.
Exterior Surfaces of Valves to be Submerged	Epoxy.
Exterior Surfaces of All Other Valves	Universal primer.
Polished or Machined Surfaces	
Flange Faces	Rust-preventive compound.
Other Surfaces	Epoxy.

Alternatively, the manufacturer’s standard coating may be used and the interior surfaces of each valve shall be subjected to a nondestructive holiday test in accordance with ASTM G62, Method A, and shall be electrically void-free.

Interior coatings shall comply with ANSI/AWWA C550 and shall be free of holidays. The total dry film thickness of shop-applied coatings shall be not less than:

Type of Coating	Minimum Dry Film Thickness
Epoxy	10mils.
Universal Primer	3 mils.

2-3. VALVE ACTUATORS. Requirements for valve actuators shall be as specified in the Valve and Gate Actuator section and as indicated in the Resilient-Seated Gate Valve Schedule.

PART 2 - ABOVE SURFACE FACILITIES

2-4. ACCESSORIES. When the Drawings or the Resilient-Seated Gate Valve Schedule indicate the need for extension stems, stem guides, position indicators, floor boxes, valve boxes, or operating stands, refer to the Valve and Gate Actuator section.

PART 3 - EXECUTION

3-1. INSTALLATION. Valves shall be installed in accordance with Valve Installation section.

3-1.01. Installation Check. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation in accordance with the Startup Requirements section, and shall revisit the jobsite as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.

The manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.

All costs for these services shall be included in the contract price.

End of Section

1.010	1.020	1.031	1.040	1.050	1.060	2.010	3.010	3.020	3.030	3.040
Tag Number	**Size**	**Application**	**Type of Installation(1)**	**Ends(2)**	**Stem(3)**	**Type of Manual Actuator(4)**	**Extension Stems**	**Floor Boxes**	**Cast Iron Operating Stands**	**Fabricated Steel Operating Stands**
	(in)									
80-V-11C	4	CW	IP	F	OS&Y	HW				
80-V-11D	24	CW	IP	F	OS&Y	HW				
80-V-16	4	CW	IP	F	OS&Y	HW				
80-V-15	24	CW	IP	F	OS&Y	HW				
80-V-17	20	CW	IP	F	OS&Y	HW				

PART 2 - ABOVE SURFACE FACILITIES

Notes:

(1)	Abbreviations for installation types are as follows:
B4	Buried, depth of 4 feet [1.2 m] or less
B20	Buried, depth greater than 4 feet [1.2 m] but 20 feet [6.1 m] or less
B	Buried, depth greater than 20 feet [6.1 m], actual depth of xx feet (Bxx)
SV20	Submerged or vaulted, depth 20 feet [6.1 m] or less
SV	Submerged or vaulted, depth greater than 20 feet [6.1 m], actual depth of xx feet(SVxx)
IP	In plant
(2)	Abbreviations for types of ends:
F	Flanged
MJ	Mechanical joint
P	Push-on joint
(3)	Abbreviations for types of stems:
NRS	Non-rising stem
OS&Y	Outside screw-and-yoke
(4)	Abbreviations for types of manual actuators:
WN	Wrench nut
HW	Handwheel

END OF SCHEDULE

PART 2 - ABOVE SURFACE FACILITIES

Section 40 05 62.16

ECCENTRIC PLUG VALVES

PART 1 - GENERAL

1-1. SCOPE. This section covers furnishing all eccentric plug valves as required by the Work and as indicated in the Eccentric Plug Valve Schedule. Plug valves shall be furnished complete with actuators and accessories as specified herein, as indicated in the schedule, and as specified in the Valve and Gate Actuators section.

1-2. GENERAL. Equipment provided under this section shall be fabricated and assembled in full conformity with Drawings, Specifications, engineering data, and instructions, unless exceptions are noted by Engineer.

Valves shall be furnished with all necessary parts and accessories indicated on the Drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of valves.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment and materials furnished under this section. If the requirements in this section are different from those in the General Equipment Stipulations, the requirements in the section shall take precedence.

1.2.02. Governing Standard. Except as modified or supplemented herein, all eccentric plug valves and manual actuators shall conform to the applicable requirements of ANSI/AWWA C517.

1-2.03. Marking. Each valve shall be marked with the manufacturer's name, valve size, and pressure rating, and the country of origin of the body casting. All markings shall be cast on the exterior surface of the valve body. An identifying serial number shall be stamped on a corrosion-resistant plate attached to the valve body.

1-2.04. Temporary Number Plates. Not used.

1-2.05. Identification. Eccentric plug valves shall be identified in accordance with the Equipment and Valve Identification section.

1-3. SUBMITTALS. Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the Submittals Procedures section.

PART 2 - ABOVE SURFACE FACILITIES

Certified copies of test reports for tests described in Section 5. of governing standard, with an affidavit of compliance as indicated in Section 6.3 of governing standard, shall be submitted to Engineer before the valves are shipped.

PART 2 - PRODUCTS

2-1. ACCEPTABLE PRODUCTS. Eccentric plug valves furnished under this section shall be manufactured by DeZurik, Pratt, Milliken, Val-Matic, Clow, or Victaulic, without exception.

2-2. MATERIALS. Materials used in the manufacture of eccentric plug valves shall be as indicated:

Body	Cast iron, ASTM A126, Class B; or ductile iron, ASTM A536, Grade 65-45-12.
Plug	Cast iron, ASTM A126, Class B; or ductile iron, ASTM A536, Grade 65-45-12.
Plug Facing	Chloroprene, Neoprene or Buna-N, 70 Type A durometer hardness in accordance with ASTM D2240.
Body Seat	Welded nickel overlay.
Upper and Lower Trunnion Bearings	Sleeve type; stainless steel or bronze.
Upper Thrust Bearing	TFE, Nylatron, or Delrin.
Stem Seal	V-type packing or U-cups, Buna-N or TFE.

The following are acceptable shop coatings.

Epoxy

For Liquid Service other than in potable water facilities	PPG Amercoat “Amercoat 385 Epoxy”, Carboline “Carboguard 890”, Sherwin-Williams "Macropoxy 646".or Tnemec “Series N69 Hi-Build Epoxoline II”.

2-3. VALVE CONSTRUCTION.

2-3.01. Valve Body. The valve port area of each valve shall be at least 80 percent of the cross section of the connecting piping for 20 inch and smaller valves and 70 percent for 24 inch and larger valves. Valves shall provide tight shutoff at the rated pressure from either direction. An adjustable closed position plug stop shall be provided.

Each valve body shall be plainly marked to indicate the seat end. The actual length of 10 inch and smaller valves shall be within plus or minus 1/16 inch of the theoretical length. The actual length of 12 inch and larger valves shall be within plus or minus 1/8 inch of the theoretical length.

Valve ends shall be compatible with connecting piping. All valves shall have flanged, grooved or mechanical joint ends as indicated in the Eccentric Plug Valve Schedule. Flange diameter and drilling shall conform to ANSI B16.1, Class 125. Flanges shall be flat faced and finished to true plane surfaces within a tolerance limit of 0.005 inch. The finished face shall be normal to the longitudinal valve axis within a maximum angular variation tolerance of 0.002 inch per foot of flange diameter. Grooved end dimensions shall conform to ANSI/AWWA C606, Table 5, for rigid joints. When grooved end valves are to be installed in flanged piping, two flange adapters compatible with the connecting piping shall be provided with each valve. Mechanical joint ends shall conform to ANSI/AWWA C111/A21.11.

2-3.02. Plug. The plug shall be of one-piece construction and shall have a cylindrical or spherical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and the body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure.

2-3.03. Seats. Seats shall be cast in the body and shall have raised, welded-in nickel overlay not less than 0.050 inch thick on all surfaces in contact with the plug face. The overlay shall be at least 90 percent nickel and have a Brinell hardness of 200 or greater.

2-3.04. Stem Seals. The valve shaft shall be sealed by U-cups or by at least four self-adjusting chevron type packing rings.

2-3.05. Working Pressure. Valves shall be rated for a minimum working pressure as specified below, except where otherwise indicated in the Eccentric Plug Valve Schedule.

Size in inches	Pressure Rating in psi
3 to 12	175
14 to 72	150

2-4. VALVE ACTUATORS. Requirements for valve actuators shall be as specified herein, as indicated in the Eccentric Plug Valve Schedule, and as specified in the Valve and Gate Actuators section. Valve actuators types shall be manual, electric types.

Geared actuators shall be used for manually operated valves in the following applications:

a. For all 4 inch and larger buried valves.

b. For all 8 inch and larger valves.

c. For all 6 inch and larger valves in throttling or free discharge applications.

d. For all 6 inch and larger valves where the unseating pressure exceeds 25 psi.

e. For all chainwheel operated valves.

f. For all valves in gas service.

Geared actuators for plug valves unless otherwise specified or listed in the Eccentric Plug Valve Schedule shall be rated for a differential pressure across the valve, on the seating side, of 100 psi for 6 inch to 8 inch valves, 50 psi for 10 inch and larger valves, and 25 psi for gas service valves and a maximum flow of 8 ft/s.

2-5. SHOP PAINTING. All interior and exterior ferrous metal surfaces, except bearing and finished surfaces and stainless steel components of valves and accessories, shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field painting.

Surfaces shall be painted as follows:

Unfinished Surfaces	
Interior Surfaces	
For Liquid Service	Epoxy.
Exterior Surfaces of All Other Valves	Universal primer.
Polished or Machined Surfaces	Rust-preventive compound.

Interior epoxy coatings shall comply with ANSI/AWWA C550 and shall be free of holidays.

The total dry film thickness of shop-applied coatings shall be not less than:

Type of Coating	Minimum Dry Film Thickness
Epoxy	10 mils
Universal Primer	3 mils

2-6. ACCESSORIES. Requirements for extension stems and stem guides, position indicators, floor boxes, operating stands, and valve boxes shall be as indicated in the Eccentric Plug Valve Schedule and as specified in the Valve and Gate Actuators section.

2-7. TESTING. Except as modified herein, eccentric plug valves shall be tested in accordance with Section 5 of the governing standard. Each valve shall be performance tested in accordance with Section 5.2 of the governing standard. The leakage test shall be applied to the seating face of the plug (tending to unseat the plug) at the rated pressure of the valve.

Each valve shall be leak tight in both directions when closed by the actuator with the maximum differential pressure applied to the plug as specified herein and in the Eccentric Plug Valve Schedule.

PART 3 – EXECUTION

3-1. PRE-INSTALLATION CHECK. Valve 80-FCV-12 will be provided by Lee County. The contractor shall coordinate with the valve manufacturer and the actuator manufacturer to be present at the job site to conduct an assessment of the valve and certify it is in good operating condition before the valve is installed. The assessment of the valve shall be completed within 60 days after Contractor receives notice to Proceed with the Contracted work.

The valve shall be evaluated by an experienced, competent, and authorized representative of the manufacturers. The manufacturer representatives shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment before installation.

The manufacturer's representatives shall furnish a written report certifying that the equipment has been evaluated and in good operating condition.

If defects are found by the manufacturers, a price for modifications/repairs shall be provided to the Engineer and Contractor within two weeks of completing the evaluation work. The modifications/repairs and cost of the modifications/repairs will be reviewed and evaluated by the Owner and Engineer, after which direction will be provided to the Contractor.

3-2. INSTALLATION. Valves shall be installed in accordance with Valve Installation section.

3-2.01. Installation Check. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation in accordance with Startup Requirements section, and shall revisit the job site as often as necessary until any problems are corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.

The manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping and appurtenances; and has been operated under full load conditions and that it has operated satisfactorily.

All costs for these services shall be included in the contract price.

End of Section

COUNTY PROVIDED PLUG VALVE.
SEE 40 05 62.16 SECTION 3-1.

DeZURIK

Submittal Data Sheet
Date: 03/01/22

MCDADE WATERWORKS INC

PO BOX 16039

TAMPA, FL
33687-6039

TAG: FMB #1

P.O. 88547
FACTORY ORDER NO 146867
FACTORY SALES ORDER NO 626837
REV 0

PROJ. NAME LEE COUNT FT MYERS BEACH
WRF & FIESTA VILLAGE WR

Fact. ITEM	Cust. ITEM	QTY	DESCRIPTION	PART NO. **9719626**
2		1 ~~2~~	PEC,24,F1,CI,NBR,NBR,S40SD0*X*A33060	

Style	PEC	DeZURIK Eccentric Plug Valve, Rectangular Port (AWWA C517)
Size	24	24 Inch (600mm); (Standard Port), Stainless Steel Bearings, Welded-In Nickel Seat (Except Stainless Steel Bodies)
End Connection	F1	Flanged, Drilled to ASME Class 125/150
Body Material	CI	Cast Iron, ASTM A126, Class B; (.5"-12" Pressure Rating 175 psi (1210 kPa); (14"& larger Pressure Rating 150 psi (1030 kPa)
Packing	NBR	.5" - 3" Acrylonitrile-Butadiene Reinforced filler in a PTFE U-ring, -20 to 180° F. (-29 to 83° C.); 4" & Larger Acrylonitrile-Butadiene Reinforced V-type , -20 to 250° F. (-29 to 121° C.)
Plug Facing	NBR	Acrylonitrile-Butadiene; -20 to 180°F (-29 to 83°C)
Temp. Rating		180 degrees F.
Pressure Rating		150 psig
Coating	S40SD0	12 mils minimum (non-stainless steel parts) of Blue DeZURIK Epoxy (NSF Std. 61) on Interior and Exterior with Standard (SP10) surface prep
Act Type	X	Specified in Modifier Below
Modifier	A33060	BECK 11-433 ELECTRIC ACTUATOR WITH L-BRACKET - P/N 1453407

RELATED DOCUMENTS

Z018524	DWG INST PEC F1 BECK 11-430
A51407	DWG VALVE ASSY PEC F 20.5-36"

PART 2 - ABOVE SURFACE FACILITIES

Name:	DeZURIK Standard Paint (Epoxy)
Material:	Modified Polyamine Epoxy, Conforms to NSF/ANSI 61, NSF/ANSI 372, AWWA C550, AWWA C210 Standards
Colors:	Blue Standard (White, Beige, Red on application)
Application:	Spray as is
% Solids by Volume:	68 % Mixed
Theoretical Coverages:	1,200 mil sq. ft. per gallon
Air Drying Time @ 75°F (24° C):	
Handling:	4 hours
To Recoat:	5 hours
Immersion Service:	7 days
VOC:	1.73 lbs./gal.
Minimum Surface Prep:	SSPC-SP-10
Performance Criteria:	This product will meet or exceed the following test requirements established for the coating system listed:

Abrasion	Method:	ASTM D 4060 CS-17 Wheel, 1000 grams load
Adhesion	Method:	ASTM D 4541 900 psi pull ASTM D 3359 Cross Hatch
Salt Spray (Fog)	Method:	ASTM B 117
Fresh Water	Method:	Constant immersion in tap water at 75°F (24°C), no blistering or delamination after 1 year immersion

DeZURIK Standard Thickness:	4 - 8 Mils
Blue Epoxy Touchup Paint 2-Part, 1 Gallon	Part Number 1391900

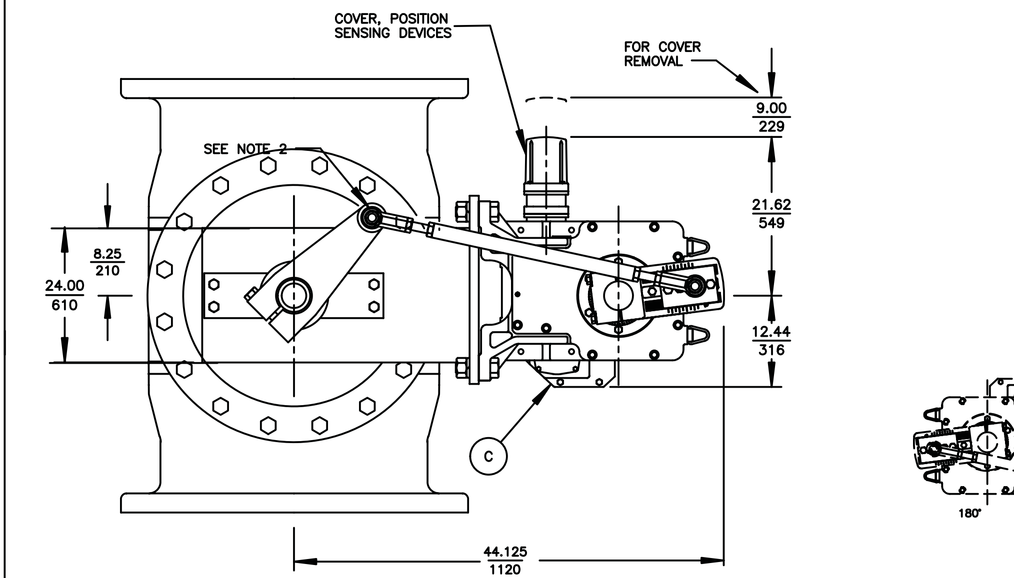
PART 2 - ABOVE SURFACE FACILITIES

VALVE SIZE	PIPE SIZE IN	PIPE SIZE MM	A	B	C	D	E	F	G	H	J	K
			DIMENSIONS INCHES/MILLIMETERS									
20.5	20	500	1.25/32	42.00/1067	18.31/465	25.00/635	1-1/8-7UNC	20	THRU			17.06/433
24	24	600	1.88/48	42.00/1067	18.31/465	29.50/749				1.38/35	20	17.06/433
24.5	24	600	1.94/49	42.00/1067	21.88/556	29.50/749	1-1/4-7UNC	20	1.50/38			21.13/537
30	30	750	2.12/54	51.00/1295	21.88/556	36.00/914				1.38/35	28	21.13/537
30.5	30	750	2.12/54	51.00/1295	24.81/630	36.00/914	1-1/4-7 UNC	28	2.00/51			24.16/614
36	36	900	2.38/60	60.00/1524	24.81/630	42.75/1086				1.62/41	32	24.16/614

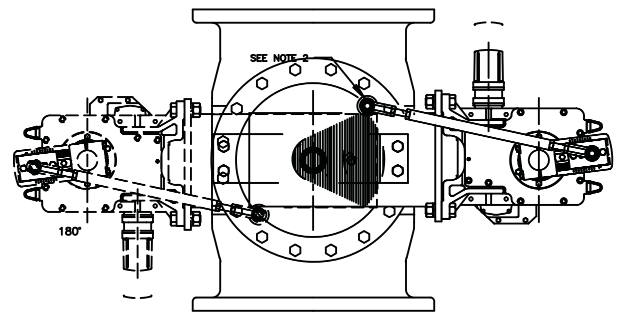
A	VALVE
C	MOTOR

NOTE:

1. FLANGES ARE FLAT FACED WITH DIAMETER AND DRILLING TO CLASS 125 ANSI STANDARD B16.1, EXCEPT FOR TAPPED HOLES AS INDICATED. SEE A-16368 FOR NON-ANSI FLANGE DATA.
2. FOR MANUAL OPERATION PUSH LEVER IN DIRECTION OF ARROW ONLY. UNIT REMAINS IN HAND OPERATION UNTIL MOTOR IS ENERGIZED.
3. INSTALLATION NOTE:
   - FOR LIQUIDS & GASES: INSTALL VALVE WITH HIGHER PRESSURE AGAINST END OPPOSITE SEAT.
   - FOR SUSPENDED SOLIDS, SLURRIES, ETC: INSTALL VALVE WITH HIGHER PRESSURE AGAINST SEAT END. IN HORIZONTAL PIPELINES, VALVE SHOULD BE INSTALLED ON IT'S SIDE SO PLUG ROTATES TO THE TOP OF THE PIPELINE WHEN OPEN. (SEE DIAGRAM BELOW).

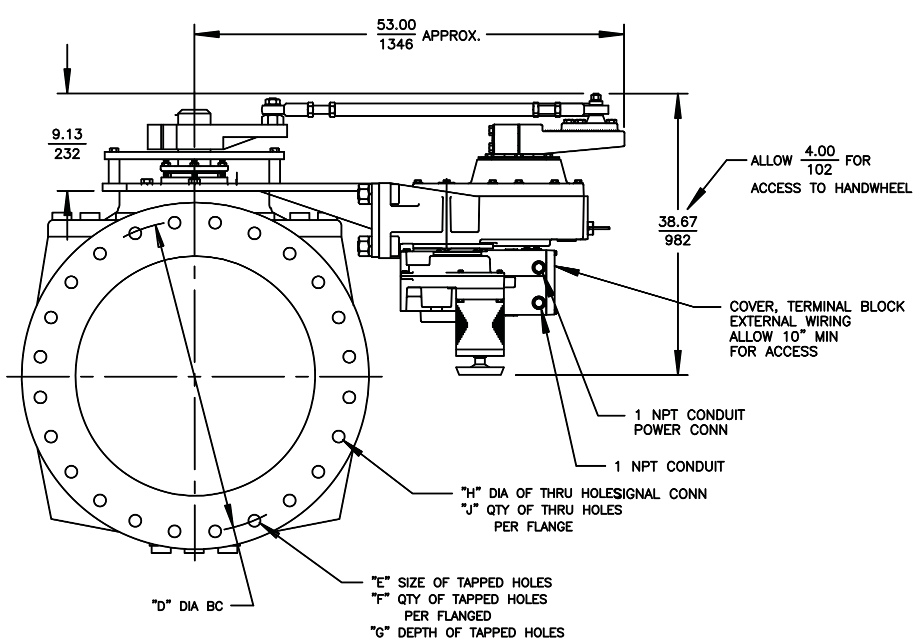


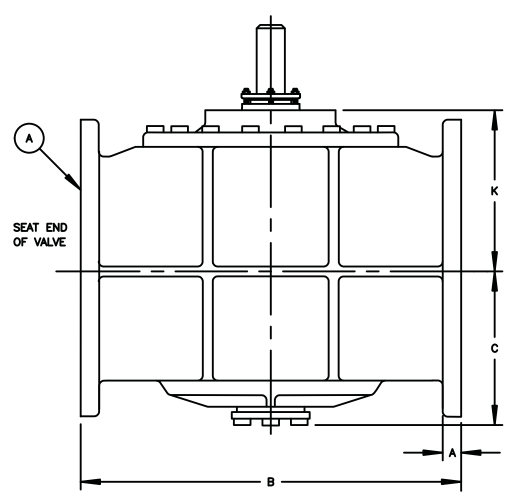
STANDARD POSITION SHOWN ON THIS DRAWING



SEAT END OF VALVE

ACTUATOR MOUNTING POSITIONS AS VIEWED FROM TOP OF VALVE. DOTTED LINES SHOW OPTIONAL MOUNTING POSITIONS.





02/23/22

50312

DeZURIK Sartell, MN USA 56377 www.dezurik.com

PEC ECCENTRIC VALVES SIZE 20.5 – 36 FLANGED BECK 11-430 MOTOR ACTUATOR

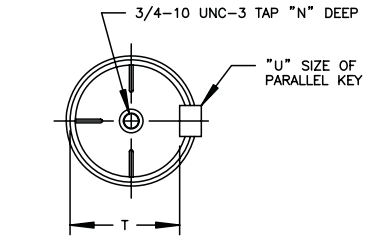
DOCT. CODE	DRAWN	APPROVED	
C1	SS	SS	Z18524
	CHECKED SS	DATE 02/22/22	

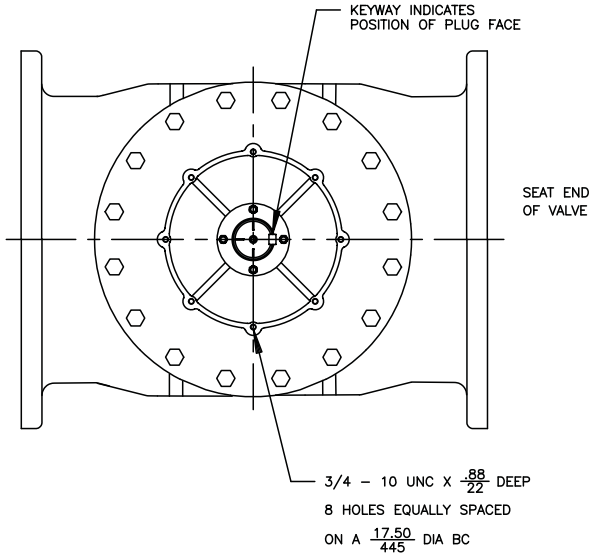
VALVE SIZE	PIPE SIZE		DIMENSIONS INCHES / MILLIMETERS															
	INCH	MM	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R IN	R MM	S
20.5	20	500	1.25 / 32	42.00 / 1067	18.31 / 465	25.00 / 635	1-1/8-7 UNC	20	THRU	N/A	N/A	17.06 / 433	9.25 / 235	7.19 / 183	2.12 / 54	2.53 / 64	4.937 / 4.935	125.40 / 125.35	5.50 / 140
24	24	600	1.88 / 48	42.00 / 1067	18.31 / 465	29.50 / 749	N/A	N/A	N/A	1.38 / 35	20	17.06 / 433	9.25 / 235	7.19 / 183	2.12 / 54	2.53 / 64	4.937 / 4.935	125.40 / 125.35	5.50 / 140
24.5	24	600	1.94 / 49	42.00 / 1067	21.88 / 556	29.50 / 749	1-1/4-7 UNC	20	1.50 / 38	N/A	N/A	21.13 / 537	9.88 / 251	7.69 / 195	1.31 / 33	2.31 / 59	5.937 / 5.935	150.80 / 150.75	6.50 / 165
30	30	750	2.12 / 54	51.00 / 1295	21.88 / 556	36.00 / 914	N/A	N/A	N/A	1.38 / 35	28	21.13 / 537	9.88 / 251	7.69 / 195	1.31 / 33	2.31 / 59	5.937 / 5.935	150.80 / 150.75	6.50 / 165
30.5	30	750	2.12 / 54	51.00 / 1295	24.81 / 630	36.00 / 914	1-1/4-7 UNC	28	2.00 / 51	N/A	N/A	24.81 / 630	10.06 / 256	8.25 / 210	1.56 / 40	2.88 / 73	5.937 / 5.935	150.80 / 150.75	6.50 / 165
36	36	900	2.38 / 60	60.00 / 1524	24.81 / 630	42.75 / 1086	N/A	N/A	N/A	1.62 / 41	32	24.81 / 630	10.06 / 256	8.25 / 210	1.56 / 40	2.88 / 73	5.937 / 5.935	150.80 / 150.75	6.50 / 165

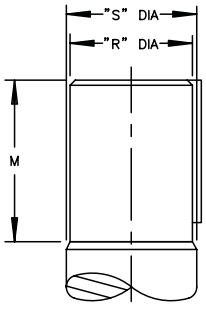
VALVE SIZE	PIPE SIZE		DIMENSIONS INCHES / MILLIMETERS			
			T		U	W
	INCH	MM	IN	MM		
20.5	20	500	4.422 / 4.407	112.32 / 111.94	1-1/4 X 7/8 X 5-13/16	8.38 / 213
24	24	600	4.422 / 4.407	112.32 / 111.94	1-1/4 X 7/8 X 5-13/16	8.38 / 213
24.5	24	600	5.341 / 5.326	135.66 / 135.28	1-1/2 X 1 X 5-7/8	9.50 / 241
30	30	750	5.341 / 5.326	135.66 / 135.28	1-1/2 X 1 X 5-7/8	9.50 / 241
30.5	30	750	5.341 / 5.326	135.66 / 135.28	1-1/2 X 1 X 7-1/4	9.50 / 241
36	36	900	5.341 / 5.326	135.66 / 135.28	1-1/2 X 1 X 7-1/4	9.50 / 241

NOTE:

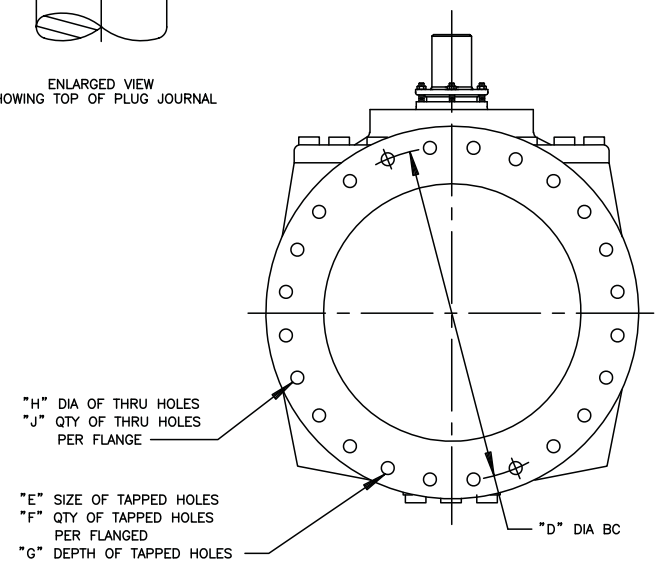
1. FLANGES ARE FLAT FACED WITH DIAMETER AND DRILLING TO CLASS 125 ANSI STANDARD B16.1, EXCEPT FOR TAPPED HOLES AS INDICATED. SEE A-16368 FOR NON-ANSI FLANGE DATA.
2. DRAWING SHOWS VALVE IN CLOSED POSITION.

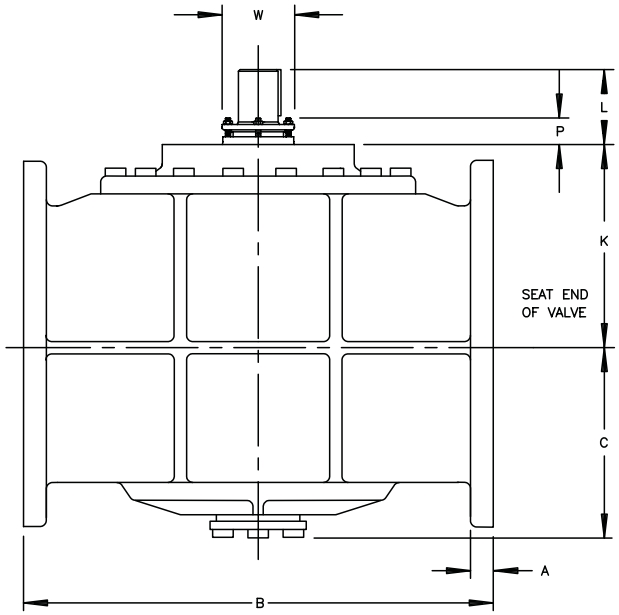






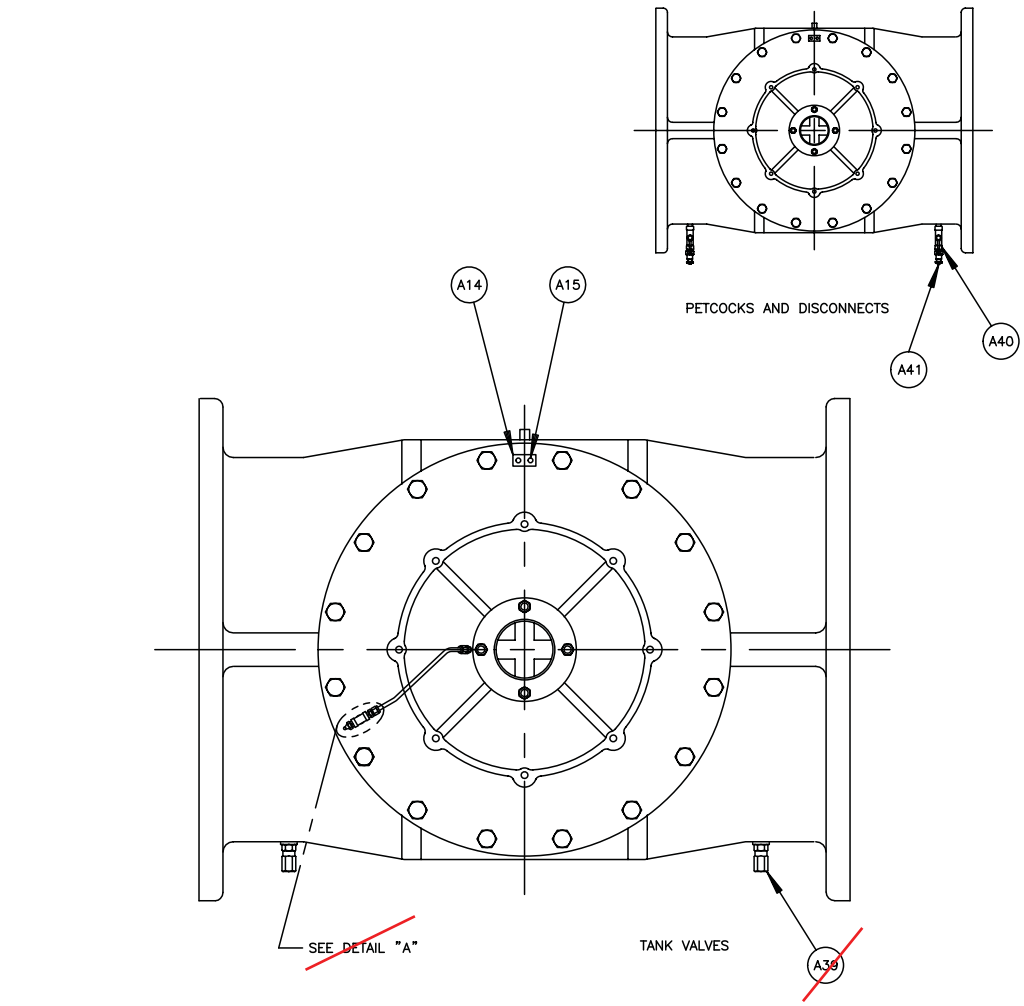
ENLARGED VIEW
SHOWING TOP OF PLUG JOURNAL





02/02/21 RLP	DeZURIK 400 | HILTON www.dezurik.com	PEC ECCENTRIC VALVES SIZE 20.5-36 FLANGED MATERIAL GROUP 1 FOR USE WITH PURCHASED ACTUATORS		
		DOCT. CODE C11	DRAWN RDD / CHECKED RDD	APPROVED RDD / DATE 02/02/21
				Z18258

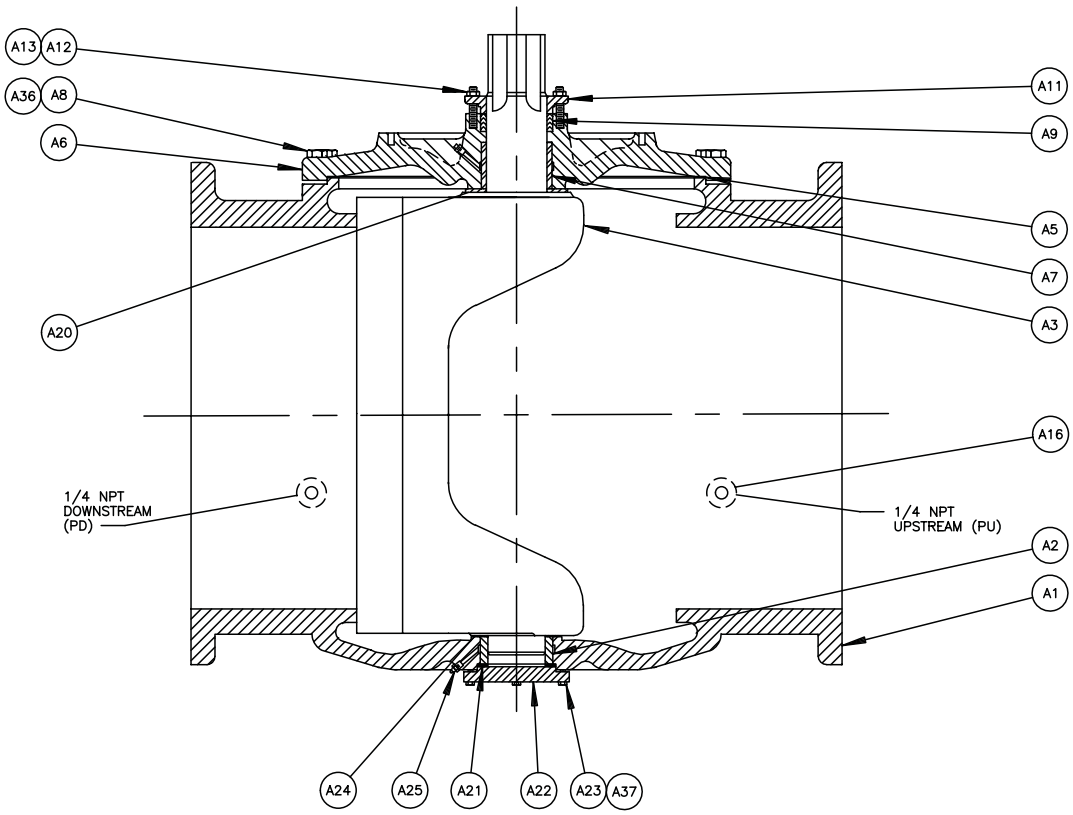
PART 2 - ABOVE SURFACE FACILITIES

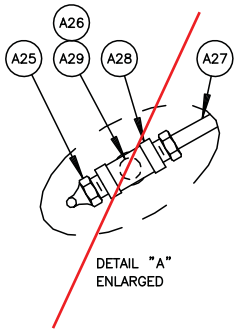


NO	PART NAME	QTY
A1	BODY	1
A2	BEARING	1
A3	PLUG	1
A4		
A5	GASKET (BODY)	1
A6	BONNET	1
A7	BEARING	1
A8	SCREW	16
A9	PACKING	–
A10		
A11	GLAND	1
A12	STUD	4
A13	NUT	4
A14	CAUTION TAG	1
A15	DRIVE SCREW	2
A16	PIPE PLUG (PU OR PD ONLY)	1
A17		
A18		
A19		
A20	GRIT EXCLUDER	1
A21	GASKET (JOURNAL COVER)	1
A22	JOURNAL COVER	1
A23	SCREW	6
A24	GRIT EXCLUDER	–
A25	PIPE PLUG (EXCEPT GR OPTION)	2
A25	LUBE FITTING (OPTION GR ONLY)	2
A26	SWIVEL CONNECTOR (OPTION GR ONLY)	1
A27	GREASE GUN HOSE (OPTION GR ONLY)	1
A28	TEE (OPTION GR ONLY)	1
A29	NIPPLE (OPTION GR ONLY)	1
A36	WASHER (FUSION COATING)	16
A37	WASHER (FUSION COATING)	6
A39	TANK VALVE (BV1)	2
A40	MANUAL VALVE (BV2)	2
A41	ADAPTOR (BV2)	2

NOTE:

1. RECOMMENDED SPARE PARTS ARE ITEMS NO A3, PLUG (IF RUBBER FACED) NO A5, A9 & NO A21.
2. WHEN ORDERING PARTS, INCLUDE VALVE SIZE AND PART NUMBER FROM DATA PLATE, ALSO INCLUDE THIS DRAWING NUMBER WITH PART NAME, NUMBER AND QUANTITY.
3. CLOCKWISE ROTATION ON PLUG STEM CLOSES VALVE.





H	70642	02/06/20
G	70337	11/20/18
F	63480	06/04/17
E	50312	04/02/12
D	62047	07/27/11
C	62054	04/20/11
B	61845	12/22/09
A	61371	11/21/05

DeZURIK APCO | HILTON
www.dezurik.com

PEC ECCENTRIC VALVE ASSEMBLY SIZES 20.5–36 FLANGED

DOCT. CODE	DRAWN	APPROVED
C1	BMP	JDB
	CHECKED JDB	DATE 03/11/99

A51407

MATERIALS OF CONSTRUCTION

DRAWING(S): A51407

WORK ORDER: 146867 **PART NO:** 9719626

DESCRIPTION: PEC,24,F1,CI,NBR,NBR,S40SD0*X*A33060

ITEM	MATERIAL
A01	IRON, ASTM A126, CLASS B
A02	STAINLESS STEEL, TYPE CF-8M, ASTM A743
A03	ACRYLONITRILE-BUTADIENE (NBR)
A03	IRON, ASTM A126, CLASS B
A05	GASKET, NON-ASBESTOS COMPRESSED SHEET GASKET MATERIAL
A06	IRON, ASTM A126, CLASS B
A07	STAINLESS STEEL, TYPE CF-8M, ASTM A743
A08	CARBON STEEL, ZINC PLATED
A09	ACRYLONITRILE-BUTADIENE (NBR)
A11	IRON, ASTM A126, CLASS B
A12	CARBON STEEL, ZINC PLATED
A13	CARBON STEEL, ZINC PLATED
A14	STAINLESS STEEL, TYPE 302
A15	STAINLESS STEEL, TYPE 18-8
A20	PTFE, TYPE II, ASTM D3294 OR D3308, GRADE 1
A21	GASKET, NON-ASBESTOS COMPRESSED SHEET GASKET MATERIAL
A22	IRON, ASTM A126, CLASS B
A23	CARBON STEEL, ZINC PLATED
A24	PTFE, TYPE II, ASTM D3294 OR D3308, GRADE 1
A25	STEEL

HAROLD BECK & SONS, INC.
11 TERRY DRIVE • NEWTOWN, PENNSYLVANIA 18940 • USA
PHONE: 215-968-4600 • FAX: 215-860-6383 • www.haroldbeck.com

sales@haroldbeck.com
Visit us on the web at www.haroldbeck.com

Ref #: **WO # 146867**

Actuator Specifications

Line Item #	Qty	Model/Part #	Application Description
1	1 ~~2~~	11-433	Valve / 24" Deep Injection Well Beck Model 11-433 Actuator for 120 VAC Open / Close Service supplied with Bracket & Linkage Hardware to mount on a 24" Dezurik PEC Plug Valve. Actuator Power = 120/1/60

SPECIFICATIONS:

Voltage/Phase/Freq:	120/1/60
Torque (lb-ft):	5,200
Stroke Timing (seconds):	108
Travel (degrees):	100
Auxiliary Limit Switches:	4X SPDT
Control Signal:	Open-Close or pushbutton operation
Feedback Signal:	NONE
Loss of Power Action:	Stay in Place
Enclosure Rating:	Weatherproof

Integral Features:
- Self-Locking, Self-Releasing Gear Train
- Handwheel (manual operation without power)
- Non-coasting Beck control motor with instant magnetic braking
- Dust-Tight Construction
- Over-Travel Limit Switches
- Cast Mechanical Stops
- 5-Position Handswitch (electrical manual operation)

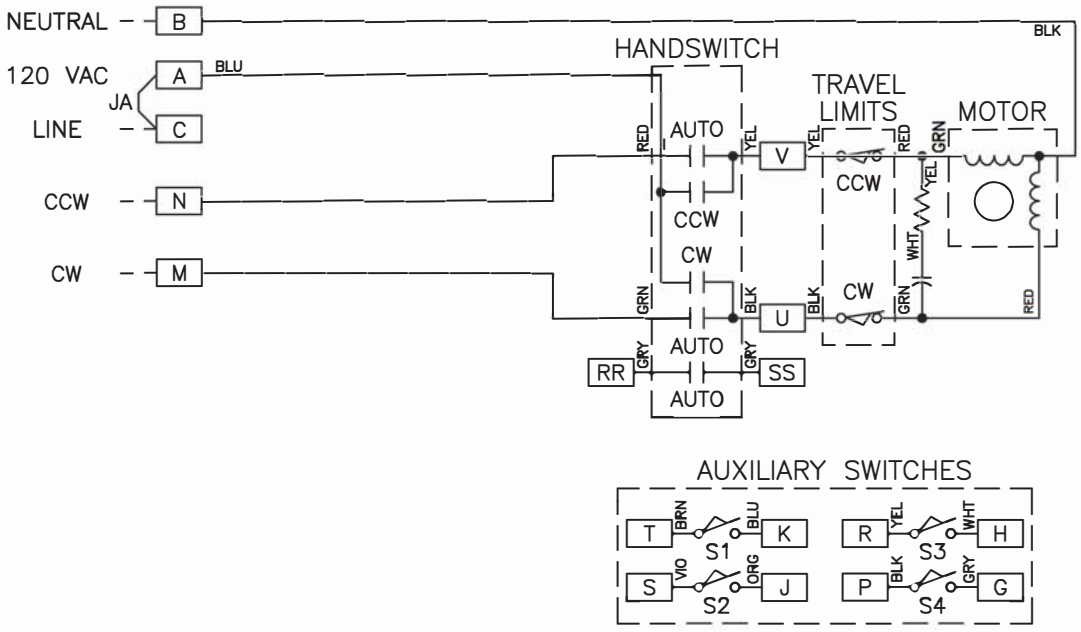
Additional Features:
Certified Test Report
Stainless Steel Tagging
Auxiliary handswitch contact closed in AUTO

Valve Info: Customer Field Mounting with Beck Supplied Mounting Hardware
24" Dezurik PEC Plug Valve

Valve/Damper Supplied By: Customer

Mounting Type: Bracket & Linkage (L-bracket)

PART 2 - ABOVE SURFACE FACILITIES



NOTE:
1. REMOVE JUMPER JA TO PREVENT HANDSWITCH INITIATED MOTION

TERMINAL CONNECTIONS FOR REMOTE CONTROL:

CW	C–M
CCW	C–N
STOP	NONE

AUXILIARY SWITCH CONFIGURATION

	FORM A	FORM B
S1	☐	☐
S2	☐	☐
S3	☐	☐
S4	☐	☐

UNUSED

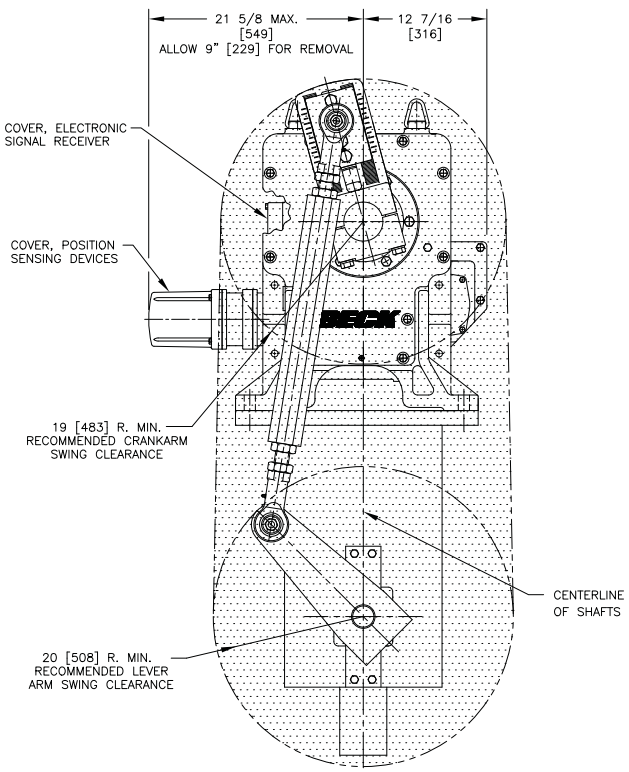
D	E	F	AA
BB	CC	DD	EE
FF	GG	HH	JJ
KK	MM	NN	PP

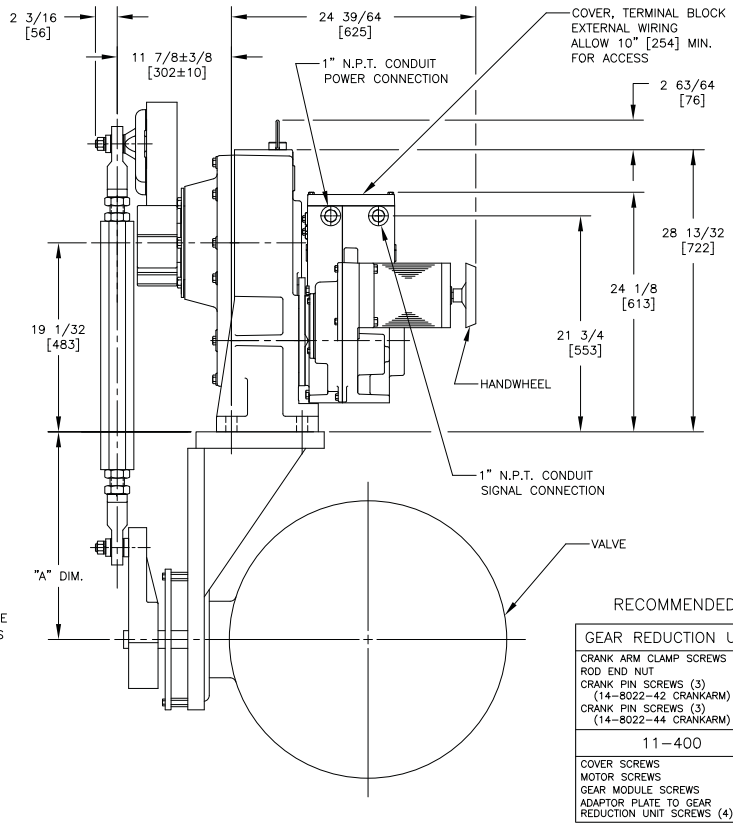
SIZE: A

HAROLD BECK & SONS INC
NEWTOWN INDUSTRIAL COMMONS NEWTOWN, PENNSYLVANIA 18940 USA

TITLE:
WIRING DIAGRAM GROUP 11-433
120 VOLT 4 AUX SWITCHES
W/ H/S AUX CLSD IN AUTO CW/CCW

DRAWN:	SCALE: NONE	DRAWING NO: WD-X179390-01/X179394-01 (actual diagram number to be determined after design completion)	REV:
CHECKED:			
APPROVED:		SHEET NO. 1 OF 1	





RECOMMENDED SCREW TORQUES

GEAR REDUCTION UNIT	THREAD SIZE	TORQUE LB–FT.	TORQUE Nm
CRANK ARM CLAMP SCREWS (4)	3/4–16	420	569
ROD END NUT	3/4–16	200	271
CRANK PIN SCREWS (3) (14–8022–42 CRANKARM)	3/4–16	420	569
CRANK PIN SCREWS (3) (14–8022–44 CRANKARM)	3/4–16	300	407
11–400	THREAD SIZE	TORQUE LB–FT.	TORQUE Nm
COVER SCREWS	5/16–18	10	14
MOTOR SCREWS	3/8–16	16	22
GEAR MODULE SCREWS	5/16–18	10	14
ADAPTOR PLATE TO GEAR REDUCTION UNIT SCREWS (4)	1/2–13	45	61

ALL DIMENSIONS ARE IN INCHES AND [MM] UNLESS OTHERWISE SPECIFIED.
THREADS AND TAPPED HOLES ARE SPECIFIED AS UNIFIED THREAD SIZES ONLY.
CONDUIT PIPE THREADS PER AMERICAN NATIONAL STANDARD TAPER PIPE THREADS (N.P.T.)

VALVE SIZE	10"	12"	14"	16"	18"	20"	24"	30"	36"	42"	48"	54"
"A" DIM	12 [305]	12 [305]	13 [330]	15 [381]	15 [381]	17 [432]	17 [432]	17 [432]	19 [483]	20 [508]	23 [584]	25 [635]

NOTES:
ALL DIMENSIONS ARE TYPICAL.
TOLERANCES: ±1/4 [±6]
IF SPECIFIC DIMENSIONS ARE REQUIRED, PLEASE CONTACT A FACTORY REPRESENTATIVE
SCREW TORQUES FOR MOUNTING HARDWARE WILL BE SUPPLIED WITH SPECIFIC VMS.

18-0430-04o

THIRD ANGLE PROJECTION

HAROLD BECK & SONS INC
NEWTOWN INDUSTRIAL COMMONS NEWTOWN, PENNSYLVANIA 18940 USA

TITLE: OUTLINE DIMENSIONS FOR UNITIZED ASSEMBLIES OF BECK 11-430 DRIVES ORIENTATION OPTION "B" & ROTARY VALVE

DRAWN:	SCALE:	DRAWING NO:	REV:
CHH 3-13-08	NONE	18-0430-04o	A
CHECKED: GMD 3-17-08			
APPROVED: JHM 3/17/08		SHEET NO. 1 OF 1	

SIZE: D

PART 2 - ABOVE SURFACE FACILITIES

DeZURIK
APCO | HILTON

RECOMMENDED LONG & SHORT TERM STORAGE PROCEDURES

LONG TERM STORAGE (6 MONTHS +)

1. All valves shall be stored in the position in which they were shipped.

2. Valves shall be stored fully enclosed in a crate or on a skid. It is acceptable to store the valves uncrated but protected from any dirt, debris or UV exposure as long as the environmental conditions as described in item 3 are met. Any desiccant packages received with the original shipment should be replaced before putting valves into long term storage. Please follow your desiccant manufacturer's recommended usage of any desiccant based on the volume of the enclosed area.

3. Valves shall be stored in a well ventilated, clean, dry indoor facility on skids or raised racks with temperatures ranging from 35°F to 95°F (2°C to 35°C) with humidity levels not exceeding 50%.

4. If the above conditions cannot be met, valves shall be separately packaged inside sealed heavy duty plastic sheeting and a weather resistant enclosure, or a standard crate lined with moisture proof paper, to protect the valves from dirt, debris and UV exposure. Desiccant packages shall be used to control moisture both inside the enclosure and the sealed heavy duty plastic covering. Please follow your desiccant manufacturer's recommended usage of any desiccant based on the volume of the enclosed area.

5. Do not store valves next to operating electric motors or equipment which may emit ozone, which can cause deterioration of valve elastomers. Store in an environment with less than 0.1 ppm concentration, at least 25 feet from ozone emitting devices, with ventilation.

6. Valves with cylinder actuators and control valves which are stored for extended periods may be subject to cylinder blow-by caused by permanent distortion of any of the seals. Valves should be operated prior to installation and damaged seals replaced. If possible, it is recommended that cylinders be cycled every 4-6 months to maintain seals.

7. Valves with electric motor operators shall be stored in accordance with the individual motor manufacturer's recommended long term storage procedures.

8. All electrical components shall be visually inspected prior to valve installation.

SHORT TERM STORAGE (LESS THAN 6 MONTHS)

1. All valves shall be stored in the position in which they were shipped.

2. Valves shall be protected from dirt, debris, excessive moisture and UV exposure. Store at temperatures ranging from 35°F to 95°F (2°C to 35°C) with humidity levels not exceeding 50%.

1.010	1.020	1.030	1.040	1.041	1.050	1.060	1.080	1.090	3.001	3.010	3.020	3.030	3.040	4.040	4.050	4.080	4.090	8.010	8.020	8.040	8.041
Tag Number	**Size**	**Rated Working Pressure**	**Type of Service(1)**	**Application**	**Type of Installation(2)**	**Ends(3)**	**Maximum Differential Pressure Across Valve**	**High Pressure Side of Plug(5)**	**Type of Electric Actuator(10)**	**Type of Housing(7)**	**Operating Time**	**Power for Electric Actuator Motor**	**Actuator Provides 120 VAC For remote controls**	**Number of Limit Switch Assemblies**	**Position Transmitter**	**Control Devices(8)**	**Remote Control Station(11)**	**Extensions Stems**	**Position Indicator for Buried Valve Actuators**	**Cast Iron Operating Stands**	**Fabricated Steel Operating Stands**
	(in)	(psi)					(psi)				(s)	(V/PH)									
80-FCV-11	24	150	O-C	Raw Water	IP	F	50	90	IE	WP	60	120 VAC	Yes	2				No			
80-FCV-12**	24	150	O-C	Raw Water	IP	F	50	90	IE	WP	60	120 VAC	Yes	2				No			

Notes:
(1) Actuators designated "O-C" are for "Open-Close" service. Actuators designated "M" are for "Modulating" service.

(2) Abbreviations for installation types are as follows:

B4	Buried, depth of 4 feet [1.2 m] or less
B20	Buried, depth greater than 4 feet [1.2 m] but 20 feet [6.1 m] or less
B	Buried, depth greater than 20 feet [6.1 m], actual depth of xx feet(Bxx)
SV20	Submerged or vaulted, depth 20 feet [6.1 m] or less
SV	Submerged or vaulted, depth greater than 20 feet [6.1 m], actual depth of xx feet(SVXX)
IP	In plant

(3) Abbreviations for valve ends are as indicated:

F	Flanged
MJ	Mechanical joint
P	Push-on joint

(4) Abbreviations for manual actuator types are as indicated:

WN	Wrench Nut
LVR	Lever
CW	ChainWheel
HW	HandWheel

(5) Abbreviations for high pressure side of plug are as indicated:

S	Seating (plug shaft side)
U	Unseating (plug seat side)

(6) Abbreviations for limit switches on manual and cylinder operated valves.

EOT	End of travel (open - close)
PSS	Pump start - stop (two intermediate positions)
ELSCH	See electrical schematics

PART 2 - ABOVE SURFACE FACILITIES

(7) Abbreviations for electronic or electric actuator housing.

WP Weatherproof
SUB Submersible [xx = depth of submergence](SUBxx)
EXP Explosion proof

(8) Abbreviations for control devices are as indicated.

Table 1: Control Devices

Abbreviations	Open-Close Push Button	Open-Stop-Close Push Button	Local-Off-Remote	Red and Green Indicator Lights
A	Required		Required	Required
B	Required		Required	
C		Required	Required	Required
D		Required	Required	
E		Required		
F	Required			
G	Required			Required
H		Required		Required

(10) Abbreviations for electric actuator types are as follows:
SE Standard Electric
IE Intelligent Electric
NE Networked Electric

(11) Abbreviations for remote control station types:
CS Control Station without indicating lights.
CIS Control Station with indicating lights.

** Owner provided. See Drawing M-103 and Section 15102 for more information.

END OF SCHEDULE

1.010	1.020	1.030	1.031	1.040	1.060	1.070	1.080	1.090	3.001	3.010	3.020	4.030	3.040	4.040	4.050	4.080	4.090	8.010	8.020	8.040	8.041	8.05	8.060	
Tag Number	Size	Type of Service(1)	Application	Type of Installation(2)	AWWA Class(3)	Maximum Non-Shock Shutoff Pressure	Maximum Differential Pressure	Maximum Velocity	Type of Electric Actuator(10)	Type of Housing(7)	Operating Time	Power for Electric Actuator	Actuator Provides 120 VAC For remote controls	Number of Limit Switch Assemblies	Open/Close End of Travel Switches	Control Devices(9)	Remote Control Station (11)	Extensions Stems	Position Indicator for Buried Valve Actuators	Cast Iron Operating Stands	Fabricated Steel Operating Stands	Torque Tubes	Extension bonnet	P & I DWG No.
	(in)					(psi)	(psi)	(ft/s)			(s)	V/PH												
80-FCV-7**	30	O-C	Raw Water	IP	150B-F	30	25	6	IE	WP	60	120 VAC	Yes	2	Yes	D	CIS		N/A					I-601

PART 2 - ABOVE SURFACE FACILITIES

Notes:

(1) Actuators designated "O-C" are for "Open-Close" service. Actuators designated "M" are for "Modulating" service.

(2) Abbreviations for installation types are as follows:

B4	Buried, depth of 4 feet [1.2 m] or less
B20	Buried, depth greater than 4 feet [1.2 m] but 20 feet [6.1 m] or less
Bxx	Buried, depth greater than 20 feet [6.1 m], actual depth of xx feet
SV20	Submerged or vaulted, depth 20 feet [6.1 m] or less
SVxx	Submerged or vaulted, depth greater than 20 feet [6.1 m], actual depth of xx feet
IP	In plant

(3) Suffix letters define valve ends as follows:

F	Flanged
W	Wafer
MJ	Mechanical joint
S	Single Flange

(4) Abbreviations for actuator types are as follows:

WN	Wrench Nut
LVR	Lever
CW	ChainWheel
HW	HandWheel

(5) If a value is indicated, the leakage test shall be performed using this pressure value rather than the pressure indicated by the AWWA class.

(6) Abbreviations for limit switches on manual and cylinder operated valves.

EOT	End of travel (open - close)
PSS	Pump start - stop (two intermediate positions)
ELSCH	See electrical schematics

(7) Abbreviations for electronic or electric actuator housing.

WP	Weatherproof
SUB	Submersible [xx = depth of submergence] (SUBxx)
EXP	Explosion proof

(8) Cylinder actuators shall have torque safety factors applied in accordance with AWWA C504.

PART 2 - ABOVE SURFACE FACILITIES

(9) Abbreviations for control devices are as indicated.

Table 1: Control Devices				
Abbreviations	Open-Close Push Button	Open-Stop- Close Push Button	Local-Off-Remote	Red and Green Indicator Lights
A	Required		Required	Required
B	Required		Required	
C		Required	Required	Required
D		Required	Required	
E		Required		
F	Required			
G	Required			Required
H		Required		Required

(10) Abbreviations for electric actuator types are as follows:
SE Standard Electric
IE Intelligent Electric
NE Networked Electric

(11) Abbreviation for remote control station types:
CS Control Station without Indicating Lights
CIS Control Station with Indicating Lights

**Existing valve. To be actuated as part of this project.

END OF SCHEDULE

PART 2 - ABOVE SURFACE FACILITIES

Section 40 05 68

CHECK VALVES

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of check valves as specified herein and as indicated in the Check Valve Schedule.

Piping, pipe supports, insulation, and accessories that are not an integral part of the valves or are not specified herein are covered in other sections.

1-2. GENERAL. Equipment furnished under this section shall be fabricated and assembled in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer unless exceptions are noted by Engineer.

Valves shall be furnished with all necessary parts and accessories indicated on the Drawings, specified, otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of valves.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Temporary Number Plates. Not used.

1-2.03. Identification. Valves specified herein shall be tagged in accordance with the Equipment and Valve Identification section.

1-3. SUBMITTALS. Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the Submittals Procedures section. Included in the submittal shall be drawings by the valve manufacturer to indicate the position of the valve actuator and valve shaft.

PART 2 – PRODUCTS

2-1. CONSTRUCTION.

2-1.01. Valves VC-1. Not used.

2-1.02. Valves VC-2. Not used.

2-1.03. Valves VC-3. Not used.

2-1.04. Valves VC-4. Not used.

2-1.05. Valves VC-5. Not used.

2-1.06. Valves VC-6.

VC-6 Water, sludge, or liquid service 2-1/2 inch and larger pipe	Rating	Class 125
	Code	AWWA C508
	Type	Horizontal swing, bolted bonnet
	Body/Bonnet	ASTM A126 Class B cast iron
	Trim	
	Seat Ring	Bronze
	Disc	Bronze
	Hinge Pins	Bronze or brass
	Bushings	Bronze
	Cover Gasket	Manufacturer's standard
	End Connection	Flanged, ASME B16.1 Class 125, flat faced
	Temp. Limitations	-20 to 212°F
	Manufacturers	Val-Matic "Flex Check Series 500"

2-1.07. Valves VC-7. Not used.

2-1.08. Valves VC-8. Not used.

2-1.09. Valves VC-9. Not used.

2-1.10. Valves VC-10. Not used.

2-1.11. Valves VC-11. Not used.

2-1.12. Valves VC-12. Not used.

2-1.13. Valves VC-13. Not used.

2-1.14. Valves VC-14. Not used.

2-1.15. Valves VC-15. Not used.

2-1.16. Valves VC-16. Not used.

2-1.17. Valves VC-17. Not used.

PART 2 - ABOVE SURFACE FACILITIES

2-1.18. Valves VC-18. Not used.

2-1.19. Valves VC-19. Not used.

2-1.20. Shop Coatings. All ferrous metal surfaces of valves and accessories, both interior and exterior, shall be shop coated for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating.

Surfaces To Be Coated	
Unfinished Surfaces	
Interior Surfaces	
Liquid Service	Epoxy enamel.
Exterior Surfaces of All Other Valves	Universal primer.
Polished or Machined Surfaces	Rust-preventive compound.
Actuators and Accessories	Universal primer.

PART 3 - EXECUTION

3-1. INSTALLATION. Materials furnished under this section shall be installed in accordance with Valve Installation section.

End of Section

Schedule 40 05 68-S01
Check Valves Schedule

1.010	1.020	1.030	1.040	1.050	1.060	
Tag Number	Size	Type of Valve	Service	Design Capacity	Ends(1)	P and I DWG No.
1	2	3	4	5	6	7
	(in)			(gpm)		
80-V-11B	24	VC6	Raw Water	6250	F	I-601

Notes:

(1) Abbreviations for valve ends are as indicated:

F	Flanged
MJ	Mechanical Joint
P	Push-on Joint

END OF SCHEDULE

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Section 40 05 86

AIR VALVES

PART 1 - GENERAL

1-1. SCOPE. This section covers furnishing combination air valves and air /vacuum valves as required by the Work, and as indicated in the Air Valve Schedule.

1-2. GENERAL. Equipment provided under this section shall be fabricated and assembled in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.
Valves shall be furnished with all necessary parts and accessories indicated on the Drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of valves.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Governing Standard. Except as modified or supplemented herein, all valves furnished under this section shall conform to the applicable performance requirements of ANSI/AWWA C512.

1-2.03. Identification. Air valves shall be tagged in accordance with the Equipment and Valve Identification section.

1-3. SUBMITTALS. Complete assembly drawings, together with detailed specifications and data covering materials used and accessories forming a part of the valves furnished, shall be submitted in accordance with the Submittals Procedures section.

PART 2 - PRODUCTS

2-1. CONSTRUCTION.

Four inch and larger air release and vacuum relief valves for clean water applications shall be integral type, HTEC “Model 986 Stainless Steel”. Unless otherwise specified or indicated on the Drawings, valves shall be provided with surge check discs on the valve inlet to restrict the exhaust air flow rate.

Two inch and smaller combination air valves for clean water applications shall be of the integral type with a valve assembly which functions as both an air and vacuum valve and an air release valve. The valves shall be HTEC “Model 986 Stainless Steel”.

Three inch and larger combination air valves for clean water applications shall consist of an air and vacuum valve with an externally mounted air release valve. The valves shall be HTEC “Model 986 Stainless Steel”. Unless otherwise specified or indicated on the Drawings, valves shall be provided with surge check discs on the valve inlet to restrict the exhaust air flow rate.

2-2. MATERIALS. Except as modified or supplemented herein, materials of construction shall comply with the governing standard.

Valve Trim	Bronze or austenitic stainless steel or polymer materials. Valve trim for valves in wastewater service shall be austenitic stainless steel.
Float	Austenitic stainless steel, polycarbonate, or foamed polypropylene.
Shop Coatings	
Epoxy (NSF-61 Certified)	PPG Amercoat “Amerlock 400 High Solids Epoxy”, Carboline “Carboguard 891”, Sherwin-Williams "Macropoxy 646NSF" or Tnemec “Series N140 Pota-Pox Plus”.
Epoxy	PPG Amercoat “Amercoat 385 Epoxy”, Carboline “Carboguard 890”, Sherwin-Williams "Macropoxy 646" or Tnemec “Series N69 Hi-Build Epoxoline II”.
Rust-Preventive Compound	As recommended by manufacturer.

2-3. SHOP PAINTING. All interior and exterior ferrous metal surfaces, except stainless steel components, shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field coating. Field painting is covered in the Protective Coatings section.

Surfaces shall be painted as indicated:

Interior Surfaces of Valves in Clean Water Applications (Raw or Treated Water in Potable Water Facilities)	NSF-61 Certified Epoxy.

PART 2 - ABOVE SURFACE FACILITIES

Interior Surfaces of Valves in Wastewater Applications	Epoxy
Exterior Surfaces of Valves To Be Installed in Manholes or Valve Vaults	Epoxy.
Exterior Surfaces of All Other Valves	Universal primer.
Polished or Machined Surfaces	Rust-preventive compound.

Interior epoxy coatings for clean water valves shall comply with ANSI/AWWA C550/NSF 61. Interior coatings for all valves shall be free of holidays. The total dry film thickness of shop-applied coatings shall be not less than:

Type of Coating	Minimum Dry Film Thickness
Epoxy	10 mils
Universal Primer	3 mils

2-4. SHUTOFF VALVES. A shutoff valve shall be provided in the piping leading to each air valve. Shutoff valves 2 inches and smaller shall be ball valves as specified in the Miscellaneous Ball Valves section. Shutoff valves 3 inches and larger shall be gate valves as specified in the Gate Valve section.

Each 4 inch and larger combination air valve shall be provided with a shutoff valve between the air and vacuum valve and the air release valve.

PART 3 - EXECUTION

3-1. INSTALLATION. Air release and combination air valves shall be installed in accordance with the Valve Installation section.

End of Section

PART 2 - ABOVE SURFACE FACILITIES

1.010	1.020	1.030	1.040	1.050	1.060	2.010	3.010	3.020
Tag Number	Type(1)	Location(2)	Inlet size	Outlet Size	Orifice Size	Inlet Type(3)	Outlet Type(4)	Working Pressure
			(in)	(in)	(in)			(psi)
80-V-19	CAV	IP	4	4	5/32	125F	125F	55
80-V-18	CAV	IP	6	6	5/32	125F	125F	55

Notes:

(1) Abbreviations for types are as indicated:

ARV	Air Release Valve
CAV	Combination Air Valve
ARVR	Air Release and Vacuum Relief Valve
VRV	Vacuum Relief Valve

(2) Abbreviations for locations are as indicated:

IP	In-plant
IV	In-vault

(3) Abbreviations for inlet types are as indicated:

T	Threaded, ANSI/ASME B1.20.1, NPT
125F	Flanged, ANSI/ASME B16.1, Class 125
250F	Flanged, ANSI/ASME B16.1, Class 250

(4) Abbreviations for outlet types are as indicated:

T	Threaded, ANSI/ASME B1.20.1, NPT
125F	Flanged, ANSI/ASME B16.1, Class 125
PH	Protective hood

End of Schedule

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Section 40 61 11

INSTRUMENTATION AND CONTROL SYSTEM

PART 1 – GENERAL

1-1. SCOPE. This section covers the furnishing and installation of instrumentation and control system components necessary to monitor and control the Deep Injection Well #2. The work includes but is not limited to:

- The addition of Inputs/Outputs (I/O) to the existing PLC-2, utilizing spares where available and/or furnishing new modules if needed
- New magnetic flowmeter
- New pressure transmitter and pressure gauge
- Equipment furnished by other Divisions
- Modification of existing PLC-2 programming
- Modification of existing Citect version 7.5 SP1 Patch 36 SCADA software

The system shall be furnished as specified, complete with all software, human machine interface (HMI) hardware, input/output hardware, instrumentation, and all devices, accessories, appurtenances, testing, and training necessary for proper operation.

1-1.02. Associated Sections. This section also includes the equipment and services specified in the following sections.

Section 406111-A	INSTRUMENT DEVICE SCHEDULE
Section 406111-B	INPUT OUTPUT SCHEDULE
Section 406883	SOFTWARE CONTROL BLOCK DESCRIPTIONS
Section 407100	FLOW INSTRUMENTS
Section 407200	PRESSURE AND LEVEL INSTRUMENTS
Section 407911	MISCELLANEOUS INSTRUMENTS

1-2. GENERAL. Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment and materials furnished under this section. If requirements in this specification differ from those in the General Equipment

PART 2 - ABOVE SURFACE FACILITIES

Stipulations, the requirements specified herein shall take precedence.

1-2.02. Drawings. The Drawings indicate locations and arrangements of equipment and may include installation details and block and one-line diagrams showing connections and interfaces with other equipment. The input/output (I/O) listsare indicated on the Drawings.

Principal components of the instrumentation systems shall be as indicated on the P&ID drawings.

1-2.03. Codes, Permits and Agency Approvals. All work performed and all materials used shall be in accordance with the National Electrical Code, and with applicable local regulations and ordinances. Where mandated by codes, panels, assemblies, materials, and equipment shall be listed by Underwriters' Laboratories. Contractor shall, as part of their work, arrange for and obtain all necessary permits, inspections, and approvals by the authorities having local jurisdiction of such work. This shall include any third-party inspections and testing of panels and equipment.

1-2.04. Supplier's Qualifications. Equipment and software furnished under this section and under other related sections listed in the Scope paragraph above shall be designed, coordinated, and supplied by a single manufacturer or supplier, hereinafter referred to as the System Supplier. The System Supplier shall be regularly engaged in the business of supplying computer-based monitoring, control, and data acquisition systems. The Contractor shall utilize the services of the System Supplier to coordinate all control system related items, to check-out and calibrate instruments, and to perform all testing, training, and startup activities specified to be provided.

The System Supplier shall have the following minimum qualifications:

- The supplier shall maintain a design office staffed with qualified technical design personnel.
- The supplier shall maintain competent and experienced service personnel to service the hardware and software furnished for this project.
- The supplier shall have as a minimum 5 years of experience in the design, coordination and supply of computer-based monitoring, control, and data acquisition systems.

1-2.05. Coordination. Systems supplied under this section shall be designed and coordinated by System Supplier for proper operation with related equipment and materials furnished by other suppliers under other sections of these specifications, under other contracts, and, where applicable, with related existing equipment. All equipment shall be designed and installed in full conformity with the Drawings, specifications, engineering data, instructions, and

PART 2 - ABOVE SURFACE FACILITIES

recommendations of the manufacturer, and the manufacturer of the related equipment.

1-2.06. Related Equipment and Materials. Related equipment and materials may include, but will not be limited to, instrumentation, motor controllers, valve actuators, chemical feeders, analytical measuring devices, conduit, cable, and piping as described in other sections or furnished under other contracts.

1-2.07. Device Tag Numbering System. All devices shall be provided with permanent identification tags. The tag numbers shall agree with System Supplier's equipment drawings and shall be as close as practical to the tag numbers used on the Drawings and device schedules. All field-mounted transmitters and devices shall have stamped stainless steel identification tags. Panel, subpanel, and rack-mounted devices shall have laminated phenolic identification tags securely fastened to the device. Hand-lettered or tape labels will not be acceptable.

1-3. GENERAL REQUIREMENTS. The Drawings and Specifications indicate the extent and general arrangement of the systems. If any departures from the Drawings or Specifications are deemed necessary by System Supplier, details of such departures and the reasons shall be submitted to Engineer for review with or before the first stage submittal. No departures shall be made without prior written acceptance.

The specifications describe the minimum requirements for hardware and software. Where System Supplier's standard configuration includes additional items of equipment or software features not specifically described herein, such equipment or features shall be furnished as a part of the system and shall be warranted as specified herein.

1-3.01. Governing Standards. Equipment furnished under this section shall be designed, constructed, and tested in accordance with IEEE 519, ANSI C37.90, FCC Part 15 - Class A, and NEMA ICS-1-109.60.

1-3.02. Dimensional Restrictions. Layout dimensions will vary between manufacturers and the layout area indicated on the Drawings is based on typical values. The System Supplier shall review the Drawings, the manufacturer's layout drawings and installation requirements, and make any modifications requisite for proper installation subject to acceptance by Engineer. At least three feet of clear access space shall be provided in front of all instrumentation and control system components.

1-3.03. Workmanship and Materials. System Supplier shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.

PART 2 - ABOVE SURFACE FACILITIES

All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except for testing.

1-3.04. Corrosive Fluids. All parts which are exposed to corrosive conditions shall be made from corrosion resistant materials. System Supplier shall submit certification that the instrument manufacturer approves the selection of materials of primary elements that are in contact with the specified process fluid to be inert to the effects of the process fluid.

1-3.05. Appurtenances. Signal converters, signal boosters, amplifiers, special power supplies, special cable, special grounding, and isolation devices shall be furnished as needed for proper performance of the equipment.

1-3.06. Programming Devices. A programming or system-configuring device shall be provided for systems that contain any equipment that requires such a device for routine calibration, maintenance, and troubleshooting. The programming device shall be complete, newly purchased for this project, and shall be in like-new condition when turned over to Owner at completion of startup.

1-4. SUBMITTALS. Complete dimensional, assembly, and installation drawings, wiring and schematic diagrams; and details, specifications, and data covering the materials used and the parts, devices and accessories forming a part of the system furnished, shall be submitted in accordance with the submittals section. Submittal data shall be grouped and submitted in three separate stages. The submittal for each stage shall be substantially complete. Individual drawings and data sheets submitted at random intervals will not be accepted for review. Equipment tag numbers or identifications used on the Drawings shall be referenced where applicable.

1-4.01. First Stage Submittal. The first stage submittal shall include the following items.

a. A detailed list of any exceptions, functional differences, or discrepancies between the system proposed by System Supplier and this specification.

b. Product catalog cut sheets on all hardware and software items, clearly marked to show the model number, optional features, and intended service of each device.

PART 2 - ABOVE SURFACE FACILITIES

c. A brief, concise description of the proposed system, including major hardware and software components and personnel training.

d. A block diagram or schematic drawing showing the principal items of equipment furnished, including model numbers, and their interrelationships.

e. Drawings showing floor and wall space or desktop area requirements for all equipment items, including allowances for door swings and maintenance access.

f. Environmental and power requirements, including heat release information for each equipment item.

g. Standard field termination drawings for all process input/output equipment, showing typical terminations for each type of point available in the system.

h. A copy of the proposed software licenses for all software associated with the system.

i, Outline for training classes.

j. Additional Requirements identified in other Division 40 sections.

1-4.02. Second Stage Submittal. Before any equipment is released for shipment to the site and before factory testing is scheduled, the following data shall be submitted.

At System Supplier's option, the first and second stage submittals may be combined.

a. Detailed functional descriptions of all software modules specified and furnished as part of System Supplier's standard system. The descriptions shall be identified with the applicable specification paragraph.

b. Complete panel fabrication drawings and details of panel wiring, piping, and painting. Panel and subpanel drawings shall be to scale and shall include overall dimensions, metal thickness, door swing, mounting details, weight, and front of panel arrangement to show general appearance, with spacing and mounting height of instruments and control devices.

c. Wiring and installation drawings for all interconnecting wiring between components of the system and between related equipment and the equipment furnished under this section. Wiring diagrams shall show complete circuits and indicate all connections. If panel terminal designations, inter-device connections, device features and options, or other features are modified during the fabrication or factory testing,

PART 2 - ABOVE SURFACE FACILITIES

revised drawings shall be submitted before shipment of the equipment to the site.

d. Fiber termination diagrams to show all fiber terminations at fiber patch panels and final termination at equipment. Fiber termination diagrams shall show individual fiber type (single or multimode), fiber core/cladding dimensions, fiber colors, circuit identifications, and type of terminator.

e. Review of drawings submitted prior to the final determination of related equipment shall not relieve System Supplier from supplying systems in full compliance with the specific requirements of the related equipment.

f. Input/output listings showing point names, numbers, and addresses. Input/output identification numbers from the contract documents shall be cross-referenced in this submittal.

g. Proposed lesson plans or outlines for all training courses specified herein, including schedule, instructors' qualifications and experience, and recommended prerequisites.

h. Standard system engineering and user manuals describing the use of the system and application programming techniques for creating reports, graphics, database, historical records, and adding new process I/O nodes to the system.

i. Additional Requirements identified in other Division 40 sections.

1-4.03. Third Stage Submittal. Complete system documentation, in the form of Operation and Maintenance Manuals, shall be submitted before the commencement of field acceptance testing. Operation and Maintenance Manuals shall include complete instruction books for each item of equipment and software furnished. Where instruction booklets cover more than one specific model or range of device, product data sheets shall be included which indicate the device model number and other special features. A complete set of "as-built" wiring, fabrication, and interconnection drawings shall be included with the manuals. If field-wiring modifications are made after these drawings are submitted, the affected drawings shall be revised and resubmitted. Additional requirements are identified in other Division 40 specification sections.

1-5. PREPARATION FOR SHIPMENT. All electronic equipment and instruments shall be suitably packaged to facilitate handling and to protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements, shall be kept dry at all times, and shall not be exposed to adverse ambient conditions.

PART 2 - ABOVE SURFACE FACILITIES

Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted surfaces that are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

Each shipment shall include an appropriate shipping list that indicates the contents of the package, including the specific instrument tags. The shipping list shall be accessible without exposing the instruments to the atmosphere. The shipping list shall also contain any cautionary notes regarding storage of the instruments, including requirements to protect the instrument from static discharge, desensitizing chemicals (solvents, paints, etc.), or ambient atmospheric conditions.

Individual instruments shall be appropriately tagged or labeled to positively identify the device. All identification shall be visible without the need to unpack the instrument from its protective packaging.

Instrument shipment and storage requirements shall be coordinated with Engineer or Owner prior to shipment. System Supplier shall provide adequate storage and be ready to accept the shipment before shipping any equipment to the site. Additional shipping and storage requirements shall be as detailed in the individual instrument specifications.

Components which are shipped loose due to transportation limitations shall be assembled and disassembled by the manufacturer prior to shipment to assure that all components fit together and are adequately supported.

1-6. DELIVERY, STORAGE, AND SHIPPING. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

1-7. SPARE PARTS. Spare parts and consumable items are specified in other sections.

1-7.01. Packaging. All spare parts shall be delivered to Owner before final acceptance of the system. Packaging of spare parts shall provide protection against dust and moisture and shall be suitable for storage. Circuit boards and other electronic parts shall be enclosed in anti-static material. All packages shall be clearly marked with the manufacturer's name, part number or other identification, date of manufacture, and approximate shelf life.

1-7.02. Replacement. System Supplier may utilize spare parts and supplies during system installation, de-bugging, startup, or training, but shall restore all such materials and supplies to the specified quantities before final acceptance of the systems.

PART 2 - ABOVE SURFACE FACILITIES

PART 2 - PRODUCTS

2-1. GENERAL REQUIREMENTS. All equipment furnished under each section referenced in SCOPE is a part of this section and shall be selected by System Supplier for its superior quality and intended performance. Equipment and materials used shall be subject to review.

2-1.01. Standard Products. The systems furnished shall be standard products. Where two or more units of the same type of equipment are supplied, they shall be the products of the same manufacturer; however, all components of the systems furnished hereunder need not be the products of one manufacturer unless specified herein.

To the extent possible, instruments used for similar types of functions and services shall be of the same brand and model line. Similar components of different instruments shall be the products of the same manufacturer to facilitate maintenance and stocking of repair parts. Whenever possible, identical units shall be furnished.

2-2. PERFORMANCE AND DESIGN REQUIREMENTS. The design of the systems furnished hereunder shall utilize concepts, techniques and features that provide maximum reliability and ease of maintenance and repair. The systems shall include board-level devices such as light emitting diodes or other indicators to facilitate quick diagnosis and repair. Diagnostic software shall be furnished to facilitate system-level troubleshooting.

Where redundant hardware is provided, the system shall be capable of performing all specified functions, without reconfiguring hardware or software, with only one device of each category in service.

2-2.01. Factory Assembly. Equipment shall be shipped completely factory assembled, except where its physical size, arrangement, configuration, or shipping and handling limitations make the shipment of completely assembled units impracticable.

2-3. POWER SUPPLY AND INSTRUMENT SIGNAL. Power supply to all control system equipment will be 120 volts, 60 Hz, single phase. System Supplier shall be responsible for distribution of power among enclosures, consoles, peripherals, and other components of the system from the power supply receptacles and junction boxes indicated on the Drawings. Power distribution hardware shall include cables and branch circuit overcurrent protection installed in accordance with the electrical section.

Unless otherwise indicated, power supply to the instrumentation will be unregulated 120 volts ac. Unless otherwise indicated, all transmitted electronic

analog instrument signals shall be 4-20 mA dc and shall be linear with the measured variable.

2-3.01. Facility Distribution System. Equipment not indicated to be powered from an uninterruptible power source shall be suitable for being supplied from the facility distribution system and shall be capable of withstanding voltage variations of ±10 percent and harmonics up to the limits of IEEE 519 without affecting operation. System Supplier shall provide voltage conditioning or filtering equipment if necessary to meet the requirements specified.

2-3.02. Power Supplies. Power supplies for voltages other than those listed above shall be an integral part of the equipment furnished. Internal power supplies shall be regulated, current limiting, and self-protected.

2-3.03. Surge Withstand. All equipment shall meet all surge withstand capability tests as defined in ANSI C37.90 without damage to the equipment.

2-3.04. Uninterruptible Power Supply. Not used.

2-4. SERVICE CONDITIONS AND ENVIRONMENTAL REQUIREMENTS. The equipment provided for the instrumentation and control system shall be suitable for the service conditions specified in the attached equipment sections.

All equipment shall be designed and selected to operate without degradation in performance throughout the environmental extremes specified. Equipment shall be designed to prevent the generation of electromagnetic and radio frequency interference and shall be in compliance with FCC Rules and Regulations, Part 15, for Class A computing devices.

2-4.01. Ambient Temperature and Elevation. All system equipment located in air conditioned rooms shall be suitable for operation in ambient temperatures from 10°C to 35°C and a relative humidity of 10 to 80 percent, noncondensing. All equipment located in non air conditioned indoor areas shall be suitable for an ambient temperature range of 0°C to 50°C and a relative humidity of 10 to 95 percent, noncondensing. All equipment located outdoors shall be suitable for operation in an ambient temperature range -20°C to 60°C and a relative humidity of 5 to 100 percent. Heaters and air conditioning/cooling equipment shall be provided where essential to maintain equipment within its manufacturer-recommended operating ranges.

All equipment and instruments shall be designed to operate at the site elevation of 17 ft.

2-4.02. Deleterious Effects. All system equipment will be installed in areas without anti-static floor construction and without any provisions for control of particulates or corrosive gases other than ordinary office-type HVAC filtering. System Supplier shall furnish any additional air cleaning equipment, anti-static chair pads, or other protective measures necessary for proper operation of the system.

All input/output hardware shall meet or exceed, without false operation, all requirements of NEMA ICS-1-109.60, Electrical Noise Tests.

2-4.03. Noise Level. The equivalent "A" weighted sound level for any system equipment located in the control room, except printers, shall not exceed 35 dBA. The sound level for printers shall not exceed 65 dBA. Sound reduction enclosures shall be provided where necessary to comply with these limits.

2-4.04. Lightning Protection. In addition to other environmental protection specified herein, the entire system shall be provided with lightning protection. Lightning protection measures shall include the following.

2-4.04.01. Grounding. All major components of the system shall have a low resistance ground connection. Grounding system provisions indicated on the Drawings shall be modified as recommended by System Supplier.

2-4.04.02. Surge Suppressors. Surge and lightning suppressors shall be non-faulting, non-interrupting, and shall protect against line-to-line and line-to-ground surges. Devices shall be solid-state metal oxide varistor (MOV) type, silicon junction type, Gas Discharge Tube (GDT) type, or some combination of these types, with a response time of less than 50 nanoseconds. Surge protective devices shall be applied for the following:

a. All 120 VAC power connections to RTUs, PLCs, DCUs, instruments and control room equipment. Surge arresters shall be Transtector "SPD I2R Series", Phoenix Contact “PLT-SEC Series”, MCG Surge Protection “400 Series” or equal.

b. All analog signal circuits where any part of the circuit is outside of the building envelope. Circuits shall be protected at both the transmitter and the control system end of the circuit. Surge protection devices shall not impede or interfere with the use of smart transmitter calibration/communication.

    1. Protection devices located at the field transmitter shall be:
        i) Loop Powered Transmitters - Eaton MTL “TP48”, Phoenix Contact “SurgeTrab Series”, Transtector “PDS Outdoor Series” or equal.

ii) Four-Wire Transmitters – Phoenix Contact “BoxTrab Series”, Schneider Electric ASCO Model 265, Emerson “SolaHD STC-SLAC Series”, or equal.

2. Protection devices in control panels shall be Transtector “I2R IEP Series”, Eaton MTL “SD Modular Series”, Phoenix Contact “TTC-6P Series” , or equal.

2-5. SOFTWARE DOCUMENTATION. System Supplier shall furnish complete documentation on all software supplied with the systems specified herein. Operating systems, compilers, assemblers, and utility and diagnostic programs that are standard commercial products of third parties need not be included in the optical media backup. Software documentation shall consist of the following principal items.

a. One backup set of any integrated circuit or solid-state memory-based plug-in firmware used.

b. Three sets of printed as-built reference documentation for any special software provided specifically for this contract.

2-6. SOFTWARE LICENSE. All software programs supplied as a standard part of System Supplier’s products for this project shall be licensed to Owner for use on the system specified herein. Such license shall not restrict Owner from using the software on the system provided hereunder or its replacement. Owner shall have the right to make copies of the software for use on the system provided. Specific requirements of System Supplier’s software license are subject to review and approval by Owner and Engineer.

2-7. INSTALLATION TEST EQUIPMENT. All necessary testing equipment for calibration and checking of system components shall be provided by System Supplier. System Supplier shall also furnish calibration and maintenance records for all testing and calibration equipment used on the site if requested by Engineer.

PART 3 – EXECUTION

3-1. INSTALLATION REQUIREMENTS. The installation of equipment furnished hereunder shall be by the Contractor or their assigned subcontractors.

3-1.01. Field Wiring. Field wiring materials and installation shall be in accordance with the electrical section.

3-1.02. Instrument Installation. Instruments shall be mounted so that they can be easily read and serviced and so that all appurtenant devices can be easily

operated. Installation details for some instruments are indicated on the Drawings.

All outdoor instrumentation shall be protected from direct sun exposure. Instruments shall be placed in locations to limit south and west sun exposure. Sunshades shall be provided on instruments that are subject to the direct sun exposure. Sunshades shall be located so the opening faces north or east where possible. Sunshades shall be provided as shown on the Drawings.

3-1.03. Salvage of Existing Equipment. Existing equipment and materials removed or replaced under this contract shall be delivered to Owner at a location designated by Owner, or shall be properly disposed of at Owner's discretion. Care shall be taken to avoid damage to equipment delivered to Owner.

Any mounting brackets, enclosures, stilling wells, piping, conduits, wiring, or openings that remain after removal of equipment and support hardware shall be removed or repaired in a manner acceptable to Owner and Engineer. Transmitters or switches containing mercury shall be removed and disposed of by personnel trained in the handling of hazardous materials and using approved procedures.

3-2. SYSTEM SOFTWARE CONFIGURATION. System software shall be configured by the System Supplier. Configuration services shall consist of the modification of the system database, operator interface graphic and tabular display screens and programming of control units to provide a fully functioning system. The System Supplier shall fully configure the system using data provided herein or supplied by the Engineer and/or the Owner after award of the contract.

3-2.01. Control System Database. The control system database shall be modified and configured by the System Supplier. The System Supplier shall determine the need for any "pseudo" database points and shall ascertain and enter all information needed to define these points. The System Supplier is responsible for entering all information associated with each point. This includes but is not limited to, descriptions, engineering units, associated displays, areas, security, etc. All fields associated with each database point must be completely filled out accurately.

3-2.02. Graphic Screen Displays. The System Supplier shall be responsible for developing and configuring the custom graphic displays. Each piece of new process equipment that is monitored by the control system shall be displayed on one or more graphic screen. Graphic screens shall be representations of the equipment and piping. The screens must accurately show all devices and equipment that is part of the control loops. These items must be done in accordance to the Configuration Standards and Conventions as described later in this section. Alarm and/or event displays shall also be modified prior to acceptance of the system.

PART 2 - ABOVE SURFACE FACILITIES

All graphic screens shall be animated to indicate the current state of the piece of equipment. The following graphic screens shall be provided, as a minimum.

- Deep Injection Well 2
- Modified Effluent Pump Station

3-2.03. Configuration Standards and Conventions. A “Software Configuration Standards and Conventions” document shall be prepared and submitted by the System Supplier. The document shall be submitted for review and approval before software configuration commences. The document shall describe and define such items as proposed graphic display process line colors/representations; symbology; color standards for “on”, “off”, “opened”, “closed”, and “alarm” conditions; alarm handling conventions; how items will be selected for control; methods for navigation between displays; address usage/naming conventions; and security setup. Before submitting the initial draft document, the System Supplier shall meet with the Engineer and/or Owner to review any of the Owner’s existing standards and conventions. All copies of this submittal shall be provided in color to insure the accuracy of each item. No black and white copies will be accepted. The colors used in the printed submittal shall accurately depict the colors and shapes proposed for use on the final system.

3-2.04. Configuration Review Meetings. Proposed graphic screens shall be reviewed with the Owner and Engineer. The System Supplier’s programming personnel shall attendthe initial review meeting.

3-2.05. Software Functional Requirements. General functional requirements for system configuration are indicated on the Drawings and described in the specifications. The information presented herein and indicated on the Drawings illustrates the general functional intent of the system and may not be sufficient to fully configure the system. The System Supplier shall be responsible for determining what additional information may be required to complete the configuration tasks, and for obtaining this information from the Engineer or the Owner.

3-3. SYSTEMS CHECK. System Supplier shall provide the services of a trained and experienced field supervisor to assist the installation contractor during installation, and to calibrate, test, and advise others of the procedures for installation, adjustment, and operation.

3-3.01. Field Manager. Not used.

3-3.02. Field Inspection at Delivery. Not used.The field supervisor shall inspect major equipment items within five working days of delivery, to assure that the equipment was not damaged during shipment and shall supervise or assist with unpacking, initial placement, and initial wiring of the system.

PART 2 - ABOVE SURFACE FACILITIES

3-3.03. Traceable Field Calibration of Instruments. After each instrument has been installed, a technical representative of System Supplier shall calibrate each instrument and shall provide a written calibration report for each instrument, indicating the results and final settings. The adjustments of calibrated instruments shall be sealed or marked, insofar as possible, to discourage tampering. Instrument calibration shall be done before checkout of the system operation. A typical instrument calibration report is attached to the end of this section.

3-3.04. Training for Installation Personnel. Personnel handling and installing instruments shall use manufacturing best practices found in manufacturer's respective installation literature. Personnel shall sign on with Owner and Engineer acknowledging that manufacturer's installation literature has been reviewed and fully understood prior to installation of instruments.

3-3.05. Field Inspection Prior to Start Up. After installation and wiring connections are complete, the field supervisor, with additional System Supplier's personnel shall verify that each external connection to the system is correctly wired and field process components and devices are functioning as intended. A minimum of 1 working day shall be included for this task, but System Supplier shall be responsible for completing the following scope of work.

3-3.05.01. Analog Signals. Analog input signals shall be simulated at the transmitting source, and verified to be received at the proper register address in the control system. Analog outputs shall be generated at the control system, and verified to be received with the correct polarity, at the respective receiving device.

3-3.05.02. Discrete Signals. Discrete input and output signals shall be simulated and verified that they are received at the respective receiving device, and at the proper voltage.

3-3.05.03. Devices by Other Suppliers. If interrelated devices furnished by other suppliers, under other contracts, or by Owner, such as valve actuators, motor controls, chemical feeders, and instruments, do not perform properly at the time of system checkout, the field supervisor shall use suitable test equipment to introduce simulated signals to and/or measure signals from these devices to locate the sources of trouble or malfunction.

3-3.05.04. System Check Out Report. The System Supplier shall submit a written report on the results of such tests to Engineer. Additional documentation shall be furnished as requested by Engineer to establish responsibility for corrective measures. System Supplier shall verify, in writing, to Engineer or Owner that System Supplier has successfully completed the external connection check before beginning system startup or field acceptance testing.

3-3.06. Start Up Assistance. After the field supervisor has completed the system check and submitted his report, System Supplier shall supply a factory-trainedprogrammer to provide on-site start up assistance. During the startup period, these personnel shall thoroughly check all equipment, correct any deficiencies, and verify the proper operation of all components. 2 working days shall be included for this task.

3-4. TESTING. The system shall be acceptance tested on site.

System Supplier shall prepare a testing procedure to be approved by Owner and Engineer that shall demonstrate that the system conforms to the specifications. The testing procedure shall be submitted at least 30 days in advance of testing. The testing shall be conducted by System Supplier and witnessed by Owner and/or Engineer.

System Supplier shall notify Engineer and Owner in writing at least 14 days before the proposed testing date. If the site acceptance test is concluded unsuccessfully, the test shall be repeated. System Supplier shall reimburse Owner and Engineer for all expenses incurred in connection with attending repeated factory or site testing necessitated by system failure or inadequate preparation.

3-4.01. Factory Acceptance Testing. Not used.

3-4.02. Site Acceptance Testing. After installation and checkout by System Supplier's personnel, the system shall be subjected to an acceptance test.

Site acceptance testing shall be scheduled after receipt of the System Check Out Report and System Supplier shall verify that all field signal changes are reflected in the proper address locations in the system database.

The site acceptance testing shall operate without loss of basic functions. The number of working days of continuous operation for the test shall be 5. The operational demonstration shall confirm that the status, alarm, and process variable signals are valid and are being updated appropriately, and that the discrete and analog output signals from the control system are being correctly transmitted and implemented. Any errors or abnormal occurrences shall be recorded by System Supplier's field representative. System Supplier's field representative need not be continuously present during the site acceptance testing but shall be available to respond to the site within one hour of notification.

3-4.02.01. Failure of Redundant Equipment. Failure of redundant equipment shall not be considered downtime provided that automatic failover occurs as specified and, in the opinion of Engineer, the failure was not caused by deficiency in design or installation. In the event of repeated failure of any

hardware component or software module, the acceptance test shall be terminated and re-started.

3-4.02.02. Completion of Test. Successful completion of the site acceptance test, including the operational demonstration, is prerequisite to Substantial Completion as specified in the Supplementary Conditions.

3-5. TRAINING. System Supplier shall conduct training courses for personnel selected by Owner. Training shall be provided in the following categories: instrument, control system maintenance, operator (pre-installation), operator (post-installation), programmer (HMI software), programmer (PLC software), networking, and supplemental shall be provided. Training shall be conducted by experienced instructors who are familiar with the specific system supplied.

3-5.01. General Training Requirements. In general, System Supplier's standard training courses may be used to meet the training objectives specified. Where standard courses do not meet these objectives, additional coursework shall be developed. Clock hour requirements for each level of training shall be as listed. A "clock hour" is defined as one hour of instruction or supervised training exercise. Training hour requirements are the number of hours of training to be provided for each student. Additional training time shall be provided if considered necessary to meet the training objectives.

3-5.01.01. Training Costs. All costs associated with the training program; excluding travel, lodging, and per diem expenses for Owner's and Engineer's personnel to attend off-site training programs; shall be the responsibility of System Supplier and shall be included in the contract price.

3-5.01.02. Lessons. Training lesson plans and other information for the second stage submittal as defined herein shall be submitted at least 30 days prior to the start of training.

3-5.02. Instrument Training. Training on the calibration, maintenance, troubleshooting, and repair for the instrument devices provided under this project shall be provided. Training shall also be provided for any hand-held or computer-based calibration devices and their associated software. 4 hours of training for 4 students shall be provided at the Owner's facility.

End of Section

INSTRUMENT NAME & SERVICE:		
BRAND, MODEL NO. & SERIAL NO.:		
TAG OR LOOP NO.:		
INPUT/OUTPUT RANGE:		
INPUT	ACTUAL OUTPUT	DESIRED OUTPUT
AS FOUND:		
AS LEFT:		
PROPORTIONAL BAND:		
RESET:		
POSITION OF SWITCHES, JUMPERS, ETC.		
COMMENTS:		
DATE OF CALIBRATION: CALIBRATED BY:		
Black & Veatch	INSTRUMENT CALIBRATION REPORT	Figure 1-406111

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406111A
INSTRUMENT DEVICE SCHEDULE

Item No. This is an arbitrary sequential number which is for reference only.
ISA Tag. This code is derived from the ISA table
Process Area Code. 2 digit numeric valve. The first digit corresponds to the Area Code Map for this project which is 3. The second digit is based on the elevation of the device. 0 - devices below grade in vault, basement, etc. 1- devices located at grade, on the first floor. 2 - devices located above grade, on floors higher than the first, etc.
Loop Number. This is the numeric (or alphanumeric) loop designation for the instrument.
Tag. This is the complete instrument identifier
Service Description. This is the description of the instrument service (i.e. Filter No. 1 Loss-of-Head).
Device Type. This is the instrument device type and should match the description as listed in the specification.
Size. A size is given if applicable (e.g., flow meters)
Output Type. This generally will be '4-20 mA' or "Dry Contact'. It could also be a serial output for smart devices (such as HART or FIELD-BUS) but only if the serial output is the primary I/O interface.
Output Range. This is the calibrated range for analog devices or the trip point(s) for discrete devices.
Power Type. This will typically be '2-wire' for devices which are loop powered from the PLC enclosure, or '4-wire' for devices which are powered form external power supplies, unless noted otherwise.
Installation Detail. This provides the sheet number of an installation detail that corresponds to the specific instrument
P&ID Drawing. This is the drawing number of the P&ID where the device is shown.
Specification. The provider for the specification section listed is responsible for supplying the device.
Remarks. This column may include a cross reference to another specification section where applicable or to a note which provides additional information.

Item No.	ISA Tag	Process Area Code	Loop Number	Tag	Service Description	Device Type	Size	Output_Type	Output_Range	Power_Type	P&ID Drawing	Specification	Remarks
1	HS	80	7A	HS80-7A	EFFLUENT PUMP HEADER VALVE HAND SWITCH MOTOR LOR	THREE-POSITION SELECTOR SWITCH	N/A	N/A	N/A	N/A	I-601	26 05 11	
2	HS	80	7B	HS80-7B	EFFLUENT PUMP HEADER VALVE HAND SWITCH MOTOR OSC	THREE-POSITION SELECTOR SWITCH	N/A	N/A	N/A	N/A	I-601	26 05 11	
3	ZSO	80	7	ZSO80-7	EFFLUENT PUMP HEADER VALVE POSITION SWITCH OPEN	POSITION SWITCH	N/A	N/A	N/A	N/A	I-601	40 79 11	
4	ZSC	80	7	ZSC80-7	EFFLUENT PUMP HEADER VALVE POSITION SWITCH CLOSE	POSITION SWITCH	N/A	N/A	N/A	N/A	I-601	40 79 11	
5	HS	80	12B	HS80-12B	EFFLUENT PUMP NO.6 DISCHARGE VALVE HAND SWITCH MOTOR LOR	THREE-POSITION SELECTOR SWITCH	N/A	N/A	N/A	N/A	I-601	26 05 11	
6	HS	80	12A	HS80-12A	EFFLUENT PUMP NO.6 DISCHARGE VALVE HAND SWITCH MOTOR OSC	THREE-POSITION SELECTOR SWITCH	N/A	N/A	N/A	N/A	I-601	26 05 11	
7	ZSO	80	12	ZSO80-12	EFFLUENT PUMP NO.6 DISCHARGE VALVE POSITION SWITCH OPEN	POSITION SWITCH OPEN	N/A	N/A	N/A	N/A	I-601	40 79 11	
8	ZSC	80	12	ZSC80-12	EFFLUENT PUMP NO.6 DISCHARGE VALVE POSITION SWITCH CLOSE	POSITION SWITCH CLOSE	N/A	N/A	N/A	N/A	I-601	40 79 11	
9	HS	80	11A	HS80-11A	INJECTION WELL INFLUENT INLET VALVE HEADER SWITCH MOTOR LOR	THREE-POSITION SELECTOR SWITCH	N/A	N/A	N/A	N/A	I-601	26 05 11	
10	HS	80	11B	HS80-11B	INJECTION WELL INFLUENT INLET VALVE HEADER SWITCH MOTOR OSC	THREE-POSITION SELECTOR SWITCH	N/A	N/A	N/A	N/A	I-601	26 05 11	
11	ZSO	80	11	ZSO80-11	INJECTION WELL INFLUENT INLET VALVE POSITION SWITCH OPEN	POSITION SWITCH OPEN	N/A	N/A	N/A	N/A	I-601	40 79 11	
12	ZSC	80	11	ZSC80-11	INJECTION WELL INFLUENT INLET VALVE POSITION SWITCH CLOSE	POSITION SWITCH CLOSE	N/A	N/A	N/A	N/A	I-601	40 79 11	
13	FIT	80	11	FIT80-11	INJECTION WELL INFLUENT FLOW MAGNETIC	FLOW TRANSMITTER	N/A	ETHERNET/IP	850-34000 GPM	4-WIRE	I-601	40 71 00	
14	PI	80	11	PI80-11	INJECTION WELL INFLUENT FLOW PRESSURE	PRESSURE INDICATOR	N/A	4-20mA	TBD	2-WIRE	I-602	40 72 00	
15	PIT	80	11	PIT80-11	INJECTION WELL INFLUENT FLOW PRESSURE	PRESSURE TRANSMITTER	N/A	4-20mA	TBD	2-WIRE	I-603	40 72 00	

PART 2 - ABOVE SURFACE FACILITIES

Input and Output Schedule - Legend/Description Sheet

Item. This is an arbitrary sequential number which is for reference only.
IO Type: This is the type of I/O signal, as follows:
AI = Analog Input
AO = Analog Output
DI = Discrete Input
DO = Discrete Output
Facility Code. The facility code for this project is WRP: Water Reclamation Plant
Controller Code. The controller code for this project is 08. The corresponding PLC ID is PLC8 and is located in the UV Building. The processes associated with the controller code is UV disinfection system
Process Area Code. 2 digit numeric valve. The first digit corresponds to the Area Code Map for this project which is 3. The second digit is based on the elevation of the device. 0 - devices below grade in vault, basement, etc. 1- devices located at grade, on the first floor. 2 - devices located above grade, on floors higher than the first, etc.

Equipment Code. This is the ISA (or similar) alpha tag representing the function of the instrument.
Loop Number. This is the loop number as shown on the P&ID drawing.
IO Tag. This is the full IO database tag
Service Description. This is the description or the function (i.e. Filter No. 1 Loss-of-Head).
Field Device. This is the tag number of equipment identifier associated with the I/O point. This column indicates the Asset ID as follows:
1st Digit - plant area designated as 3
2nd Digit - equipment elevation level; 0 = subterranean, basement; 1 = ground floor or above grade; 2 = second floor or on foor of single story bldg
3rd & 4th Digit - abbreviations of the name and classification asset (found on legend sheet under equipment codes)
5th, 6th, & 7th Digit - loop number

Controller ID. This is a sequential number for a given type within a specific controller (PLC or DCU).
Analog Data (Signal Type). This will typically be 4-20mA, but could also be 1-5Vdc, serial, HART, FLD-BUS, or similar to indicate the signal type of the associated input or output.

Analog Data (Signal Range). This will be the scaled value of the input in engineering units.
Analog Data (Power Type). This will typically be '2-wire' for devices which are loop powered from the PLC enclosure, or '4-wire' for devices which are powered form external power supplies, unless noted otherwise. Devices connected using Modbus IP will have no entry because they will use an Ethernet connection for communication to the PLC.

Discrete Data (Signal Type). This will be 120V, ETHERNET, or similar to indicate the signal type of the associated input or output.
Discrete Data (Closed State). This will indicate the state of the input or output when it is considered to be closed or energized (normal, alarm, running, failed, etc.).
Discrete Data (Power Source). This will indicate the location of the power source for the wetting voltage on the contacts, as follows:
Field = External field power source. (May require interposing relays or isolated I/O module type.)
Local = Power originates from within the PLC or I/O enclosure.
Discrete Data (Interp Relay). This will be either 'Yes' or 'No' to indicate whether the input or output requires an interposing relay. Relays are typically required to isolate external voltage sources. See specifications for additional details.

DWG Name. This column indicates associated Process & Instrumentation Diagram.
Existing I/O Location. This column indicates existing I/O points. It lists the rack, slot, and point of the existing I/O in the format
RxSyyPzz where x=rack number yy=slot number and zz=point number (if slot or point number is less than 10, a leading zero is used)
Remarks. This column may include a cross reference to another specification section where applicable, or to a note which provides additional information. Notes are appended to the end of the I/O listing.

Item No.	IO Type	Facility Code	Controller Code	Process Area Code	Equipment Code	Loop Number	IO Tag	Service Description	Field Device	Controller_ID	Analog Signal Type	Analog Signal Range	Analog Power Type	Digital Signal Type	Digital Close State	Digital_Power_Source	Digital_Interp_Relay	DWG Name	Remarks
1	DI	LCU	08	80	YI	7	LCU_08_80_YI_7	EFFLUENT PUMP HEADER VALVE 7 IN REMOTE	HS80-7A	PLC-2	N/A	N/A	N/A	120V	IN REMOTE	PLC	NO	I-601	
2	DO	LCU	08	80	ZCO	7	LCU_08_80_ZCO_7	EFFLUENT PUMP HEADER VALVE 7 CLOSE COMMAND	HS80-7B	PLC-2	N/A	N/A	N/A	120V	OPEN CMD	FIELD	YES	I-601	
3	DO	LCU	08	80	ZCC	7	LCU_08_80_ZCC_7	EFFLUENT PUMP HEADER VALVE 7 OPEN COMMAND	HS80-7B	PLC-2	N/A	N/A	N/A	120V	CLOSE CMD	FIELD	YES	I-601	
4	DI	LCU	08	80	ZIO	7	LCU_08_80_ZIO_7	EFFLUENT PUMP HEADER VALVE 7 OPEN	ZSO80-7	PLC-2	N/A	N/A	N/A	120V	OPEN	PLC	NO	I-601	
5	DI	LCU	08	80	ZIC	7	LCU_08_80_ZIC_7	EFFLUENT PUMP HEADER VALVE 7 CLOSED	ZSC80-7	PLC-2	N/A	N/A	N/A	120V	CLOSED	PLC	NO	I-601	
6	DI	LCU	08	80	YI	11	LCU_08_80_YI_11	INJECTION WELL INFLUENT INLET VALVE 11 IN REMOTE	HS80-11A	PLC-2	N/A	N/A	N/A	120V	IN REMOTE	PLC	NO	I-601	
7	DO	LCU	08	80	ZCO	11	LCU_08_80_ZCO_11	INJECTION WELL INFLUENT INLET VALVE 11 CLOSE COMMAND	HS80-11B	PLC-2	N/A	N/A	N/A	120V	OPEN CMD	FIELD	YES	I-601	
8	DO	LCU	08	80	ZCC	11	LCU_08_80_ZCC_11	INJECTION WELL INFLUENT INLET VALVE 11 OPEN COMMAND	HS80-11B	PLC-2	N/A	N/A	N/A	120V	CLOSE CMD	FIELD	YES	I-601	
9	DI	LCU	08	80	ZIO	11	LCU_08_80_ZIO_11	INJECTION WELL INFLUENT INLET VALVE 11 OPEN	ZSO80-11	PLC-2	N/A	N/A	N/A	120V	OPEN	PLC	NO	I-601	
10	DI	LCU	08	80	ZIC	11	LCU_08_80_ZIC_11	INJECTION WELL INFLUENT INLET VALVE 11 CLOSED	ZSC80-11	PLC-2	N/A	N/A	N/A	120V	CLOSED	PLC	NO	I-601	
11	DI	LCU	08	80	YI	12	LCU_08_80_YI_12	EFFLUENT PUMP NO.6 DISCHARGE VALVE 12 IN REMOTE	HS80-12A	PLC-2	N/A	N/A	N/A	120V	IN REMOTE	PLC	NO	I-601	
12	DO	LCU	08	80	ZCO	12	LCU_08_80_ZCO_12	EFFLUENT PUMP NO.6 DISCHARGE VALVE 12 CLOSE COMMAND	HS80-12B	PLC-2	N/A	N/A	N/A	120V	OPEN CMD	FIELD	YES	I-601	
13	DO	LCU	08	80	ZCC	12	LCU_08_80_ZCC_12	EFFLUENT PUMP NO.6 DISCHARGE VALVE 12 OPEN COMMAND	HS80-12B	PLC-2	N/A	N/A	N/A	120V	CLOSE CMD	FIELD	YES	I-601	
14	DI	LCU	08	80	ZIO	12	LCU_08_80_ZIO_12	EFFLUENT PUMP NO.6 DISCHARGE VALVE 12 OPEN	ZSO80-12	PLC-2	N/A	N/A	N/A	120V	OPEN	PLC	NO	I-601	
15	DI	LCU	08	80	ZIC	12	LCU_08_80_ZIC_12	EFFLUENT PUMP NO.6 DISCHARGE VALVE 12 CLOSED	ZSC80-12	PLC-2	N/A	N/A	N/A	120V	CLOSED	PLC	NO	I-601	
16	AI	LCU	08	80	FI	11	LCU_08_80_FI_11	INJECTION WELL INFLUENT FLOW	FIT80-11	PLC-2	4-20mA	TBD	2-WIRE	N/A	N/A	FIELD	N/A	I-601	
17	AI	LCU	08	80	PI	11	LCU_08_80_PI_11	INJECTION WELL INFLUENT PRESSURE	PIT80-11	PLC-2	4-20mA	TBD	2-WIRE	N/A	N/A	FIELD	N/A	I-601	

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SOFTWARE CONTROL BLOCK DESCRIPTIONS

PART 1 - GENERAL

1-1. SCOPE. This section provides functional descriptions of the PLC and computer software requirements for the Instrumentation and Control System as indicated on the Drawings. These descriptions are intended to provide an overview of the operating concept of the plant process equipment rather than describing in detail every operating feature or interlock.

1-1.01. Control System. The Instrumentation and Control System section shall apply to all systems described in this section.

PART 2 – PRODUCTS

2-1. GENERAL. The descriptions are applicable to the software specified in the Instrumentation and Control System section.

PART 3 - EXECUTION

3-1. PLC PROGRAMMING FUNCTIONAL REQUIREMENTS. The following paragraphs describe general configuration tasks that are required for the system PLC(s). These tasks shall be programmed in any applicable PLC. Each PLC may have multiple instances of each of these tasks, or may have no instances of some or all of these tasks. The input/output lists (located in these documents as specified in the Instrumentation and Control System section) and detailed equipment control descriptions (included herein) shall be referenced to determine the requirements for each PLC.

The following paragraphs cover functional requirements of the software, which are generic and may or may not be related to any specific control loop.

3-1.01. Available Process Values. All PLC-generated process alarm, equipment status, and process variable values shall be available at any operator workstation.

3-1.02. Flow Values. Flow values shall be integrated, totalized, and stored in the PLC registers so the values displayed on the HMI computers and on the field processor will be identical.

3-1.03. System Failure. Failure of a PLC shall result in safe shutdown of associated process equipment. Interposing relays shall be provided where required to assure that equipment will revert to its fail-safe condition. Failure of any PLC or its communication shall be alarmed on the HMI computer.

3-1.04. HMI Computers. The HMI computers shall function as a monitoring system, not as a controller, for the process equipment. The computer shall download set points and other information to the PLCs, and the PLCs shall perform all control algorithms, so a temporary failure of the any HMI computer will not disrupt plant control.

3-1.05. Rack/Module Configuration. The rack and module definitions for each PLC, as well as the PLC communications configuration shall be completely configured to allow proper addressing of all field connected I/O points. This shall include configuration of any remote input/output (RIO) racks.

3-1.06. PLC Database Definition. The PLC database will include both field I/O points and internally generated points required for programming. All field I/O points and internal programming points shall be fully defined according to database naming conventions approved by Owner. As a minimum, each database point shall be provided with a tag name, engineering unit, alarm parameters, and description.

3-1.07. Analog Scaling. Each analog input and output will be appropriately scaled for use in internal PLC programming, monitoring by the HMI computers, or transmission to other PLCs. Requirements for raw count values shall be coordinated with the operator interface software to ensure compatibility.

3-1.08. Equipment Runtimes. For each equipment item whose "run" status is monitored by a PLC, an internal equipment runtime shall be accumulated by the respective PLC. The runtime procedure will monitor the status of the equipment "run" contact and, when the equipment is running, increment a software timer that maintains equipment runtime to within a one-minute resolution. The timer shall stop incrementing, but not reset, when the "run" contact indicates that the equipment is not running. The timer value shall increment an hour counter that maintains an integer value representing the equipment run time in hours. The counter value shall be available for display on the HMI computer. A manual reset of the runtime value shall be available at the HMI computers for personnel at the supervisor level and above.

3-1.09. Change-of-State Alarms. While equipment is controllable from the PLC ("in remote"), discrete output commands shall be compared to their respective process feedback status signal (where available) to verify proper execution. If the feedback status does not match the most recent output command (after an adjustable 2 to 300 second time delay), an alarm message shall be displayed on the HMI computer and the condition shall be logged as an alarm, requiring

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operator acknowledgment. The alarm shall remain energized until the proper discrete condition is sensed or until the operator resets the alarm through the HMI computer.

3-1.10. Equipment Availability. In general, equipment with PLC control has been provided with a local selector switch that transfers control to the PLC. The PLC shall monitor the position of this switch to determine if the equipment is available for PLC control. If the equipment is not available, the PLC program shall not attempt to implement remote manual or automatic status changes for the equipment. The PLC program may, however, need to implement special routines if equipment unavailability affects a sequence (as described in the detailed equipment descriptions).

3-1.11. Maintained/Momentary Outputs. The need for maintained or momentary control outputs shall be determined from the input/output listing and the electrical schematics. In general, equipment with only one control output indicated in the I/O list shall be programmed for a maintained control output. Equipment with two (or more) control outputs shall be programmed for momentary outputs. Provisions shall be made, in either case, to remove the active state (start, open, forward, initiate, etc.) control output when an equipment failure is sensed or when the equipment transitions from available to unavailable (local switch change).

3-1.12. Equipment Mode Changes. Unless otherwise indicated in the equipment control descriptions, equipment in automatic mode shall be transitioned to manual mode (and stopped) if the equipment fails or becomes unavailable or if the PLC processor resets.

3-1.13. Manual/Auto Bumpless Transfer. Unless otherwise indicated in the equipment control descriptions, equipment changes from automatic to manual control shall be bumpless. Equipment running or stopped in automatic mode shall remain running or stopped when manual mode is selected.

3-2. HMI FUNCTIONAL REQUIREMENTS. The following paragraphs describe general configuration tasks that are required for the HMI and related software.

3-2.01. Database. The existing system database, including field I/O and internal points shall be modified according to the existing database point naming conventions approved by Owner. Database generation for field I/O shall include all required coordination with PLC level addresses...

3-2.02. Trend Displays. Trend displays shall be developed to present real-time and historical process data in an X-Y graph format. Real-time trends shall utilize current process values to generate temporary graphs that do not retain data values. Historical trends shall utilize historically collected data and shall access the data files directly for use in the trend display. Historical trends shall allow paging forward and back to the limits of the collected data. The trending package shall be configured to automatically retrieve historical data from the

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proper data file to accommodate the paging functions. Content of the trends will be determined after meeting with Owner. One real-time trend displays and one historical trend displays shall be provided.

3-2.03. Alarms. Existing system alarming shall be modified to include new I/O. This shall include configuration of graphical alarm displays, and configuration of audible alarms through the HMI speakers. All process or system alarms shall appear on the existing alarm summary screen and the alarm banner of each process graphic. Alarms and events shall be color coded on the alarm summary screen, with initial colors based on Owner conventions or the default colors associated with the graphics package. The colors may be adjusted after meeting with Owner. Alarm prioritizing and area assignments (if any) shall be coordinated with Owner at the first configuration meeting.

For LOW or LOW-LOW analog or discrete alarms which do not apply if associated equipment is not operating, provisions shall be made to prevent/Lock generation of the alarm unless the associated equipment is operating. This shall include alarms such as low amperage alarms for pumps that are not running. This may also include low flows or pressures when associated pumps are not operating (this will only apply if periodic operation of the equipment is considered normal).

All alarms/events shall be time stamped when displayed or printed. Unacknowledged alarms shall not automatically clear from the alarm summary if they return to normal before being acknowledged.

3-2.04. Reporting. Not used.

3-2.05. Historical Data Collection. System data shall be collected for historical archiving and for use in trending and reporting functions. Requirements for data collection shall be as needed to support the trends developed.

3-2.06. Manual Entry of Data. The human machine interface (HMI) computers shall allow manual entry of laboratory data and other variables, which shall then be available for display and use in reports. Operator entered commands from any of the HMI computers shall be logged at all HMI computers.

3-3. EQUIPMENT CONTROL AND CONTROL MODE OVERVIEW. The following paragraphs explain the general format and control modes that are used in the detailed equipment descriptions. These paragraphs apply to the attached, project specific, equipment control descriptions included herein.

3-3.01. General. Appended to this section are the equipment control programming requirements, with requirements for both PLC programming and the minimum operator interface functions. The HMI requirements represent the anticipated display generation requirements and shall be adjusted if the PLC

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programming warrants adjustment.

3-3.02. Control Modes. There are two general control modes available for the process equipment: 1) remote manual, and 2) remote auto. Remote manual control provides a means for operators to adjust equipment status or setpoint, through the HMI, using manually initiated commands. Remote automatic control provides a means for automatically changing equipment status or setpoint based on measured process parameters, calculated values, or operator setpoints. Some equipment may have more than one remote auto mode.

Descriptions for local control are included in the detailed equipment control descriptions. They are provided primarily for documentation purposes and for information. These controls are hardwired and require no programming effort.

3-4. DETAILED EQUIPMENT CONTROL DESCRIPTIONS. The following paragraphs describe specific function requirements for various software control blocks in the control system. These descriptions are intended to provide an overview of the operational concept for the facilities, rather than describing in detail every operating feature or interlock.

Loop Description Title: Typical Open/Close Valve/Gate.

Associated Equipment
80-FCV-7, 80-FCV-11, 80-FCV-12

Local Manual Mode
Local manual control of the valve(s) shall be provided through the LOCAL-OFF-REMOTE (L-O-R) selector switch and OPEN/STOP/CLOSE pushbuttons (or alternatively OPEN-STOP-CLOSE spring return-to-center selector switch) provided on the motorized valve operator. When the L-O-R switch is in the LOCAL, valve position shall be controlled by pressing/holding the OPEN or CLOSE pushbuttons until the valve reaches the desired position.

Local Auto Mode
None

Remote Manual Mode
Computer manual control shall be provided through the PLC. When the L-O-R selector switch at the valve is in the REMOTE position and MANUAL is selected at the HMI, the valve shall be positioned using the OPEN/CLOSE commands by the operator at the HMI.

Remote Auto Mode
None.

Alarms
Valve Fail to Open (PLC Generated)
Valve Fail to Close (PLC Generated).
Indications
Valve Open, Valve Close, Valve Remote

HMI and OIT Requirements
The existing valve pop-up display shall be modified or replaced with a new pop-up to provide open and close commands. The valve symbol shall be a selectable target which retrieves the respective control overlay display. The overlay display shall contain control targets which allow selection of manual valve control (open/close) and valve fail timer setpoint entry.

End of Section

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FLOW INSTRUMENTS

PART 1 - GENERAL

1-1. SCOPE. The Flow Instrument Section covers the furnishing of flow instruments and accessories required for the Instrumentation and Control System as specified herein or as indicated on the Drawings.

Equipment and services provided under this section shall be subject to the Instrumentation and Control System section. This section shall be used and referenced only in conjunction with the Instrumentation and Control System section. Supplementing the Instrumentation and Control System section, instrument data, special requirements, and options are indicated on the Drawings or the Instrument Device Schedule.

When multiple instruments of a particular type are specified, and each requires different features, the required features are described on the Drawings or the Instrument Device Schedule.

1-2. DESIGN CRITERIA. Each device shall be a pre-assembled, packaged unit. Upon delivery to the work site, each device or system shall be ready for installation with only minor piping and electrical connections required by Contractor.

Primary elements shall derive any required power from the transmitter, unless otherwise indicated.

The instruments shall be installed to measure, monitor, or display the specified process at the ranges and service conditions indicated on the Drawings or as indicated in the Instrument Device Schedule. The instruments shall be installed at the locations indicated on the Drawings or in the Instrument Device Schedule.

Where possible, each instrument shall be factory wet flow calibrated to the full scale flow range of the sensors or calibration ranges indicated on the Drawings or in the Instrument Device Schedule. Transmitters or similar measurement instruments shall be calibrated using National Institute of Standards and Technology (NIST) approved bench calibration procedures, when such procedures exist for the instrument type. Calibration and configuration data shall be stored digitally in each device, including the instrument tag designation indicated on the Drawings or Instrument Device Schedule.

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1-3. SUBMITTALS. Submittals shall be made as specified in the Instrumentation and Control System section.

1-4. SHIPMENT, PROTECTION, AND STORAGE. Equipment provided under this section shall be shipped, protected, and stored as specified in the Instrumentation and Control System section. Identification of packaging shall be as specified in the Instrumentation and Control System section.

PART 2 - PRODUCTS

2-1. GENERAL. The following paragraphs provide minimum device requirements. The Drawings or Instrument Device Schedule shall be used to determine any additional instrument options, requirements, or service conditions.

2-1.01. Interconnecting Cable. For instruments where the primary element and transmitter are physically separated, interconnecting cable from the element to the transmitter shall be provided. The cable shall be the type approved by the instrument manufacturer for the intended purpose of interfacing the element to the transmitter. Length of cable shall be a minimum of three meters or as indicated on the Drawings or in the Instrument Device Schedule. The interconnecting cable shall be provided in the length necessary for installation. Splices shall not be allowed in the installed cable.

2-1.02. Programming Device. For instruments that require a dedicated programming device for calibration, maintenance, or troubleshooting, one such programming device shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). The programming device shall include appropriate operation manuals and shall be included in the training requirements. For systems that allow the programming device functions to be implemented in software, running on a laptop computer, the software shall be provided instead of the programming device.

2-1.03. Configuration Software/Serial Interface. Devices indicated as requiring a serial interface shall be provided with all accessories required to properly communicate over the serial link. As a minimum, an appropriate cable shall be provided to allow the transmitter serial interface to be connected to a personal computer. One licensed copy of the diagnostic/interface software shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). Software shall be capable of running under the Windows 10 operating system. If the software furnished performs the same functions as the programming device, specified elsewhere, then the programming device shall not be furnished.

2-2. FLOW INSTRUMENTATION.

2-2.01. Magnetic Flowmeters, Signal Converters, and Accessories.

2-2.01.01. Magnetic Flowmeter. The integral or Remote Transmitter Magnetic Flowmeter shall be a completely obstruction less, in-line flowmeter with no constrictions in the flow of fluid through the meter and shall include a flanged spool piece style magnetic flow tube with a transmitter capable of converting and transmitting a signal from the flow tube. The Flow Meter shall consist of F304 SS flange (ASME class 150) material with a Fluorocarbon PFA liner with minimum thickness for liner being 0.125 Inches. Liner protectors shall be provided on all flow tubes if a manufacturer requires them. The flow tubes shall be provided with flush mounted and self-cleaning SS 316L electrodes. Any other electrode material used or submitted, must be approved by LEE County Utilities Electrical Group. Grounding Rings shall be provided for all meter and should be of same material as electrodes. The magnetic flow meters shall use a dual frequency excitation technique to achieve fast response time, stable zero stability, and strong immunity against process-generated noise. Magnetic flow meters shall use the characterized field principle of pulsed electromagnetic induction and produce a DC signal directly proportional to the liquid flow rate. All construction Materials for metallic wetted parts shall be SS 316L. Flow tube shall be rated for temperatures of up to 130°C (266°F) and pressures up to 1.1 times the flange rating of adjacent piping. Flow meter systems shall be rated for ambient temperatures of -40 to +60°C. Transmitter shall meet IP66/67/NEMA-4X requirements. Flange diameter and bolt drilling pattern shall comply with ANSI/ASME B16.5 for line sizes from one-half inch to 24 inches or AWWA C207 for line sizes larger than 24 inches. Provide flow tubes that are factory calibrated and assigned a calibration constant or factor to be entered into the associated transmitter as part of the meter configuration parameters. Manual verification/calibration of the flow meter shall be allowed as the customer requires. Meter configuration parameters shall be stored in non-volatile memory in the transmitter. An output hold feature shall be provided to maintain a constant output during configuration changes. Flow Meters shall be factory calibrated to NIST traceable standards. Provide certified factory calibration records.

The meter shall be capable of standing empty for extended periods of time without damage to any components.

The meter housing shall be of a splash-proof and drip-proof design.

Magnetic flow meter systems shall comply with ISO9001 standards and be manufactured by Yokogawa ADMAG TI Series AXG or AXW; no other manufacturers will be considered acceptable. Written approval by Lee County Electrical Dept shall be required to change the manufacturer model codes if different than the ones listed above. Manufacturer to provide a written five-year extended warranty from (a) date of issuance of "Certificate of Proper Installation" and Operation and (b) production of self-calibration report acceptable to Engineer and Owner, whichever is later.

2-2.01.02. Magnetic Flowmeter Transmitter. The transmitter shall utilize Ethernet/IP communication protocol. The transmitter shall use "Total Insight Smart" electronics. It shall contain automatic, continuous zero correction, signal processing routines for noise rejection, and an integral, backlit, 4-line dot matrix LCD readout capable of displaying flow rate and totalized flow. The transmitter shall continuously run self-diagnostic (verification function) that can be executed without removing the flow meter from piping with routines and report errors via display or communication messages. The transmitter shall be shipped equipped with RJ-45 Ethernet/IP ports. The magnetic flowmeter shall have an integral SD card for data logging. Data logging shall be possible for up to 4 process data simultaneously. The overall accuracy of the transmitter shall be 0.35% of the rate over the flow velocity range of +/- 1 mm/s. Repeatability shall be 0.1% of the rate; minimum rangeability shall be 100:1. The minimum required liquid conductivity the meter can operate at shall be 3 uS/cm. Maximum response time shall be between 5 and 200 milliseconds as a minimum. Transmitter ambient temperature operating limits shall be -40 to +60°C. The power supply shall be 120VAC, 60 Hz. The transmitter shall provide an automatic low flow cutoff below a user-configurable low flow condition (0-10%). The transmitter's outputs shall also be capable of being forced to zero by an external unpowered signal. The transmitter's preamplifier input impedance shall be a minimum of 109-1011 ohms, making the system suited for amplifying low-level input signals and capable of operation with a material build-up on the electrodes.

The transmitter shall be capable of communicating over an Ethernet/IP network with a remote configuration device. The remote configuration (laptop) device shall be capable of being placed anywhere in the loop. A security lockout feature shall be provided to prevent unauthorized modification of configuration parameters. In addition, the flow transmitter will have a secondary RJ-45 Ethernet service port for communication with a laptop in the field.

PART 3 - EXECUTION

3-1. FIELD SERVICES. All contractor employees working on installing the new Instruments will review the Manufacturer's best install practice in the instrument manuals, dated and sign off that they fully understand how to install them before they can work on the instruments. The Manufacturer's representative shall conduct a field inspection after installation, perform start-up of the flow meters, certify in writing the meters' proper installation, and verify the calibration of flowmeters after installation. The Manufacturer shall also provide one day of on-site training of customer personnel. Training will include field and classroom instruction. If the transmitter is integral to the flow tube, provide manufacturers or third-party sunshield cover to protect transmitter face. Flow meter systems cable for onboard calibration verification shall be provided along with field verification system

(including software key code) that automatically tests the flow measurement system and can produce a traceable printed certificate of calibration verification.

Instruments shall not be shipped to the Work Site until two weeks prior to the scheduled installation. The System Supplier shall be responsible for coordinating the installation schedule with the Installation Contractor. Each shipment shall contain a listing of protective measures required to maintain sensor operation, including a listing of any common construction or cleaning chemicals that may affect instrument operation.

Note: The Mag Flowmeter tube flanges fasteners will be Stainless Steel, and the bolts will be a Grade 5, with flat washers on both the bolt and nut side, a lock washer on the nut side, with a minimum of 1.5 thread showing past the nut after factory torque is met.

End of Section

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PRESSURE INSTRUMENTS

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of pressure instruments and accessories required for the Instrumentation and Control System as specified herein or as indicated on the Drawings.

Equipment and services provided under this section shall be subject to the Instrumentation and Control System section. This section shall be used and referenced only in conjunction with the Instrumentation and Control System section. Supplementing the Instrumentation and Control System section, instrument data, special requirements, and options are indicated on the Drawings or the Instrument Device Schedule.

When multiple instruments of a particular type are specified, and each requires different features, the required features are described on the Drawings or the Instrument Device Schedule.

1-2. DESIGN CRITERIA. Each device shall be a pre-assembled, packaged unit. Upon delivery to the work site, each device or system shall be ready for installation with only minor piping and electrical connections required by Contractor.

Primary elements shall derive any required power from the transmitter, unless otherwise indicated.

No pressure instrumentation shall use mercury in switches or any other internal components.

The instruments shall be installed to measure, monitor, or display the specified process at the ranges and service conditions indicated on the Drawings or as indicated in the Instrument Device Schedule. The instruments shall be installed at the locations indicated on the Drawings or in the Instrument Device Schedule.

Where possible, each instrument shall be factory calibrated to the calibration ranges indicated in the Drawings or in the Instrument Device Schedule. Transmitters or similar measurement instruments shall be calibrated using National Institute of Standards and Technology (NIST) approved bench calibration procedures, when such procedures exist for the instrument type.

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Calibration data shall be stored digitally in each device, including the instrument tag designation indicated on the Drawings and/or Instrument Device Schedule.

1-3. SUBMITTALS. Submittals shall be made as specified in the Instrumentation and Control System section.

1-4. SHIPMENT, PROTECTION, AND STORAGE. Equipment provided under this section shall be shipped, protected, and stored in accordance with the requirements of the Instrumentation and Control System section. Identification of packaging shall be as described in the Instrumentation and Control System section.

PART 2 - PRODUCTS

2-1. GENERAL. The following paragraphs provide minimum device stipulations. The Drawings or Instrument Device Schedule shall be used to determine any additional instrument options, requirements, or service conditions.

2-1.01. Interconnecting Cable. For systems where the primary element and transmitter are physically separated, interconnecting cable from the element to the transmitter shall be provided. The cable shall be the type approved by the instrument manufacturer for the intended purpose of interfacing the element to the transmitter. Length of cable shall be a minimum of three meters or as indicated in the Drawings or Instrument Device Schedule.

2-1.02. Programming Device. For systems that require a dedicated programming device for calibration, maintenance, or troubleshooting, one such programming device shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section.) The programming device shall include appropriate operation manuals and shall be included in the training requirements. For systems that allow the programming device functions to be implemented in software, running on a laptop computer, the software shall be provided instead of the programming device.

2-1.03. Configuration Software/Serial Interface. Devices indicated as requiring a serial interface shall be provided with all accessories required to properly communicate over the serial link. An appropriate cable shall be provided to allow the transmitter serial interface to be connected to a personal computer. One licensed copy of the diagnostic/interface software shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). Software shall be capable of running under Microsoft's Windows 10 operating system. If the software furnished performs the same functions as the programming device, specified elsewhere, then the programming device shall not be furnished.

2-2. PRESSURE INSTRUMENTATION.

2-2.01. Pressure Transmitters. Transmitters shall be an all-solid state electronic two-wire device that does not require a direct power connection to the transmitter. Isolated 4-20mA DC with HART (Version 7) communication protocol shall be provided along with adjustable electronic zero and span, with elevated or suppressed zero, as the application requires. The adjustment shall be possible without mechanical fulcrum points or a handheld configurator. Transmitters shall be enclosed in a NEMA Type 4X housing. All necessary hardware for transmitter mounting shall be provided along with valve manifolds as specified—Mount valve manifold integrally to the Pressure Seal, Flow Through Diaphragm, and transmitter. The valve manifold, pressure seal diaphragm, and transmitter shall be assembled by Manufacturer and shipped as an assembly. Provide sun shield for outdoor installations. Provide Yokogawa Block and Bleed Manifold model: C13ST-2GSCT-NN-NNPS1-NNNN. Transmitters shall be provided with brackets for wall and pipe-stand mounting as required.

Transmitters shall be factory calibrated to the required range and provided with the manufacturer's standard hand-held communications/calibration device. One device shall be furnished for all transmitters provided by a single manufacturer.

Transmitters tagged on the Drawings or specified to be indicating type shall be furnished with LCD type digital indicators.

Transmitters will have a turndown ratio of 30:1, or more.

Transmitters shall be Yokogawa EJA530E-JBS4N-022EN/FF1/D1 ~~Yokogawa PSI.~~

2-2.30. Well Level Draw Down Transmitter (Cable Suspended). The submersible pressure transmitter shall have the following local indicator: Yokogawa Model UM33A-000-10/LP complete with 4-20 mA analog output and 24-volt DC loop power. Provide a lightning arrestor Model. (Written approval required by LCU Electrical Dept). The level transmitter j-box at the wellhead will be no smaller than 12" x12" x6". The enclosure shall be rated for NEMA-4X. Therefore, it can also house the desiccant container. The contractor shall also purchase and install the In-Situ Outboard Desiccant Pack Part Number: 0051380. Dimensions: 1.25" DIA x 4.50" Length. Cable shall be Tefzel type.

2-2.30. Field-Mount Pressure Gauges. Pressure gauges shall be of the indicating dial type, with C-type phosphor bronze Bourdon tube; stainless steel rotary geared movement; phenolic or polypropylene open front turret case; adjustable pointer; stainless steel, phenolic, or polypropylene ring; and acrylic plastic or shatterproof glass window.

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Gauge dial shall be 4-1/2 inch size, with white background and black markings. The units of measurement shall be indicated on the dial face. Subdivisions of the scale shall conform to the requirements of the governing standard. Pointer travel shall be not less than 200 degrees or more than 270 degrees of arc.

Surface-mounted gauges shall be provided with 1/4 inch NPT connections. All stem-mounted gauges shall be provided with 1/2 inch [12 mm] NPT connections. Where indicated in the Drawings or on the Instrument Device Schedule, stem mounted gauges shall have an adjustable viewing angle to allow the gauge to be positioned for optimum viewing.

All pressure gauges shall measure in psi [kPa] and all vacuum gauges in inches [mm] water. All gauges shall have a suitable range to give mid-scale readings under normal conditions. Gauge accuracy shall be 0.5 percent of scale range.

Each gauge shall be provided with a threaded end, ball-type gauge valve. Gauge valve materials shall be compatible with the measured process. Where the process is not defined, gauge valves shall have AISI Type 316 stainless steel wetted parts and Teflon seals. Multi-port gauge valves shall have all unused ports plugged. Gauge valve construction shall be as detailed in the Miscellaneous Instruments section.

Where indicated on the Drawings or the Instrument Device Schedule, the pressure gauge shall be provided with a pressure snubber. Each snubber shall be of a size and pressure range compatible with the gauge served. Snubbers shall be Ashcroft "Pulsation Dampers", or approved equal.

Gauges shall be installed at the locations indicated on the Drawings, with installation conforming to the installation details. All gauges and snubbers shall be installed in the vertical, upright position. Thread sealer, suitable for use with the associated process, shall be used in the assembly of threaded connections. All connections shall be free from leaks. Lines shall be purged of trapped air at gauge locations prior to installation of the gauge or diaphragm seal.

Each gauge shall be provided with all required mounting hardware to securely mount the unit according to the mounting requirements indicated in the Drawings or the Instrument Device Schedule.

Unless otherwise indicated, mounting and installation hardware shall be Type 316L stainless steel.

Pressure gauges shall be Ashcroft "1279 Duragauge", or equal.

PART 3 - EXECUTION

3-1. FIELD SERVICES. Manufacturer's field services shall be provided for installation, field calibration, startup, and training as specified in the Instrumentation and Control System section.

Instruments shall not be shipped to the Work Site until two weeks prior to the scheduled installation. System Supplier shall be responsible for coordinating the installation schedule with the Installation Contractor. Each shipment shall contain a listing of protective measures required to maintain sensor operation, including a listing of any common construction or cleaning chemicals that may affect instrument operation.

Note: All contractor employees working on installing the new Instruments will review the Manufacturer's best install practice in the instrument manuals, dated and sign off that they fully understand how to install them before they can work on the instruments.
At three or nine o'clock, the pressure transmitter feed will be tapped off the well raw water pipe.

End of Section

PART 2 - ABOVE SURFACE FACILITIES

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Section 40 79 11

MISCELLANEOUS INSTRUMENTS

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of all miscellaneous instruments and accessories required for the Instrumentation and Control System as specified herein or as indicated on the Drawings.

Equipment and services provided under this section shall be subject to the Instrumentation and Control System section. This section shall be used and referenced only in conjunction with the Instrumentation and Control System section. Supplementing the Instrumentation and Control System section, instrument data, special requirements, and options are indicated on the Drawings or the Instrument Device Schedule.

When multiple miscellaneous instruments of a particular type are indicated, and each requires different selectable features, the required features are described on the Drawings or in Instrument Device Schedule.

1-2. DESIGN CRITERIA. Each device shall be a pre-assembled, packaged unit. Upon delivery to the work site, each device or system shall be ready for installation with only minor piping and electrical connections required by System Supplier.

Primary elements shall derive any required power from the transmitter, unless otherwise indicated.

The instruments shall be installed to measure, monitor, or display the specified process at the ranges and service conditions indicated on the Drawings or as indicated in the Instrument Device Schedule. The instruments shall be installed at the locations indicated on the Drawings or the Instrument Device Schedule.

Where possible, each instrument shall be factory calibrated to the calibration ranges indicated in the Instrument Device Schedule. Transmitters or similar measurement instruments shall be calibrated using National Institute of Standards and Technology (NIST) approved bench calibration procedures, when such procedures exist for the instrument type. Calibration data shall be stored digitally in each device, including the instrument tag designation indicated on the Instrument Device Schedule.

1-3 SUBMITTALS. Submittals shall be made as specified in Instrumentation and Control System section.

PART 2 - ABOVE SURFACE FACILITIES

1-4 SHIPMENT, PROTECTION, AND STORAGE. Equipment provided under this section shall be shipped, protected, and stored as specified in the Instrumentation and Control System section. Identification of packaging shall be as described in the Instrumentation and Control System section.

PART 2 - PRODUCTS

2-1. GENERAL. The following paragraphs provide minimum device stipulations. The Instrument Device Schedule shall be used to determine any additional instrument options, requirements, or service conditions.

2-1.01. Interconnecting Cable. For systems where the primary element and transmitter are physically separated, interconnecting cable from the element to the transmitter shall be provided. The cable shall be the type approved by the instrument manufacturer for the intended purpose of interfacing the element to the transmitter. Length of cable shall be a minimum of three meters or as indicated in the Instrument Device Schedule.

2-1.02. Programming Device. For instruments that require a dedicated programming device for calibration, maintenance, or troubleshooting, one such programming device shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). The programming device shall include appropriate operation manuals and shall be included in the training requirements. For systems that allow the programming device functions to be implemented in software, running on a laptop computer, the software shall be provided instead of the programming device.

2-1.03. Configuration Software/Serial Interface. Devices indicated as requiring a serial interface shall be provided with all accessories required to properly communicate over the serial link. An appropriate cable shall be provided to allow the transmitter serial interface to be connected to a personal computer. One licensed copy of the diagnostic/interface software shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). Software shall be capable of running under Microsoft's Windows 10 operating system. If the software furnished performs the same functions as the programming device, specified elsewhere, then the programming device shall not be furnished.

2-2. MISCELLANEOUS INSTRUMENTS.

2-2.01. Limit Switches. Valves listed in the valve schedules as having limit switches shall be provided with limit switches mounted on the valve operating mechanism housing cover plate. A limit switch shall be provided at each end of valve travel position. Each switch shall be actuated by a separate lever with a 3 inch minimum radius continuously adjustable around the center line of the

valve shaft or extension shaft. Limit switches for motorized valve actuators are covered in another section.

Each limit switch shall be heavy-duty type, with a cast NEMA Type 4 enclosure, a spring-return roller lever, and four isolated contacts (two normally open and two normally closed) rated 10 amperes at 120 to 480 V ac and 5 amperes at 125 V dc. The switches shall be Allen Bradley "802T" or Square D "9007 Type C".

PART 3 - EXECUTION

3-1. FIELD SERVICES. Manufacturer's field services shall be provided for installation, field calibration, startup, and training as specified in the Instrumentation and Control System section.

Instruments shall not be shipped to the Work Site until two weeks prior to the scheduled installation. The System Supplier shall be responsible for coordinating the installation schedule with the Installation Contractor. Each shipment shall contain a listing of protective measures required to maintain sensor operation, including a listing of any common construction or cleaning chemicals that may affect instrument operation.

End of Section

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Drawing D-120-105 Existing Lift Station

ATTACHMENT 1

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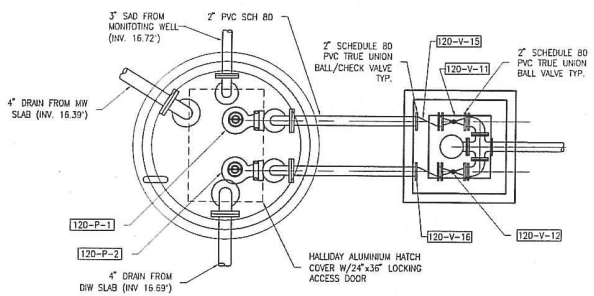
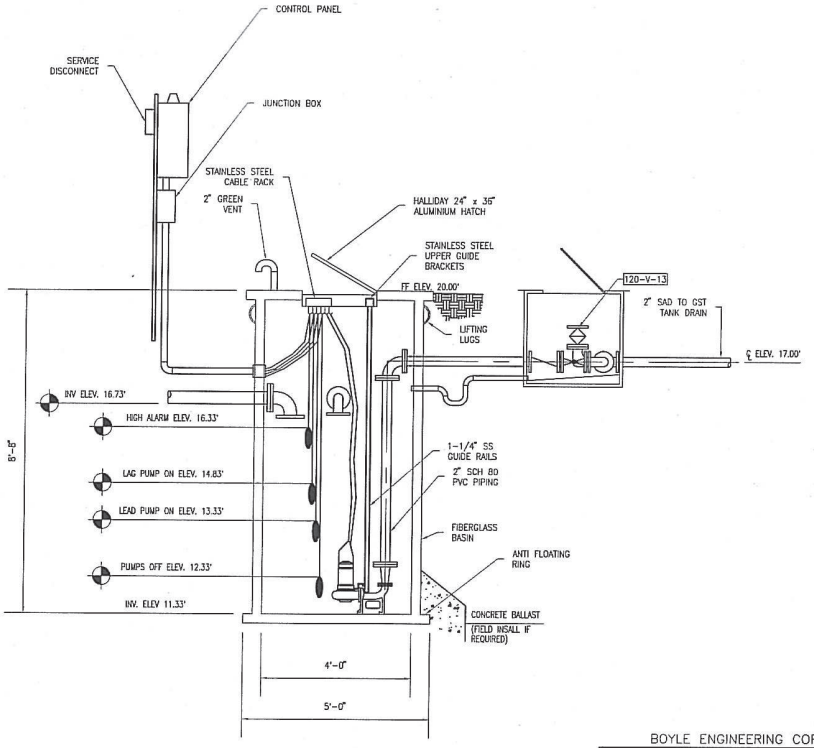
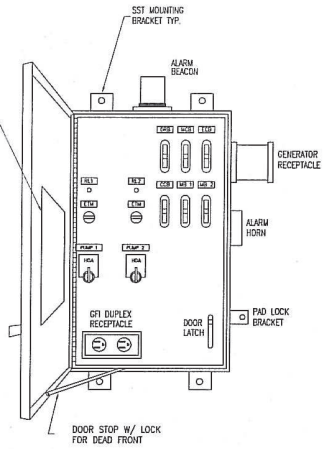




LIFT STATION PLAN AND SECTION

SCALE: 1" = 20'



CONTROL PANEL / DEAD FRONT

SCALE: N.T.S.

SOUTH FLORIDA LIFT STATION, INC.

PACKAGED FIBERGLASS LIFTSTATIONS
D.E.P. OR STANDARD CONTROL PANELS

COMPLETE WORKING SYSTEM SHALL BE SUPPLIED:
SOUTH FLORIDA LIFT STATION, INC.
FORT MYERS, FL 33901
(239) 332-0041
(239) 332-0045 FAX

SPECIFICATION
DESIGN CONDITIONS
MODEL: TP2BM — H.P.: 1
VOLT: 480/277 — PHASE: 3
DISCHARGE: 1 1/2" — IMPELLER: SINGLE VANE
GPM: 36 — TDH: 29

FOR TECHNICAL ASSIATANCE, CONTACT
SOUTH FLORIDA LIFT STATION, INC.
FORT MYERS, FL 33901
(239) 332-0041
(239) 332-0045 FAX

SUBMERSIBLE NON CLOG PUMPS

SUBMERSIBLE NON CLOG PUMPS SHALL BE HOMA MODEL TP2BM. THE PUMPS SHALL BE INSTALLED IN THE H-20 GP FRP WET WELL UTILISING A DUAL SLIDE RAIL SYSTEM. THE UNIT SHALL BE CAPABLE OF ALL MATERIAL IN DOMESTIC AND COMMERCIAL SEWAGE, INCLUDING FOREIGN OBJECTS SUCH AS PLASTICS, SANITARY NAPKINS AND DISPOSABLE DIAPERS, WHICH WILL PASS THROUGH THE PUMP AND THE SCH 80 PVC DISCHARGE PIPING.

PUMP SHALL BE CAPABLE OF HANDALING 1" MIN. SOLIDS AT 1-1/2" DISCHARGE AT 3450 RPM. SINGLE PHASE MOTORS SHALL BE OF THE CAPACITOR START, CAPACITOR RUN TYPE FOR HIGH STARTING TORQUE. STATOR WINDING SHALL BE OPEN WITH CLASS F INSULATION AND SHALL BE HEAT-SHRINK FITTED INTO THE STATOR HOUSING. THE USE OF PINS BOLTS OR OTHER FASTENING DEVICES IS NOT ACCEPTABLE. A HEAT SENSOR THERMOSTAT SHALL BE ATTACHED TO THE TOP OF THE MOTOR WINDING AND SHALL BE CONNECTED IN SERIES WITH THE MAGNETIC CONTACTOR COIL IN THE CONTROL PANEL TO STOP THE MOTOR IF WINDING TEMPERATURE EXCEEDS 140 DEGREES CELCIUS, BUT SHALL AUTOMATICALLY RESET WHEN THE WINDING TEMPERATURE RETURNS TO NORMAL. TWO HEAT SENSOR THERMOSTAT SHALL BE USED ON THREE PHASE MOTORS. UPPER AND LOWER SEALS SHALL BE SILICON vs. SILICON CARBIDE.

H-20 LOAD RATED WETWELL WITH LIFTING LUGS

THE FIBERGLASS WETWELL MUST BE H-20 LOAD RATED W/INTEGRAL LIFTING LUGS, AND CERTIFICATION OF THIS RATING MUST BE SUPPLIED AT TIME OF SUBMITTAL. THE WETWELL SHALL BE MANUFACTURED OF FIBERGLASS REINFORCED POLYESTER (FRP) OF DIAMETER AND DEPTH AS SHOEN ON THE LIFT STATION ELEVATION DETAIL. THE WALL THICKNESS SHALL BE ADEQUATE FOR THE DEPTH OF THE WETWELL TO MAINTAIN THE H-20 LOAD RATING. REINFORCING MATERIALS: THE REINFORCING MATERIAL SHALL BE COMMERCIAL GRADE TYPE "E" GLASS IN THE FORM OF MAT, CHOPPED OR ROVING FABRIC, HAVING A COUPLING AGENT THAT WILL PROVIDE A SUITABLE BOND BETWEEN THE CLASS REINFORCEMENT AND THE RESIN. ADDATIVES SUCH AS THIXOTOPIC AGENTS, CATALYST, PROMOTERS, ETC. MAY BE ADDED AS REQUIRED BY THE SPECIFIC MANUFACTURING PROCESS TO BE USED TO MEET THE REQUIREMENTS OF THIS SPECIFICATION. THE RESIN SYSTEM SHALL BE SUITABLE FOR ATMOSPHERES CONTAINING HYDROGEN SULPHIDE AND DILUTE SULPHURIC ACID AS WELL AS OTHER GASSES ASSOCIATED WITH WASTE WATER COLLECTION SYSTEMS. WET WELL SHALL BE A ONE PIECE UNIT MANUFACTURED BY L.F. MANUFACTURING, INC. OR ENGINEERS APPROVED EQUIVALENT. EACH WET WELL IS FACTORY SERIAL NUMBERED FOR QUALITY AND LOW GRADE TESTING AND TRACKING PURPOSES.

H-20 LOAD RATING

THE COMPLETE WET WELL SHALL HAVE A MINIMUM DYNAMIC-LOAD RATING OR 16,000 FT-LB WHEN TESTED. THE COMPLETE WET WEL SHALL NOT HAVE LEAKS, CRACKS, OR SUFFER FROM DELAMINATION, BLISTERS, WRINKLES, DRY AREAS, OR OTHER DAMAGES WHEN LOAD TESTED TO 40,000 FT-LBS. WET WELL SHALL NOT DEFLECT VERTICALLY DOWNWARD MORE THAN 1/4" A THE POINT OF LOAD APPLICATION WHEN LOADED TO 24,000 LBS.

WATER TIGHT INTEGRITY

ALL WET WELLS ARE 100% WATER TIGHT. PUMP MOUNTING BOLTS ARE INSTALLED FOR EASIER INSTALLATION AND TO ENSURE BASIN WATER TIGHT INTEGRITY. AN INTEGRAL FIBERGLASS SLOPED BOTTOM CAN BE INSTALLED UPON REQUEST FROM CONTRACTOR OR ENGINEER. LENGTH AND HEIGHT OF SLOPE CAN CHANGE DUE TO DIAMETER OF WET WELL AND SIZE OF PUMPS.

ALUMINIUM HATCH COVER

SHALL BE MANUFACTURED FROM 1/4" ALUMINIUM DIAMOND PLATE AND BUILT TO WITHSTAND A LOAD OF 150 LB PER S.F. AND SHALL BE MANUFACTURED BY HALLIDAY PRODUCTS OR EQUAL. STAINLESS STEEL BOLTS, NUTS AND HINGES -W/LOCKING STAPLE.

FLOATS

SHALL BE ANCHOR SCIENTIFIC POLYPROYLENE NON-MERCURE FLOAT SWITCHES RATED AT 5 AMPS AT 120V OR EQUAL.

SPECIFICATIONS FOR DUPLEX D.E.P. TYPE CONTROL PANEL

EACH PANEL SHALL CONTROL TWO 1 HP, 480/277 VOLT, 3 PHASE, 60 Hz PUMPS. A NEUTRAL SHALL BE SUPPLIED TO THE PANEL FOR 120 VOLT CONTROL POWER.

PANEL ENCLOSURE
ENCLOSURE SHALL BE NEMA 4X FABRICATED FROM 304L STAINLES STEEL. OUTER DOOR SHALL HAVE HINGES AND MEANS FOR PADLOCKING. INNER DEAD FRONT DOOR SHALL BE 5052-H32 ALLOY ALUMINUM. ALL MOUNTING HOLES SHALL BE DRILLED AND TAPPED, SELF TAPPING SCRED NOT ACCEPTABLE. ALL BOLTS, NUTS LOCK WASHERS AND MACHINE SCREWS SHALL BE STAINLESS STEEL.

THE FOLLOWING MAJOR COMPONENTS ARE REQUIRED:

1) MAIN BREAKER
2) EMERGENCY BREAKER AND GENERATOR RECEPTACLE-RUSSEL STOLL
3) PUMP BREAKERS
4) CONTROL CIRCUIT BREAKERS
5) ALTERNATOR
6) HIGH LEVEL FLASHING ALARM LIGHT
7) HIGH LEVEL ALARM WITH SILENCE - WHEN SILENCE LIGHT STAYS ON
8) LIGHTING ARRESTOR
9) SURGE SUPRESSOR
10) PHASE/UNDER VOLTAGE MONITORING RELAY IF 3 PHASE. UNDER VOLTAGE MONITORING RELAY IF SINGLE PHASE
11) NEMA RATED MOTOR STARTERS WITH OVERLOAD PROTECTION FOR ALL POWER LEGS
12) ELAPSE TIME METERS
13) RUN LIGHTS
14) CAPACITORS AND START-RELAYS ANS APPROVED FOR HOMA PUMPS ON SINGLE PHASE SYSTEMS

TYPICAL SEQUENCE OR OPERATION:

ON RISE LEVEL:
LOWEST FLOAT WILL CLOSE CIRCUIT RELAY. LEAD PUMP ON FLOAT CLOSES TO BRING LEAD PUMP ON. IF LEAD DOES NOT RECEDE AND WATER CONTINUES TO RISE, THE LAG FLOAT WILL CLOSE AND BRING THE ON THE LAG PUMP. FURTHER RISING OF LEVEL IN WET WELL WILL CONTINUE CLOSE 4TH FLOAT (HIGH LEVEL) AND ACTIVATE HIGH LEVEL ALARM LIGHT AND HORN.

ON FALLING LEVEL:
ALL PUMPS WILL DE-ENERGIZE AT THE OPENEING OF THE LOWEST (OFF) FLOAT CONTROL CIRCUITRY WILL BE SUCH THAT NO FLOAT WILL DEPEND ON ANOTHER FLOAT FOR ITS CONTROL POWER. CONTROL PANEL SCHEMATIC, IN PLASTIC LAMINATE, IS TO BE AFFIXED TO THE INSIDE OF THE OUTER DOOR. ALL WIRING SHALL BE NUMBERED. IN THE EVENT THE PUMPS BEING FURNISHED REQUIRE SEAL FAILURE COMPONENTS AND INDICATION TO VALIDATE THE WARRANTY, THESE COMPONENTS SHALL BE FURNISHED AS REQUIRED. ALL COMPONENT LABELS SHALL BE OF THE LASER PRINTED MYLAR PLASTIC LABELS. A 24-HOUR EMERGENCY TELEPHONE CONTACT SHALL BE DISPLAYED BY THE OWNER.

BASIN DIAMETER (INCHES)	CUBIC FEET OF CONCRETE REQUIRED PER FOOT OF BASIN DEPTH
24	2
30	3.5
36	5
48	8.5
60	12

BOYLE ENGINEERING CORPORATION

FDEP PERMIT

FOR REVIEW USE ONLY

DATE: 03/19/07

REV	DATE	DESCRIPTION	APPR
1	2/12/07	RECORD INFORMATION ADDED	

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DESIGNED BY: GNEW
DRAWN BY: GNEW
CHECKED BY: VJG
DATE: JAN 2006

PROJECT ENGINEER: VICTOR J. GODLEWSKI JR., PE
REG NUMBER: 33139 — EXP DATE: 02/28/07
PROJECT NUMBER: FE-W61-102-00
CAD STANDARDS: BOYLE

Wharton-Smith, Inc. CONSTRUCTION GROUP

BOYLE ENGINEERING CORPORATION
4415 METRO PARKWAY, SUITE 404
FORT MYERS, FLORIDA 33916
FL. ENGINEERING BUS. NO. 2005
(239) 278-7996

THREE OAKS WASTEWATER TREATMENT PLANT EXPANSION

LIFT STATION PLAN AND SECTIONS

DRAWING: D-120-105

SHEET: 89 OF 000 SHEETS

DWG DATE: May 07, 2007 2:23pm
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USER: ewesch